2017 MEETING ISHPSSB & ABFHIB

SÃO PAULO, BRAZIL
16 TO 21 JULY, 2017

BOOK OF ABSTRACTS

BOOK OF ABSTRACTS OF THE ISHPSSB & ABFHIB 2017 MEETING

INTERNATIONAL SOCIETY FOR THE HISTORY, PHILOSOPHY AND SOCIAL STUDIES OF BIOLOGY (ISHPSSB)

&

ASSOCIAÇÃO BRASILEIRA DE FILOSOFIA E HISTÓRIA DA BIOLOGIA (ABFHIB)

ISHPSSB

2017

ABFHIB

SÃO PAULO, BRAZIL
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Conference Schedule

	SUNDAY JULY 16	MONDAY JULY 17	TUESDAY JULY 18	WEDNESDAY JULY 19	THURSDAY JULY 20	FRIDAY JULY 21
07:00			Birdwatching at Butantan*			
08:00		Registration / secretariat	Registration / secretariat	secretariat	secretariat	secretariat
09:00		Parallel Sessions 1	Parallel Sessions 4	Parallel Sessions 8	Parallel Sessions 11	Parallel Sessions 14
10:00		coffee break	coffee break	coffee break	coffee break	coffee break
11:00		Parallel Sessions 2	Parallel Sessions 5	Parallel Sessions 9	Parallel Sessions 12	Parallel Sessions 15
12:00		lunch break	lunch break	lunch break	lunch break	lunch break
13:00	Registration	ISHPSSB Council meeting	Early career scholar mentoring lunch / ABFHiB Council meeting	Grad. Student general meeting / Membership diversity meeting/ Butantan's Lab visit*	ISHPSSB Council meeting	ISHPSSB Council meeting
14:00	Visit to Butantan's museums					
15:00	Brazilian music concert					
16:00	Butantan park visit	Parallel Sessions 3	Parallel Sessions 6	Parallel Sessions 10	Parallel Sessions 13	Excursions in São Paulo/ USP/ Butantan
17:00	President's welcome	coffee break	coffee break	coffee break	coffee break	
		transfer to CDI		transfer to CDI	transfer to CDI	
18:00	Cinema	Plenary conference	Parallel Sessions 7	Plenary conference	Awards ceremony and ISHPSSB general meeting	
18:40	Welcome to São Paulo cocktail					
19:00					transfer to dinner	
20:00		Poster session and refreshments			Conference dinner	
21:00						
22:00						

Most activities will be held at the Biosciences Institute of the University of São Paulo, in several rooms (see map on the next page). The plenary sessions, however, will occur at the auditorium of the International Diffusion Center (CDI, in Portuguese), inside the campus of the University of São Paulo (transfer buses will be available).

Biosciences Institute
University of São Paulo

❶ AG-ZOO
(General Auditorium, Zoology)

❷ Restaurant

❸ CD-A1, CD-A2, CD-A3
(Didactic Center, Auditoriums 1, 2, 3)

❹ AG-BOT
(General Auditorium, Botanic)

❺ MINAS1, MINAS2, MINAS3, LABLIC
and Secretariat & Conference Shop

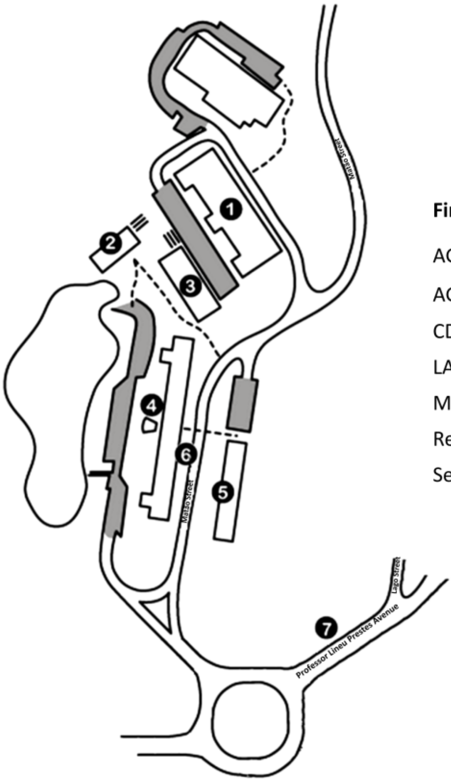
❻ Bus stop: "Biociências"

❼ Bus stop: "Rua do Lago"

Parking lots

Walking paths

Adaptado do mapa da Semana Temática de Biologia USP



Finding aid (alphabetical order)

AG-BOT ❹

AG-ZOO ❶

CD-A1, CD-A2, CD-A3 ❸

LABLIC ❺

MINAS1, MINAS2, MINAS3 ❺

Restaurant ❷

Secretariat & Conference Shop ❺

Conference Program

Sunday, July 16
(On Sunday, all activities will occur at the Butantan Institute)
13:00-17:00 Registration, at Butantan Institute
13:30-15:00 Visit to the museums of Butantan
15:00-16:00 Brazilian music concert
16:00-17:00 Butantan park visit
17:00-18:00 President's welcome speech
18:00-18:40 Cinema
18:40-21:00 Welcome to São Paulo cocktail

Monday, July 17
(All activities will be held at the Biosciences Institute, up to 17:00 o'clock; then, the participants will be taken by bus to CDI[*])
08:00-09:00 Registration, secretariat (LABLIC)
09:00-10:30 Parallel Sessions 1 – see page 8
10:30-11:00 Coffee break
11:00-12:30 Parallel Sessions 2 – see page 26
12:30-15:30 Lunch break; meeting of the ISHPSSB Council
15:30-17:00 Parallel Sessions 3 – see page 50
17:00-17:30 Coffee break
17:30-18:00 Transportation to CDI*
18:00-19:30 Plenary conference 1, CDI*
    Naomi Oreskes (Harvard University)
    "Can science be viewed as ex ante authoritative in a post-factual world?"
19:30-21:00 Poster session and refreshments – see page 74

[*] CDI = Auditorium of the International Broadcasting Center ("Centro de Difusão Internacional" in Portuguese). There will be transportation by bus for all participants and visitors. Boarding on the buses will take place at Rua do Matão, in front of the aisle 14, starting at 17:30 o'clock.

Tuesday, July 18

(All activities will be held at the Biosciences Institute, except for birdwatching)

07:00-08:30 Birdwatching at Butantan Institute (limited vacancies, requires advance registration)

08:00-09:00 Registration, secretariat (LABLIC)

09:00-10:30 Parallel Sessions 4 – see page 109

10:30-11:00 Coffee break

11:00-12:30 Parallel Sessions 5 – see page 136

12:30-15:30 Lunch break; early career mentoring lunch; ABFHiB Council meeting

15:30-17:00 Parallel Sessions 6 – see page 160

17:00-17:30 Coffee break

17:30-19:00 Parallel Sessions 7 – see page 186

Wednesday, July 19

(All activities will be held at the Biosciences Institute, up to 17:00 o'clock; then, the participants will be taken by bus to CDI*)

08:00-09:00 Registration, secretariat (LABLIC)

09:00-10:30 Parallel Sessions 8 – see page 202

10:30-11:00 Coffee break

11:00-12:30 Parallel Sessions 9 – see page 227

12:30-15:30 Lunch break; Grad. students general meeting; Membership diversity meeting; visit to Butantan lab (registration required)

15:30-17:00 Parallel Sessions 10 – see page 253

17:00-17:30 Coffee break

17:30-18:00 Transportation to CDI*

18:00-19:30 Plenary conference 2, CDI*

Kevin N. Laland (Center for Biological Diversity, School of Biology, University of St. Andrews, UK)

"What use is an extended evolutionary synthesis?"

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* CDI = Auditorium of the International Broadcasting Center ("Centro de Difusão Internacional" in Portuguese). There will be transportation by bus for all participants and visitors. Boarding on the buses will take place at Rua do Matão, in front of the aisle 14, starting at 17:30 o'clock.

Thursday, July 20

(All activities will be held at the Biosciences Institute, up to 17:00 o'clock; then, the participants will be taken by bus to CDI*)

08:00-09:00 Registration, secretariat (LABLIC)

09:00-10:30 Parallel Sessions 11 – see page 280

10:30-11:00 Coffee break

11:00-12:30 Parallel Sessions 12 – see page 303

12:30-15:30 Lunch break; ISHPSSB Council meeting

15:30-17:00 Parallel Sessions 13 – see page 330

17:00-17:30 Coffee break

17:30-18:00 Transportation to CDI*

18:00-19:30 Awards ceremony and ISHPSSB general meeting, at CDI

19:30-20:00 Transportation to conference dinner

20:00-22:30 Conference dinner

Friday, July 21

(All activities will be held at the Biosciences Institute)

08:00-09:00 Registration, secretariat (LABLIC)

09:00-10:30 Parallel Sessions 14 – see page 358

10:30-11:00 Coffee break

11:00-12:30 Parallel Sessions 15 – see page 381

12:30-15:30 Lunch break; ISHPSSB Council meeting

15:30-19:00 Excursions in São Paulo, University of São Paulo and Butantan Institute

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* CDI = Auditorium of the International Broadcasting Center ("Centro de Difusão Internacional" in Portuguese). There will be transportation by bus for all participants and visitors. Boarding on the buses will take place at Rua do Matão, in front of the aisle 14, starting at 17:30 o'clock.

MONDAY JULY 17
09:00-10:30 – Parallel sessions 1

ORGANIZED SESSION STANDARD TALKS – AG-ZOO
Heredity and Evolution in an Ibero-American Context
Orgs.: Marsha Richmond (Department of History, Wayne State University, USA, marsha.richmond@wayne.edu) and Ana Barahona (School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, ana.barahona@ciencias.unam.mx)

In honor of ISH meeting in South America for the first time, this session examines the history of heredity and evolution in an Ibero-American context. The papers explore different aspects of genetics and evolutionary studies as pursued in Europe and North America and also transferred, translated, received, and pursued in various countries in the Americas, with a particular focus on Latin and South America. The role of gender in the life sciences is particularly prominent, including a focus on: the influence of masculinity on the reception of Darwinism in Argentina, the role of women within the work carried on by scientific couples pursuing "familial science" in an Ibero-American context, and the gendered order and nature of work within scientific institutions in Mexico and Spain. In addition, the flow of scientific knowledge between Europe, the United States, and Latin and South America is scrutinized. There were clear advantages to this cross-fertilization in terms of knowledge production and institution building, and Central and South American organisms were critical to the advancement of North American research programs. But there were also disadvantages to such collaboration, especially the prospect of potential conflict, when differences in interpretation could lead to disagreements among the participating groups and ultimately to antagonism. This session provides a robust examination of the different elements entailed by the pursuit of heredity and evolution studies in an Ibero-American context.

Chair of the session: Ana Barahona (School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, ana.barahona@ciencias.unam.mx)

Papers:

The biology of masculinity: The evolution of gender in nineteenth century Argentina

Adriana Novoa (University of South Florida, USA, ainovoa@usf.edu)

The links between race and the introduction of evolutionary ideas in Latin America has been covered by the scholarship produced by historians of science, but the same cannot be said about gender, particularly how new ideas about heredity, natural selection, and competition started to erode the old model of republican masculinity that was part of liberal ideology of the first half of the nineteenth century. Clearly, by the 1890s this model was in crisis and there were many debates about how heredity affected manhood and traditional gender values. In this essay, I will examine the case of Argentina during the nineteenth century to show how a new model of masculinity started to emerge by the 1870s promoting men with strength, natural energy, and in general a balance between natural virtues and acquired ones. This implied radical changes from the culture of sensibility that had been relevant before. The man who was the result of nature's choices was based on analogies coming from biology that identify "instinct" and "natural law" as markers of healthy development. This also provided an understanding of heredity that privileged natural selection in organisms as favoring certain traits for men, keeping a careful balance between what was natural and what was social. In my essay, I will show how this narrative was built and the political and scientific consequences of the debates around it. Politically, I will analyze the scientific evidence provided in the debates about the creation of military service for all men who were eighteen years old, and the divorce laws debated by the beginning of the twentieth century. Scientifically, I will demonstrate the connections that existed between the development of evolutionary psychology and the treatment of mental diseases among men deemed inferior due to their inheritance.

The introduction of population genetics studies in Brazil (1943-1960): a bibliometric study

Lilian Al-Chueyr Pereira Martins (University de São Paulo/Ribeirão Preto, Brazil, lacpm@ffclrp.usp.br) & José Franco Monte Sião (Group of History and Theory of Biology (GHTB), University of São Paulo, Brazil, jfmontesiao@ig.com.br)

An important centre in which genetic research started and was carried out in Brazil during the 20th century was situated at the Faculty of Philosophy, Sciences and Linguistics of the University of São Paulo, headed by André Dreyfus (1897-1952). Beginning in 1943, four times Dreyfus' group was visited by the Ukrainian geneticist Theodosius Dobzhansky (1900-1975), whose name is mainly associated with the Evolutionary Synthesis. The partnership between Dobzhansky and Brazilian researchers included, among other things, the development of a project supported by the Rockefeller Foundation that lasted about twenty years. This presentation has two aims. First, to evaluate the impact made by Dobzhansky's visits on the studies of genetics and evolution developed by the members of Dreyfus' group during the 1940's and the 1950's. Second, to elucidate the factors which could have contributed to the increase or decrease of Brazilians' and Dobzhansky's publications related to the project in some periods as well as the end of their partnership. The analysis undertaken covers a representative sample of the content of the works written individually by the members of the Dreyfus' group, either co-authored or in collaboration with Dobzhansky, and a bibliometric study. It leads to the conclusion that Dobzhansky's visits had an impact not only in quantitative terms (the number of individual and joint publications) but also in qualitative terms. The group that was previously dedicating itself to the study of invertebrates, after the first visit of Dobzhansky adopted a new line of investigation (the genetics of populations) with a new experimental material (*Drosophila*). Besides that, it explored a relatively under-studied region: the tropical zone. However, the study also detected some decrease of individual and joint publications related to the subject of the project during some periods. Among the main factors in such a decrease can be pointed out: the adoption of new experimental materials by some members of the group; the involvement with subjects not related to the initial project, such as botany; Dobzhansky's and his wife's health problems during the third visit; and scientific disagreements between Dobzhansky and Brazilian researchers.

Central-American species/North-American knowledge: The cytogenetic research program of Sally Hughes-Schrader and Franz Schrader

Marsha Richmond (Department of History, Wayne State University, USA, marsha.richmond@wayne.edu)

In 1928 Sally Hughes-Schrader (1895-1984) and her husband Franz Schrader (1891-1962) made a research trip to Belize, British Honduras, and Guatemala to collect species of *Icerya*, a group of small insects of the order Hemiptera commonly known as scale insects. The husband-wife research team pursued an active research program on sex determination using *Icerya* species from the mid-1920s, exploring the unusual hermaphroditic system of propagation. On the basis of their long-time study of Coccids, the two researchers formulated a hypothesis for the evolutionary origins of haplo-diploid parthenogenesis as a possible evolutionary intermediate stage between ordinary diploid species with sex chromosomes and haplo-diploid parthenogenetic species (Schrader and Hughes-Schrader, 1931). This paper explores the research trip the couple made to Central America in search of species that would expand their understanding of the genetics and evolutionary implications of systems of sexual reproduction.

ORGANIZED SESSION STANDARD TALKS – CD-A1
The Enduring Relevance of Organicism for Philosophy of Biology

Orgs.: Jan Baedke (Department of Philosophy I, Ruhr University Bochum, Germany, jan.baedke@rub.de) and Daniel J. Nicholson (Centre for the Study of Life Sciences, Egenis, University of Exeter, UK, dan.j.nicholson@gmail.com)

Chair of the session: Jan Baedke (Department of Philosophy I, Ruhr University Bochum, Germany, jan.baedke@rub.de)

In the first decades of the twentieth century, and especially in the interwar period, scientific efforts to establish a theoretical biology increasingly flourished. This held especially for philosophically-minded biologists in the UK and in German-speaking contexts, and to a lesser extent also in the United States. The heterogeneous movement usually referred to as ‘organicism’ is of particular note. Organicists shared at least two viewpoints: (i) that biology is in need of strengthening its conceptual foundations in order to deal with the rapid development of new experimental technologies and data available (esp. in fields like genetics, cytology, and embryology) and (ii) that the characteristics of living systems can neither be understood through vitalism nor mechanicism, but necessitate a third way in which the concept of the organism takes a central role.

In this session, we will address a number of topics associated with organicism (as well as with the related movement of dialectical materialism) from historical and philosophical perspectives. In particular, we will discuss what contemporary philosophers of biology can learn from this earlier tradition in the field. How can old debates about concepts such as organism, mechanism, organization, level, and life, as well as metaphysical frameworks such as process philosophy, all prominent in organicist views, enrich contemporary debates in philosophy of biology and the biosciences? Can we, for example, use such concepts and theories to address current postgenomic challenges of linking organisms with their environments and development with evolution? How do current organism-centered theories in biology differ from those of the organicists? Can organicism guide us to a better conceptualization of the organization of living systems, including their hierarchical structure, compared to recent attempts in the so-called 'new mechanistic philosophy'? And, more generally, why has organicism been almost complete neglected by philosophers of biology and what does this tell us about the historiography of the field?

Papers:

Organicist Philosophy of Biology: Then and now

Daniel J. Nicholson (Centre for the Study of Life Sciences, Egenis, University of Exeter, UK, dan.j.nicholson@gmail.com)

The philosophy of biology is generally perceived to be a relatively young discipline, having only emerged in the last third of the twentieth century. The reality, however, is that it already existed as a clearly defined field of research over half a century earlier. It was particularly prominent in the interwar period, owing to an international community of philosophically-minded biologists and biologically-minded philosophers—known collectively as the organicists—who sought to develop a new theoretical foundation for biology following the then recent revolutionary developments in physics. Prominent organicists included J.S. Haldane, W.E. Ritter, E.S. Russell, J.H. Woodger, J. Needham, L.v. Bertalanffy, and P.A. Weiss. What is most striking when we revisit the organicist corpus today is the extraordinary degree of continuity that exists between that discourse and the present one. This talk will illustrate this continuity by examining the contemporary relevance of one of the pivotal theses of organicism, namely that the organism is the central concept in biological explanation, and that it constitutes the starting point for all biological theorizing. The organicists regarded the organism as a system in which the parts are fundamentally interrelated and their activities are directed towards the production, maintenance, and restoration of the whole. The organicists drew two key implications from their understanding of the organism. The first is that ‘the activity of the whole cannot be fully explained in terms of the activities of the parts isolated by analysis’, and the second is that ‘no part of any living unity and no single process of any complex organic activity can be fully understood in isolation from the structure and activities of the organism as a whole’. I will show how their commitment to these two ‘laws of biological method’, as Russell called them, led them to prefigure most of the now familiar anti-reductionist critiques of developmental genetics and molecular biology. With regards to developmental genetics, it led them to maintain that heredity would only be understood epigenetically by studying the robustness and plasticity of ontogeny, rather than preformationistically by attending to the deterministic action of genes (indeed, some even questioned the very existence of genes as physical hereditary particles). And with regards to molecular biology, it led them to declare that a cell would never be understood by providing a comprehensive repository of all its constituents (given that what is crucial is how these constituents are organized by the cell as a whole), and also that it is deeply misleading to endow individual molecules (such as genes) with the causal powers and systemic properties that we observe in the cell as a whole (self-regulation, self-organization, etc.). Overall, the claim I will defend in this talk is that organicist philosophy of biology continues to be relevant three quarters of a century later, as it anticipated a wide range of subsequent developments, including the articulation of developmental systems theory, the rise of systems biology, and many of the criticisms of mechanistic explanation currently in vogue.

Locating the organism in the environment: Old and new challenges

Jan Baedke (Department of Philosophy I, Ruhr University Bochum, Germany, jan.baedke@rub.de)

In the early 20th century, comprehensive experimental investigations allowed new insights into the plasticity of organisms, their robustness and regeneration, as well as their reaction norms and responsiveness to various environmental cues. These investigations set the foundations for a new organism-centered biology. It was made up of a heterogeneous group of biologists especially in the UK and in the German-speaking word that held a number of theoretical and philosophical viewpoints, including organicism (e.g., Woodger, Waddington, v. Bertalanffy) and dialectical materialism (e.g., Needham, Schaxel). A central topic in this group was the interest in developing a theoretical framework that allowed conceptualizing organism-environment interaction, both from developmental and evolutionary viewpoints. This framework was built on two assumptions: (i) The organism and the environment form a insoluble whole. They show causal reciprocity and inextricable interdependence. (ii) The biological individual – the organism – is the central unit in biological theorizing.

In this talk I will reconstruct the basic tenets of this organismic biology with respect to how its advocates understood the relationship between the organism and the environment. I will show that a major challenge was to conciliate assumptions (i) and (ii). In other words, to stress the interwovenness of the organism with its environment, but, at the same time, to secure the organism as an identifiable unit to which one can attribute, for example, activity and agency. It will be argued that this problem of losing the organism in its environment was addressed by explicating what it means for organisms to be alive. A multi-faced concept of life was developed, including functionalist, metabolic, as well as biochemical and physical views of life, that allowed defining and delimiting organisms as life forms in their environment. Finally, this paper shows that current trends towards a new organism-centered biology and biophilosophy face a very similar challenge. Again, the plastic organism is threatened to be not only embedded but dissolved in its environment, to lose its agency as an independent active unit, and to stand out in complex interdependencies of causal reciprocity. Based on these findings, it will be described how new organism-centered approaches can learn from old ones.

Joseph Needham's contributions to the development of the levels concept in biology (1929-1945)

Daniel Brooks (Konrad Lorenz Institute, Vienna, Austria, daniel.brooks@kli.ac.at)

The origins of the contemporary concept of 'levels of organization' in biology and philosophy can be traced to the organicist biologists of the 1920-30's. Though the basic term "levels" had been introduced into the scientific lexicon earlier as a significant technical concept, it was quickly observed to be a largely unanalyzed term in need of active development. Organicist proponents engaged soon thereafter articulating the meaning and significance of the term for biology. Consequently, the term served to both preserve a materialist scientific ontology while elaborating the unique explanatory problems that distinguish biology from the physical sciences.

This paper will analyze Joseph Needham's development of the concept of 'levels of organization' in biology during the period of 1929-1945. Needham's efforts imbued 'levels' with a programmatic character that was instrumental in its uptake as the pervasive, central theoretical concept it is known as today. This development proceeded in three stages. The first stage, spanning approximately 1929 to the early 1930's, comprised reconciling his experimentalist-oriented epistemology of biology with Joseph Woodger's philosophical work. The introduction of 'levels' into a biological context by Woodger's Biological Principles had a significant impact on Needham's scientific epistemology. Secondly, Needham proceeded in the early- to mid-1930's to elaborate a problem-oriented understanding of 'levels' that successfully combined these lines of thought. Here Needham's development of 'levels' departed from Woodger's theory-first approach, emphasizing the practical significance of the term for more adequately articulating the problems working biologists sought to solve in their research practices.

These efforts, thirdly, culminated in his 1937 Herbert Spencer Lecture "Integrative Levels", which would also mark his last major contribution to developing the levels concept. The mark this work would leave on the term, however, was more baffling than beneficial. Instead of the piecemeal experimentalist epistemology of the prior years, Needham's lecture ventured deep into, i.a., a sweeping biologistic view of human society and its ultimate future. Nonetheless, the paper remains noteworthy as (1) a resource directly linking the continuity of usage of 'levels' from its organicist roots to subsequent users and developers in biology at large, (2) a programmatic expression of the term now linked to an established system of usage, and as (3) introducing the provisional namesake label under which 'levels' was initially absorbed into the scientific community during the critical period of 1942-45.

ORGANIZED SESSION STANDARD TALKS – CD-A2

The Resituation of Scientific Knowledge

Org. and chair of the session: James Griesemer (Department of Philosophy; Science and Technology Studies Program, University of California, Davis, USA, jrgriesemer@ucdavis.edu)

This panel is concerned with describing examples of and proposing tentative mechanisms for what Mary Morgan (2014) called the "resituation" of scientific knowledge — how techniques, models, instruments, data, and other constituent parts of the research process are taken up and put to use in new contexts, and how they are changed in the process. Morgan argued that knowledge is generated locally, and must therefore travel to other sites if it is to be accepted. The papers in this panel explore mechanisms and processes of resituation in a variety of life science practices, from experimental procedures, to dataset generation and analysis, to modeling, to commercialization of biotechnologies. We consider not only acceptance of findings and concepts, but also conditions under which resituation of scientific knowledge results in uptake, adoption, and use in new sites to produce new knowledge. We consider a range of scales of social organization of scientific work, focusing on examples from the biological sciences, from individuals in (and moving between) labs, to whole laboratories and research institutes, to specialties and disciplines. Collectively, the papers aim to generate discussion of Morgan's provocative paper and more broadly of the role of institutions (as collective capacities, sensu Elihu Gerson) as well as organizations (as collections of people organized by shared work and which realize institutions).

References:

Gerson, E. M. (in preparation). *Institutions and Repertoires*.

Morgan, M. S. 2014. Resituating Knowledge: Generic Strategies and Case Studies. *Philosophy of Science* 81(5): 1012-1024.

Papers:

Substantiating genetic and cultural continuity: Partial connections between genomic, archaeological and linguistic datasets

Carlos Andrés Barragán (University of California, Davis, USA, barragan.carlosandres@gmail.com)

In this talk I am offering an ongoing analysis on how life scientists studying DNA from contemporary and Pre-Columbian Native American populations generate and interpret genomic datasets using data from archaeology, ethnohistory and linguistics. I particularly focus on two research networks, one located at the University College of London and the other at the Instituto de Genética Humana in Bogotá. Within each laboratory my ethnographic and archival work follows specific studies aiming to map out biological relations between past and contemporary human populations living in what today is known as Colombia. I have been tracking how senior scientists and graduate students pull data from archaeology, ethnohistory and linguistics in order to produce, contextualize and interpret genomic datasets. I seek to understand how these life scientists appraise non-genomic datasets and how in their dissection these researchers engage with or silence inherent assumptions in the production of archaeological, ethnohistorical and linguistic datasets. I care about how these mechanisms for silencing "noise" in resituated datasets allow the production of genomic data and claims about cultural and biological continuity between human populations across time and space. Conceptually, I am drawing from Mary S. Morgan's project to understand how the resituation of scientific knowledge works.

Reference:

Morgan, M. S. 2014. "Resituating Knowledge: Generic Strategies and Case Studies". *Philosophy of Science* 81(5): 1012-1024.

Resituating scientific knowledge using commercial platforms

L. Scott Cole (University of California, Davis, USA, lscole@ucdavis.edu)

In this talk, I will explore the nature of platform-based resituation of scientific knowledge and the strategies used by commercial labs to foster successful resituation. Mary Morgan (2014) describes "resituation" as the process by which scientific knowledge developed at one local site is made relevant at one or more other local sites. She recently characterized generic strategies used by scientists to foster resituation of locally generated knowledge. If scientific knowledge can be thought of as comprising both new experimental results and new experimental methods (i.e. non-generic means of generating results), then I suggest that resituation also occurs when an instrument platform developed by a commercial science laboratory is purchased and employed by local science labs. In fact, a commercial lab's success is based on successful resituation. To ground my exploration I will use a case study of the resituation of scientific knowledge about the rapid sequencing of DNA by Applied Biosystems, Inc. (Foster City, CA) via their Model 377 DNA Sequencer instrument platform in the mid-1990s. Strategies or mechanism that I will consider include: 1) "embedding knowledge" in packaged products, 2) "providing static knowledge" (e.g., user manuals), 3) "providing dynamic knowledge" accessible from company employees of different technical levels, 4) "facilitating access to dynamic knowledge" accessible from other local customer labs (i.e., user groups), and 5) "encouraging access to 3rd party partner knowledge" that takes all of these forms but which mainly is embedded in other products that support successful resituation of the platform.

Reference:
Morgan, M. S. 2014. “Resituating Knowledge: Generic Strategies and Case Studies”. *Philosophy of Science* 81(5): 1012-1024.

Situating the resituation of knowledge

James Griesemer (Department of Philosophy; Science and Technology Studies Program, University of California, Davis, USA, jrgriesemer@ucdavis.edu)

In this talk, I will briefly report and reflect on some preliminary data from interviews with a post-doc whose experience in joining a new lab in a new university I am tracking. The data are intended to serve a larger project to investigate what Mary Morgan (2014) has called the “resituation” of scientific knowledge. Because scientific knowledge is always locally generated, how it becomes accepted in other “sites” is a phenomenon in need of investigation because it is not at all obvious that, how, when, or to what extent it happens. Morgan argued that resituation can be described in terms of a small number of generic strategies that are not discipline specific. Here, I focus on several specific embodiments of knowledge that a post-doc may bring from graduate training at one site to post-doctoral training at another site: datasets, models, software, and findings (in the form of “go to” publications) that are the kinds of tools of the trade (and elements of a functioning research system or platform) in any given site. Rather than acceptance, my focus is on commitment to use. I seek to understand the mechanisms through which the post-doc resituates knowledge in these forms from graduate school to post-doctoral employment and in turn what objects of knowledge are resituated through uptake by the post-doc. I will try to sketch broad aspects of this way of studying problems of scientific organizations, institutions, and change through the lens of my preliminary observations on this one “data point.”

Reference:
Morgan, M. S. 2014. “Resituating Knowledge: Generic Strategies and Case Studies”. *Philosophy of Science* 81(5): 1012-1024.

INDIVIDUAL PAPERS SESSION – CD-A3
History of Medicine

Chair of the session: Michel Morange (Cavaillès Center, Ecole Normale Supérieure, Paris, France, morange@biologie.ens.fr)

Papers:

Optics and analogy in Fracastoro's definition of "seeds of contagion at a distance"

Ruy Jose Henriquez Garrido (Department of Logic and Philosophy of Science, University Complutense of Madrid, Spain, ruyjose@ucm.es)

For the Galenic medicine of the Renaissance, the plague and other numerous contagious diseases that devastated Europe were inexplicable. In light of this problem, the Veronese physician Girolamo Fracastoro (1478-1553) proposed the notion of "seeds of contagion" (*seminaria contagionum*) as the specific cause of the contagion.

In spite of his attempt to preserve the prevailing medical paradigm, Fracastoro's theory of contagion represented a departure in medicine by establishing an ontological definition of the disease, as opposed to the Galenic physiological definition. The theory of "seeds of contagion" thus became one of the most important precedents of the microbial theory of diseases.

Nevertheless, Fracastoro had serious problems with contagion at a distance. The conceptual framework of Aristotelian physics prevented the existence of a vacuum, making it impossible to transmit a body or organism over distances without the existence of a material medium. In other words, it was inconceivable to think in terms of processes that did not involve direct contact.

In addition, Fracastoro had to find answers to many important questions, such as: why a specific organism acquired one contagious disease and not another, why some individuals were free from contagion, or how certain animal species could be free from epidemics, while other nearby species succumbed to them. In short, what is the force that regulates the propensity to acquire certain contagious diseases?

To overcome these difficulties, Fracastoro proposed "analogies of contagion". In this theory he brought together the scholastic doctrine of "On the Multiplication of Species" (Grosseteste-Bacon), which was based on optics and theories of light, and the Neoplatonic conception of "analogy" as the conveyor of sympathy-antipathy (Ficino).

The purpose of this paper is to understand the process behind Fracastoro's definition of seeds of contagion at a distance to see if he achieved his aim of eliminating the traditional explanation of contagion based on hidden qualities. The idea is to establish whether he provided a truly quantitative explanation and if it is a forerunner of Gassendi and Boyle's corpuscularian doctrine.

The sociality network of Albert Calmette's studies about the development process of the bacillus BCG

Kelly Regina Silva Campos (Graduate Studies Program in Science Education, São Paulo State University Júlio de Mesquita Filho (UNESP), Brazil, hzf666@live.com), Luiz Felipe Reversi (Graduate Studies Program in Science Education, São Paulo State University Júlio de Mesquita Filho (UNESP), Brazil, lfr182@hotmail.com), Ana Maria de Andrade Caldeira (Department of Education, São Paulo State University Júlio de Mesquita Filho (UNESP), Brazil, anacaldeira@fc.unesp.br) and João José Caluzi (Department of Physics; São Paulo State University Júlio de Mesquita Filho (UNESP), Brazil, caluzi@fc.unesp.br)

The French doctor Léon Charles Albert Calmette (1863-1933) is known as one of the contributors to the development of the bacillus named BCG (Bacillus Calmette-Guérin), important in medicine history due to its use as a vaccine against tuberculosis. The name bacillus BCG has its origin from its development in association with the French veterinarian Jean-Marie Camille Guérin (1872-1961).

There is a common belief among students that science is a solitary pursuit and the ideas appear spontaneously in the mind. This is a stereotyped perception about the nature of science that we seek to disavow, showing Calmette´s researches about the development of bacillus BCG using a Sociability Network elaborated by us.

To illustrate how the Sociability Network can explain the social nature of science, we delineate BCG’s development by Calmette and Guérin. During this process they counted on many scientists, such as the German microbiologist Emil von Behring (1854-1917) and the French veterinarian Edmond Nocard (1850-1903), revealing that science isn’t a solitary pursuit. Von Behring, for instance, sent the bovine tuberculosis bacilli used by Calmette and Guérin, and Nocard provided some theoretical basis and biological material for them.

We organized the contributions of Albert Calmette, in the period of 1905 to 1933, for the development of the bacillus BCG. For this purpose, we used the original papers published by him. In these papers, we show controversies and dialogues with other researchers, integrating an internalist and externalist approach of the history of science, by discussing scientific concepts within his papers and the social, economical and political influences in the respective historical context.

It is possible to observe how the interaction with other studies and ideas of the period oriented Calmette's researches. For instance, concerning the origin of pulmonary tuberculosis, the majority of scientists contended that the infection took place in the respiratory tract, but there was a second hypothesis which claimed that the infection had an intestinal origin. Calmette and Guérin proposed themselves to study this question, oriented by the discussions of the scientific community, and tried to answer it with the contribution of experimentation.

The Sociability Network can help students to overcome their naïve visions of science, such as the beliefs that it is a solitary pursuit and that ideas appear spontaneously in the scientist's mind, previously mentioned.

Bacteriophage in the Pasteurian tradition

Michel Morange (Cavaillès Center, Ecole Normale Supérieure, Paris, France, morange@biologie.ens.fr)

One century ago, Félix d'Hérelle was the co-discoverer of the bacteriophage (with Frederick Twort), and the most active promoter of its study. He considered the bacteriophage as a model system to understand the origin of life and its fundamental characteristics, as well as a way to fight against infectious diseases.

The debate between Félix d'Hérelle and Jules Bordet on the exogenous or endogenous nature of the bacteriophage has been extensively studied by William Summers and other historians. In this contribution, I will explore how the conceptions and actions of d'Hérelle fitted (or not) French and Pasteurian traditions of research. First, I will show that his definition of life, and his emphasis on assimilation as a property characteristic of it, was a legacy of Claude Bernard, and of the strong influence he had. The attempts of d'Hérelle to use the bacteriophage as a weapon against infectious diseases were also inscribed in a program initiated by Pasteur himself as early as the 1880s. Pasteur demonstrated the efficiency of the agent of cholera against rabbits through experiments done in Champagne, and pressed his nephew, Adrien Loir, to use it in Australia. Loir did not succeed: Australia was not France, and it was difficult to translate the experience acquired in France to the dimensions of this continent. Félix d'Hérelle himself had used bacilli to fight against locust plagues when he was in Argentina, before his discovery of the bacteriophage. Finally, I will compare the conceptions of disease and immunity proposed by Pasteur and his followers, with those of d'Hérelle.

INDIVIDUAL PAPERS SESSION – MINAS1

Neurosciences: Philosophical Perspectives

Chair of the session: Osvaldo Frota Pessoa Jr. (Department of Philosophy, Faculty of Philosophy, Letters and Human Sciences, University of São Paulo, Brazil, opessoa@usp.br)

Papers:

Situating the individual: An expanded account of psychological mechanisms

Matthew Smithdeal (Department of Philosophy, University of British Columbia, Canada, matthew.smithdeal@gmail.com)

Recently, Piccinini and Craver have argued that psychological explanation can be unified if we accept that functional analyses are sketches of complete mechanistic explanations. In this sense, functional analyses are elliptical sketches of a capacity that can be integrated into multilevel mechanistic explanations of capacities. On these terms, functional analysis and mechanistic explanation constrain each other and are therefore not autonomous. Shapiro argues against this and defends the autonomy of functional explanation by arguing that Piccinini and Craver's view is either question-begging or trivial. In response, I argue that Shapiro has fundamentally misunderstood Piccinini and Craver's position. He seems to understand them as offering an account of what psychological explanation should be doing. They are, in fact, offering a descriptive account in line with the originally stated goals of the Machamer, Darden, Craver (MDC) interpretation of mechanisms. In conclusion, I argue that Piccinini and Craver are correct, but that their proposal does not go far enough. Psychological explanation should also recognize the situatedness of the individual. A complete explanation of a capacity will consider this as well as the functional and structural components. Likewise, in developing an account of psychological mechanisms, we should not ignore parallel lessons in the development of a view of biological mechanisms.

References:

Machamer, P., Darden, L., and Craver, C. F. 2000. Thinking about Mechanisms. *Philosophy of Science* 67(1): 1-25.

Piccinini, G., and Craver, C. 2011. Integrating psychology and neuroscience: functional analyses as mechanism sketches. *Synthese* 183(3): 283-311.
Shapiro, L. A. 2016. Mechanism or Bust? Explanation in Psychology. *The British Journal for the Philosophy of Science*. axv062.

On the coming revolution in brain science

Osvaldo Frota Pessoa Jr. (Department of Philosophy, Faculty of Philosophy, Letters and Human Sciences, University of São Paulo, Brazil, opessoa@usp.br)

The fast pace of experimental research in neuroscience suggests that a conceptual revolution in the sciences of the brain is forthcoming in the near future. One can imagine that an essential component of this new paradigm shift will be the inclusion of consciousness and the self in the scientific worldview. “Consciousness” here is not understood merely in the behavioristic sense, but is defined ostensively as “what it is like” to be in a certain subjective state. From the perspective of the Philosophy of Mind, a crucial aspect is how the “explanatory gap” between the quantitative scientific description of the brain and qualitative subjective experience will be dealt with. Our suggestion is that basic the psychophysical laws relating the two (cf. Feigl and Chalmers) will have to be postulated as unexplained principles: “given such-and-such a class of brain states, a human being will subjectively experience a certain *qualia*”. The number of such basic laws and the rule of combination for generating derived qualitative states are obviously still unknown. We predict that an important step for the onset of the coming revolution in brain science will be the solution of the localization problem: what area of the brain is the proximal cause of consciousness? Is it located in a certain region, such as in nuclei in the thalamus or in the dorsolateral prefrontal cortex, or is it distributed in a holistic manner throughout the brain? This problem, of course, is coupled to the question of when primary consciousness arose in biological evolution. At the level of fish? Do octopuses have subjective experiences? An examination of modern scientific revolutions, such as plate tectonics, indicates that data-driven revolutions happen very quickly, once compelling evidence is available, and that the winning ideas might coexist with others during a significant period of time before the onset of the revolution. As a metaphysical guiding principle, we adopt “qualitative physicalism”, also known as the “colored-brain thesis” (Stubenberg), which claims that subjective qualia are identical to real physical properties of brain tissue (contra mechanicism). We consider that consciousness is not simply a function of the organization of the parts of the brain, reproducible in machines (thus rejecting functionalism), but agree with Searle's "biological naturalism", according to which biological matter is essential for consciousness. Consciousness thus depends on matter and form (organization), while biological matter lacking the appropriate organization (such as in plants) would not lead to the emergence of consciousness, although it would have some sort of "protopsychism", which could be incorporated into a non-mechanistic definition of "life". This could be viewed as some form of vitalistic materialism (see Skrbina), although the "qualities" or "proto-mind-stuff" that pervades biological matter (and ultimately all of reality) would have no causal powers over and above that of the mechanistic aspect of reality.

INDIVIDUAL PAPERS SESSION – MINAS2

Life and organisms: Philosophical Perspectives

Chair of the session: Susie Fisher (Department of Natural Sciences, Biological Thought Program, The Open University of Israel, susiefish@gmail.com)

Papers:

"Life created" – for the love of science?

Susie Fisher (Department of Natural Sciences, Biological Thought Program, The Open University of Israel, susiefish@gmail.com)

My work concerns situations in which experimental procedures resulted in the production of viable biological entities, which were then publicly hailed as "creation of life." For example, in 1955, an infective virus (tobacco mosaic virus, TMV) was reconstructed from its protein and ribonucleic acid components. Another example, from the mid-1960s, was the use of a viral enzyme to make in-vitro copies of the same virus' RNA. The synthetic RNA was indistinguishable from the original virus' RNA. It was physically, chemically, and biologically (infectivity) similar. Just recently, Craig Venter's group announced the successful making of "synthetic" bacteria that were capable of replicating billions of times. Although the entities mentioned above differ considerably in their level of complexity – a molecule, a virus, and bacteria – their construction was lauded, mainly by the media, as an act of creation of life.

A deliberation of creation of life calls for a discussion of "what is life." What makes scientists and others believe that a particular entity is alive? What are its properties? To further complicate the issue, there has never been a consensual definition of life that one can refer to. In this presentation, I will focus on the public's reaction to the reconstruction of the TMV virus, using newspaper reports and popular scientific texts to describe the media's response. I will briefly discuss the problematics of attributing life to a virus, which will lead up to my main question: What stood behind the media's enthusiastic reaction to this scientific achievement? Was it merely an admiration of the power of science and of scientists "playing god," or did other kinds of interests underlie the media's excitement?

Why life cannot be engineered but can be defined

Thomas Heams (Animal Genetics and Integrative Biology, INRA, France, thomas.heams@agroparistech)

The diversity of definitions of biological life is well known. Many core concepts of many scientific disciplines face debates over their definitions. But defining life is specially challenging because it is multilevel, complex, and mostly because it is a combination: it associates physiological and genetic features, with historical and systemic dimensions. This leads a growing number of authors to "stop worrying" about such definitions, or to advocate for their plurality and even fuzziness as a way to be inclusive and flexible toward the wide variety of life forms and life processes. Nonetheless, such a tendency does not go without problems. In the context of synthetic biology for example, blurry definitions of life allow many approximations and even legitimate claims that get always farther from scientific standards: still elusive shared minimal definitions of life would be necessary conditions to avoid the pitfalls of story-telling in this emerging discipline. This can be exemplified by the extensive use of the concept of "life engineering", which takes for granted that living entities can be studied as small modular engines. But even if living entities have such mechanistic features, this is not enough, and by far, to capture their specificity, precisely because they share them with non-living machines. On the contrary, living beings combine these features with other natural ones, such historicity, fragility, randomness, and collectiveness, that are seldom captured by life-as-precise-machines visions of the biological world, and that deserve to be reintegrated in our definitions of life. To progress in this task, I will counter-intuitively build on the notion of lifeness as a continuum between mineral and organic matter to defend the idea that a modest yet useful core definition of life is possible, as a limit state within an infra-living world of possibilities. Moreover, I will illustrate that infra-living entities are actually ubiquitous in the natural world, their very existence being a demonstration that defining life without resorting to boundaries is possible and promising.

Epigenetics and the molecularization of the social
Flavio D'Abramo (Free University Berlin, Germany, flavio.dabramo@fu-berlin.de)

The vision we have of living beings is deeply influenced by science that in turn translates into medical and technological practices. In this talk I will analyse one of the most controversial and lasting topics of science: the manner in which organisms develop, evolve and interact with the environment, broadly conceived. During the centuries this controversy has taken different shapes: from the epigenesis/preformation schism, through the Lamarckism vs. neo-Darwinism dichotomy, till the battle between those sustaining a genetic determinism contra scholars holding a nature/culture codetermination. Here I focus specifically on epigenetics as contention during the cold war. Particularly, I show how during the "Towards a Theoretical Biology" conferences organized by Conrad H. Waddington, epigenetics was integrated within a specific metaphysical program that replaced its previous framework. The new program was value-laden, based on a certain type of objectivity, and explicitly relevant for the context composed by individuals and local communities around the globe.

MONDAY JULY 17
11:00-12:30 – Parallel sessions 2

ORGANIZED SESSION STANDARD TALKS – AG-ZOO
Heredity and Evolution in an Ibero-American Context
Orgs. Marsha Richmond (Department of History, Wayne State University, USA, marsha.richmond@wayne.edu) and Ana Barahona

(School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, ana.barahona@ciencias.unam.mx)

Chair of the session: Marsha Richmond (Department of History, Wayne State University, USA, marsha.richmond@wayne.edu)

Papers:

Women geneticists, families and Drosophila *populations*

Marta Velasco Martín (Institute of Philosophy, Superior Council of Scientific Investigations (CSIC), Spain, marta.velasco@cchs.csic.es)

In 1950, the European fly species *Drosophila subobscura* appeared for first time in one Spanish paper to which the geneticist María Monclús had contributed. The paper was signed by her husband, also a geneticist, and had resulted from a research visit of the scientist couple to the Department of Genetics of the Instituto Marco Marchi de Pallanza in Italy. The geneticist of Russian origin Natasha Sivertzeva-Dobzhansky never worked on *Drosophila subobscura*. However, among the different *Drosophila* species she studied, there was one of the *subobscura* American relatives: *Drosophila pseudoobscura*. Her work contributed to most of the papers her husband Theodosius Dobzhansky signed in the first half of the 20th century on genetics of populations of *Drosophila*. Despite being developed in different continents and cultural environments, the scientific biographies of these two women and of the *Drosophila* fly species they studied show scientific knowledge production as the result of a shared creativity and intimacy between scientific partnerships and of works conducted in places inside and outside laboratories, including not only field stations but also households. This paper deals with *Drosophila* genetics that was co-produced in the local context of the research conducted in family and in the transnational context of a scientific style carried out by sharing the research activity of family endeavors as male products with other colleagues. A gender approach to studying knowledge production by María Monclús and Natasha Sivertzeva-Dobzhansky, both married to scientific colleagues, allows uncovering scientific practices, geographical centers of production, and relationships as agents. Scientific papers, congresses, conferences and international research journeys took part in a story in which, by exploring familial communities, I retrieve those agents, not only of women but also of children and their familial units so as to situate them in the history of genetics.

Women and the workplace: The work of Leonor Buentello at the first Unit of Human Genetics in Mexico

Ana Barahona (School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, ana.barahona@ciencias.unam.mx)

This paper addresses the gendered organization of the scientific work at the first Unit on Human Genetics of the Mexican Institute for Social Security (IMSS). This workplace had been founded in the 1960s by Mexican physician-turned-geneticist Salvador Armendares, who spent two years in Oxford under Alan Stevenson's tutoring. There, women and men had different tasks, duties and authority according to their gender, and individual and professional skills. I will focus on Mexican virologist-turned-geneticist Leonor Buentello who studied medicine at the National University of Mexico and graduated in virus genetics at Freiburg, Germany under the supervision of Richard von Hass. By the time she returned to Mexico to work with Armendares, he was performing the cytogenetic techniques he had brought back to Mexico from Oxford. Virologist Buentello began her career in medical cytogenetics alongside Armendares, learning cytogenetic techniques and joining him in their practice. Given her skillful handling of these techniques, she conducted tissue cultures and karyotyping of the hospital's patients, and was responsible for the supervision of blood sampling to ensure the correct identification of children, and for monitoring patients. Her work was of crucial importance inasmuch as she was the contact between the patients and the laboratory, between the bed and the bench in a two-way traffic. Although this gave her power in the clinical setting, the gender order in the workplace did not grant her equality. Only Armendares along with other young male researchers were responsible for the conception, elaboration, writing and conduct of the research projects; meanwhile Buentello, besides her role at the hospital, was more involved with the standardization of the experimental techniques in the laboratory. This narrative intends to return her to the forefront of the history of cytogenetics in Mexico and to illustrate the contribution of women to scientific developments and the dissemination of ideas on cytogenetics and medicine when research on human genetics was becoming a medical domain for diagnosis at an international level.

ORGANIZED SESSION STANDARD TALKS – CD-A1

Teleology and Organization in Biological Systems

Orgs.: Matteo Mossio (Institute of History and Philosophy of Sciences and Techniques, IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne, France, matteo.mossio@univ-paris1.fr) and Andrea Gambarotto (Superior Institute of Philosophy, Catholic University Catholique of Louvain, andrea.gambarotto@gmail.com)

Teleology is a kind of explanation by which the goal of an entity contributes to explaining the very existence of that entity. In mainstream philosophy of biology, teleology is mostly considered as a leftover of pre-Darwinian frameworks, such as natural theology and its appeal to a divine Designer whose intentions explain the existence of biological organisms. In the Darwinian theory of evolution, teleology is consistently reframed in terms of natural selection exerted on random variations, which produces adaptations. Adaptations, in turn, explain the existence of a biological trait or part by appealing to its evolutionary goal, which is the effect favored by selection. From the evolutionary perspective, hence, teleology is characterized by appealing to the effects of a trait type designed by natural selection in a lineage, given the selective advantage that it conferred to individual bearers in a population.

This double session explores the idea that this conception of teleology should be complemented by a more fundamental understanding of purposiveness, which is inherent to any biological individual as such, and cannot be simply reduced to a consequence of natural selection. In particular, the aim of the session is to link this kind of purposiveness to the notion of organization, taken as the most distinctive aspect of individual biological systems. The organization of biological systems is inherently teleological, insofar as the effects of its activity play a role in determining and maintaining its conditions of existence. Because of their teleological nature, hence, individual biological systems realize self-determination and self-maintenance. This view has a long tradition going back, among others, to Kant's Critique of Teleological Judgment, Bernard's milieu intérieur and, in particular, Piaget's notion of organizational closure that has been further elaborated in more recent studies.

Organizational closure provides a naturalized grounding for teleology, which in turn opens the way to the naturalization of two related biological dimensions, i.e. normativity and functionality. The conditions of existence of the organization can be understood as its intrinsic goal and, thereby, as the norms that its activity is supposed to comply with. In turn, the different contributions of the parts to the maintenance of the organization (and, therefore, of themselves) are their biological functions. Teleological explanations are therefore closely intertwined with functional ascriptions, insofar as the maintenance of biological organization is explained by making explicit the contribution of the integrated parts to the whole to which they belong. Furthermore, the connection between teleology and organization implies the idea that the whole organization is not just the result of the properties of the parts and their interactions, but also a theoretical principle that makes biological (functional) explanations possible. From a mere explanandum of biological science, it becomes a fundamental explanans.

The session explores the conceptual connections between teleology and organization in the biological domain, so as to assess its strengths and weaknesses. The talks focus on general conceptual, ethical and historical aspects, as well as on the applications to specific fields of biological research, such as development, heredity, ecology, and origins of life.

Chair of the session: Kepa Ruiz-Mirazo (Dept. of Logic and Philosophy of Science & Biophysics Institute (CSIC, UPV/EHU), University of the Basque Country, Spain, kepa.ruiz-mirazo@ehu.es)

Papers:

What makes biological organization teleological?

Matteo Mossio (Institute of History and Philosophy of Sciences and Techniques, IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne, France, matteo.mossio@univ-paris1.fr)

I argue that the organization of individual biological systems can be legitimately conceived of as an intrinsically teleological regime. The core of the argument consists in establishing a conceptual connection between organization and intrinsic teleology through the concept of self-determination: biological organization is teleological because the effects of its activity contribute to determining the conditions of its own existence.

Crucially, I suggest that not any form of circularity realizes self-determination, which should be specifically understood as self-constraint. Biological systems are constituted by structures that constrain the thermodynamic flow of energy and matter so as to maintain these very structures. More specifically, in the biological domain self-constraint takes the form of closure, i.e. a network of constraints that maintain each other, such that the whole network can be said to collectively self-constrain, and therefore to self-determine. Biological systems are organized in the precise sense that they realize a closure of constraints.

Why is self-constraint the only circular causal regime which can be said to realize self-determination, and therefore to be teleological? I will contend that if circular causation does not occur as self-constraint, it amounts to a chain of transformations in which the system as a whole plays no role in specifying its own conditions of existence, which are sufficiently determined by the external boundary conditions. In contrast, self-constraint implies that the system itself makes an irreducible contribution, specifying its own dynamics: hence, self-constraint involves self-determination, and biological organization (as a form of self-constraint through closure) is intrinsically teleological.

Organization can be conceived as a theoretical principle that makes biological explanation possible in different domains, and at different level of description. Some of the other talks included in this session explore precisely this research direction. In the conclusion, I rather discuss whether or not intrinsic teleology might be realized beyond the biological domain. I argue that, on the one hand, the realization of organizational closure beyond the biological realm appears to be highly unlikely, insofar as it requires such a high degree of complexity that any actual realization might be pertinently included in the biological domain. Accordingly, organization seems to be a distinctive biological principle. On the other hand, the occurrence of simpler forms of self-constraint, which do not involve closure, remains a controversial issue, in particular with respect to the case of self-organizing dissipative systems. Future scientific investigations will presumably provide a better understanding of the boundaries of intrinsic teleology in the natural world, in its more general sense.

Kant and beyond: natural purposiveness from an organizational perspective

Andrea Gambarotto (Superior Institute of Philosophy, Catholic University of Louvain, andrea.gambarotto@gmail.com)

In his very last paper, entitled "Life after Kant," Francisco Varela argued for the necessity, after two centuries, to move beyond the unstable position set out by Kant in the Critique of Judgment, and therefore provide a fresh re-understanding of living individuality as a natural purpose. In fact, Kant held an unstable position by arguing on the one hand for the impossibility of a reductionist account of organisms, while on the other hand maintaining that the teleological features displayed by living systems should be considered only as a heuristic principle, not as an ontologically essential feature. In a similar way, the overwhelming preference in philosophy of biology today is to explain away purposiveness as the statistical result of natural selection which post factum gives the semblance of goal-directedness. Hegel was the first who criticized Kant's equivocal position and tried to formulate a theory of living individuality at whose core was the idea of intrinsic purposiveness as a constitutive feature of living systems. Some recent developments in philosophy of biology have argued along these lines that the organization of biological systems is inherently teleological, which means that its activity is, in a fundamental sense, first and foremost directed toward an end (Mossio & Bich 2014). The paper expands on the historical background and theoretical implications of this idea, asking what does it mean, for us today, to claim that living organisms are intrinsically teleological entities.

Organizational teleology and functional normativity
Cristian Saborido (Department of Logic, History and Philosophy of Science, National University of Distance Education (UNED), Spain, cristian.saborido@fsof.uned.es)

The Organizational Approach (OA) to biological function is built upon the core idea that a function explains the very existence of the functional trait (See Schlosser 1998, McLaughlin 2001, Christensen & Bickhard 2002, Mossio et al. 2009, Saborido et al. 2011). The specific regime that grounds functionality is the "organizational closure" of living beings, i.e. the realization of a web of material structures which exert mutually constraining actions on their boundary conditions, such that the whole web is collectively self-maintaining. Therefore, the OA claims that the reasons for the existence of a functional trait are naturalistically grounded in the organizational features of biological systems.

A function is, according to the OA, defined as a specific constraint exerted by a part or trait subject to organizational closure. Accordingly, the OA offers an integration of the main existing accounts in the philosophical literature on functions (i.e. the "selected effects" and the "systemic" approaches) insofar as it defines function appealing to a causal loop within current biological organizations. This causal loop allows ascribing a function to a specific disposition of a trait that contributes to the maintenance of the biological organization to which the trait itself belongs.

Here, I will argue that the OA establishes a strong conceptual connection between teleology and normativity in its theoretical definition of biological function, and justifies the function/non-function distinction from a naturalized view. A trait's effect that contributes to the self-maintenance of the organization through organizational closure would be a norm for this trait. The conditions of existence of the system are here interpreted as the norms of its own activity: a functional trait must behave in a specific way; otherwise it would cease to exist.

The structure of this talk will be the following: in the first part I will explain in detail this theoretical definition, arguing that it is based on a notion of "organizational teleology" that grounds a normative dimension of functional ascriptions in biology. In the second part, I will focus on the scope and implications of this conceptual connection between teleology and normativity for the theoretical justification of the prevalent normative discourse in fields such as ecology or medicine. In the last part, I will discuss the scope and limits of the OA to account for other –more sophisticated- conceptions of normativity.

ORGANIZED SESSION STANDARD TALKS – CD-A2
The Resituation of Scientific Knowledge

Org. and chair of the session: James Griesemer (Department of Philosophy, Science and Technology Studies Program, University of California, Davis, USA, jrgriesemer@ucdavis.edu)

Papers:

Versioning as a means to track resituation

Jason Oakes (University of California, Davis, USA, oakes@ucdavis.edu)

This panel is concerned with examples of and tentative mechanisms for the resituation of scientific knowledge – how techniques, models, instruments, data, and other constituent parts of the research process are taken up and put to use in new contexts, and how they are changed in the process. In many cases the resituation can lead to confusion for the analyst: is a given dataset, model, or technique put to work in a different context the same entity or practice as it was in its originating situation? Or should it be regarded as something totally new? To help clarify this problem I offer the notion of "version" as a way of marking and tracking the various changes and movements that take place as a result of the resituation of scientific knowledge (Griesemer 2006, 2007). Maintenance and control of different versions of a model, practice, or standard is collectively performed by the members of the social group in which that research element is practiced. Versions may be adopted, proliferated, ignored, split, or even merged by their practitioners, according to the needs of specific research groups. I provide some illustrative cases from the history of biology, economics, and the practices of business management in the 20th century from my own research (Oakes 2016) as well as recent work by Ankeny and Leonelli (2016), and Knuutila and Loettgers (2016).

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The work of metabolism of anomalies at sites of scientific communities drives recruitment and re-situation of knowledge from other communities

Alok Srivastava (Tremont Research Institute, San Francisco, USA, alok.srivastava@gmail.com)

In this paper I will describe and analyze a historical case where the borrowings and re-situation of knowledges across two scientific communities resulted in a convergent transformation of the situated knowledges in both communities. The generally accepted abstractions underwent revisions and the hybrid methods invented were useable by both communities. I will trace the use by one scientific community of the knowledge(s) of another scientific community in their end-directed activities. They recruited and resituated pieces of knowledge to aid in the work of ‘metabolism of anomalies’ in their research program. This case involves two specialized communities in the larger world of structural biology: X-ray crystallographers and bio-molecular NMR (Nuclear Magnetic Resonance) people. These two communities have had their knowledges and commitments pulled closer together in the last decade by the 2009 publication by Fraser et al., from Tom Alber’s laboratory at UC Berkeley, demonstrating multiple structures in a protein enzyme with different biological activities. The Alber group - a crystallography laboratory - in Berkeley, modified modeling methods inspired by practices in the NMR community to deal with specific needs of their research program. They also carried out X-ray crystallographic characterizations at room temperature which matches experimental conditions commonly used in the NMR community – as opposed to the conventional practice of using cryo-cooled temperature of (100 deg. Kelvin) in crystallography laboratories. A method - the Ringer Procedure - was inspired by facts and methods in the NMR world and was used to ‘metabolize the anomalies’ in the crystallographic studies of enzymes. The success of this method allowed the group to revive and address a more general set of natural possibilities marked by a longstanding puzzle about anomalies present but routinely averaged out (i.e. not metabolized) in the primary process of gathering crystallographic data of all proteins. In this study I will attempt to trace the steps through which the routine work of ‘metabolism of anomalies’ in the enterprise of the laboratory drove the acts of borrowings, re-situation, adaptations and inventions leading to the new discoveries.

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Final panel discussion on the Resituation of Scientific Knowledge

INDIVIDUAL PAPERS SESSION – CD-A3
Biological Education I

Chair of the session: Sarah M. Roe (Department of Philosophy, Southern Connecticut State University, USA, roes1@southernct.edu)

Papers:

Why science education needs philosophy

Martin Joseph Bremer (College of Education, Florida State University, USA, mb11z@my.fsu.edu)

Despite losing any semblance of credibility, logical positivism is still entrenched in science education. Education, as a social institution, has been subject to governmental decisions, political will and social demands (federal, state, local government, and prevailing public opinion). I look at historical context which explains why logical positivism has been subsumed by education, and why it is pervasive in educational thought. Interestingly enough, the counter argument has been present for longer, however, did not garner favor specifically because it does not share the seductive, though obviously flawed, arguments in the logical positivist influenced train of thought e.g. assessment, accountability, high-stakes testing. I argue that the views of John Dewey, noted pragmatist and educational philosopher, provide a solid foundation on which to build a comprehensive science education curriculum. Starting with Dewey's vision and pairing it with a strong environmental ethics perspective will provide teachers with a means to circumvent the underpinnings of logical positivism. Furthermore, I argue that this Deweyian perspective is directly in line with noted ecologists (Leopold, Carson, Clark, etc.). The resulting educational perspective promotes a comprehensive curriculum which encompasses current scientific knowledge, and lessons. This curricular realignment also moves outcome variables toward environmentally and socially responsible outcomes rather than emphasis remaining on high-stakes test scores and the volatility of political and economic variables. To put it another way, this focus is one of long-term ecological sustainability and democratic engagement (in the Deweyian sense); all the while avoiding the pitfalls of immediate, short-term returns being valued as 'education.'

The Citizen Science Movement according to Feyerabend: Taking advice from a madman

Sarah M. Roe (Department of Philosophy, Southern Connecticut State University, USA, roes1@southernct.edu)

The slogan 'anything goes' first appears in Paul Feyerabend's book Against Method. Many have speculated on what exactly was meant by the slogan and even more philosophers and scientists have quickly discarded Feyerabend's antidote as the obvious ramblings of a madman. Within this paper, I utilize Feyerabend's work to better understand the new citizen scientist movement, namely the utilization of nonscientists for certain scientific tasks. I argue that Feyerabend would champion a more radicalized citizen science, one that allows for the possibility of integrating citizens into every level of the scientific process.

Feyerabend teaches us that while the current citizen science movement is primarily focused on what the citizen can do for science and what the citizen can learn from science, the movement should also focus on what science can do for the citizen and what science can learn from the citizen. Feyerabend may offer us a better understanding of how citizen science can best promote scientific education, offer broader knowledge to participants, increase citizen interest in conservation and policy, increase both local and national citizen engagement, and promote a rewarding experience for both the expert and citizen. As such, I argue that Feyerabend would have championed citizen science on a more nuanced and multileveled continuum, where the benefits of citizens could be properly amplified within the sciences.

Applying technology and history of science to develop an innovative teaching-learning sequence about natural selection and nature of science

Eduardo Cortez (Inter-unit Graduate Studies Program in Science Education, University of São Paulo, Brazil, ecortez.biousp@gmail.com)

This research aims to disclose the first iteration of a teaching-learning sequence (TLS) applied to 9th graders in order to teach them about natural selection and about science as a social enterprise. Such TLS was constructed based on guidelines provided by Méheut and Psillos (2004). Adopting history of science as a teaching-learning tool, the whole TLS comprises a narrative that is interrupted from time to time in order to discuss pertinent features regarding nature of science, specially emphasizing how the ideas of transmutation and natural selection were not built by naturalists working alone, but are ideas that were born and shaped by means of collective work. The narrative, sometimes, acquires a story-telling shape; other times it must be explored through inquiry-fostering activities, but the TLS's core, showing Charles Darwin (1809-1882) working in London during the years 1837-1838, analyzing the material collected during the Beagle voyage, together with Syms Covington (1816-1861), his "servant", and writing on his secret notebooks on transmutation, has been presented to the students through an online game developed with RPG Maker (© Enterbrain, Degica). In order to assess the potential success of the TLS, students have answered pre- and post-tests containing two open-questions, one regarding the way students see the work of scientists, and another regarding how evolution works. The answers about evolution were analyzed and discussed under the perspective of conceptual-profile change, adopting profiles empirically constructed by Sepulveda, Mortimer and El-Hani (2013). From 19 respondents, 11 students started thinking in an intra-organic-functionalism perspective, without considering any role for the environment, and 8 thinking in a providential-adjustment perspective. After the TLS, only 2 students remained in their starting perspective (providential-adjustment); 5 students changed from intra-organic-functionalism to providential-adjustment perspective; 6 students (3 from each starting perspective) changed to a transformational perspective, in which transformations are natural in the development of a species; and 6 students (also 3 from each starting perspective) changed to a variational perspective, regarding a correct view on how natural selections works. These results show that the TLS was able to promote changing of profile perspective, however it still can be improved, in order to provoke more students to think in an informed variational way. This will be done, in a second iteration, by bringing in more examples on how intraspecific variation occurs, how it was perceived by Charles Darwin, and what is the relevance of this feature to the species. The question about the way scientists work could not be analyzed since, in the post-test: 13 students have misinterpreted the question and answered how natural selection works. These answers show that it is necessary to reformulate this question for a second iteration of the TLS.

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INDIVIDUAL PAPERS SESSION – MINAS1

Phylogenetics: Philosophical Perspectives

Chair of the session: Celso Neto (Department of Philosophy, University of Calgary, Canada, celso.alvesneto@ucalgary.ca)

Papers:

Species cohesion in the age of discordance

Celso Neto (Department of Philosophy, University of Calgary, Canada, celso.alvesneto@ucalgary.ca)

Since the Modern Synthesis, it is common to claim that species are cohesive entities (Mayr 1973, Templeton 1989, Barker 2007). But what does this mean? Broadly speaking, cohesion is a sort of uniformity among organisms of a species (Ereshefsky 2001). This uniformity manifests itself at a time, as organisms are genotypically and phenotypically similar to each other, but also across time, as they share an evolutionary fate (Wiley 1980, Barker & Wilson 2010). In this paper, I discuss species cohesion in the light of phylogenetic discordance (Doolittle & Bapteste 2007). Discordance is prevalent in evolution and refers to the fact that most species histories do not map on to the histories of the genes they contain (Mallett et al. 2015). Moreover, phylogenetic discordance promotes genetic polymorphism within species and, relatedly, differences in the evolutionary fate of conspecific organisms. Hence, discordance raises the following issue concerning species cohesion: why are species cohesive entities despite their having high rates of discordance? In other terms, why doesn't discordance prevent cohesion? In this paper, I provide a theoretical framework for analyzing the relation between cohesion and phylogenetic discordance. This framework allows biologists and philosophers to tackle the above questions and to make sense of species cohesion in the face of discordance.

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What can species theorists learn from Parfit?

Yuichi Amitani (Tokyo University of Agriculture, Okhotsk, Japan, yuiami@gmail.com) and Tetsuji Isedam (Department of Philosophy and History of Science, Kyoto University, Japan, iseda.tetuji.6n@kyoto-u.ac.jp)

Implications of the Parfitian reductionist account of personal identity ---psychological continuity, not personal identity, is important to answer questions crucial to us--- have been widely discussed. In contrast, little attention has been given to the parallels between a person and species. In this paper we apply Parfit's reductionist account to the concept of species and explore how far we can go with the implications from this, including that if we set aside purely taxonomic concerns, what matters in the study of speciation is not to see whether and when a particular population became a distinct species, but to find causal or historical processes behind that (e.g., the establishment of reproductive isolation and the branching of phylogeny).

To this end, after reviewing Parfit's account of personal identity and a possible application of it to species, we will review and examine the two controversies between renowned evolutionary biologists, Jerry Coyne & H. Allen Orr and Guy Bush. One controversy is on the methodological issues in studying speciation, and the other concerns whether or not a species of maggot flies is in the process of sympatric speciation. We will argue that even though the two camps had very different views on the methodological and conceptual issues concerning species (the first debate), they did not show great interest in whether or not a population of maggot flies is counted as a distinct species (the second debate). This case study suggests that what matters in the end for the students of speciation is not to call one population a species, but to find causal relations in the process of speciation.

The molecularization of phylogenetics – preconditions and consequences

Nina Kranke (Department of Philosophy, University of Kassel, Germany, ninakranke@yahoo.de)

Phylogenetics is the study of evolutionary relationships among groups of organisms (e.g. populations or species) or individual organisms. Research practices in this field are characterized by a high degree of molecularization, i.e. a predominant use of molecular characters, e.g. protein and DNA sequences. In my paper, I examine the preconditions and consequences of molecularization in phylogenetics. I argue that the increased use of molecular characters was fostered by the advent of numerical taxonomy and the establishment of an instrumental and pragmatic approach to cladistics, which initiated a shift from a qualitative to a quantitative approach to phylogenetic analysis. Due to the entrenchment of the quantitative approach in phylogenetics, computers and DNA sequencers were established in biology labs, the development of computer software for phylogenetic analysis was promoted, and the use of molecular characters increased. Nowadays, large amounts of molecular data can be generated with a relatively small amount of time and money. In phylogenetics the interaction between scientific methods and technologies resulted in highly automatized processes of data generation and processing. The frequent use of molecular data also changed observational systems in phylogenetics. A larger distance between the researcher and the organisms was created by placing more and more devices between the observer and the observed entities. As a consequence of an ongoing process of molecularization, the study of evolutionary history of organisms and groups of organisms was reduced to studying the history of their genes and genomes. Working as a molecular systematist in modern research environments requires relatively little expert knowledge about the organisms or the algorithms that are used to generate hypotheses about phylogenetic relationships, because a large amount of work in phylogenetics is done by machines. The adaptation of a quantitative approach and the subsequent process of molecularization led to an inflation of data and an increased production of scientific statements with relatively low explanatory power.

INDIVIDUAL PAPERS SESSION – MINAS2
Systems Biology and Big Data: Philosophical Perspectives
Chair of the session: Constantinos Mekios

Papers:

Is biology once again setting a new agenda for philosophy of science?
David Montminy (Department of Philosophy, University of Montreal, Canada,
david.montminy@umontreal.ca)

The inclusion of biology in twentieth century philosophy of science has had a tremendous impact on the way philosophy was done and led to the emergence of new research programs that were not hitherto imagined when physics was the locus classicus of (almost) all philosophers of science. Nowadays, the rise of Big Data techniques is often said to set the stage for an enhanced integration of data and theory and for more accurate predictions for a vast array of scientific models. While we are still waiting for a thorough analysis of the impact of such techniques for science as a whole, there is a recent attempt at such an analysis for biology. Sabina Leonelli (2016) calls for a reform of epistemology of science based on two important features of contemporary biology: 1- the amount of non-propositional knowledge involved in Big Data biology; and 2- the scale and predominance of data-related practices. This reform is centered around two tenets: 1- the relational view of data, which is poised to replace the representational view of data; and 2- the situated account of knowledge (inspired from Dewey (1938), Haraway (1988) and Longino (2002)), which is poised to replace the contextual account of knowledge. The contribution of this talk will be threefold. 1- It will assess the soundness of Leonelli's bold reform proposition; 2- it will show how such a reform can be applied to another discipline of the life sciences, i.e. ecology; and 3- it will demonstrate that the proposed reform is compatible with the notion of hierarchy of models, as developed by Suppes (1969), but only at the expense of a repositioning of priorities from theoretical model to data model.

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Can organizing principles continue to transform the research program of systems biology in a productive manner?

Constantinos Mekios (Department of Philosophy, Stonehill College, Easton, MA, USA,
cmekios@stonehill.edu)

The view that the reexamination of theoretical contributions made by 20th century general systemologists may produce practical solutions to longstanding problems of biological complexity has recently been garnering support from an increasing number of philosophers of biology. The potential of high-level principles of biological organization to facilitate explanation in systems biology by permitting the generalization of results obtained at the molecular level (Wolkenhauer et al. 2012; Green and Wolkenhauer 2013), suggests that theoretical efforts to identify such principles should no longer be regarded as practically inconsequential. On the contrary, as Alon (2007) has already demonstrated, formal expressions of basic system principles (design principles) elucidated by the study of regulatory networks in engineering are transferable into the practice of biology. In this new context, they serve as valuable tools for experimental design, as well as for the purpose of modeling complex biological systems and predicting their behavior. We begin this paper by considering some examples of concrete methods by which biologists have successfully incorporated mathematical expressions of general system properties into applied research projects (e.g., in the emerging field of synthetic biology, or in systems medicine). In the process of discussing the relevant cases, we also seek to critically evaluate the extent to which the introduction of organizing principles has impacted the research program of systems biology. After arguing that our analysis of current experimental trends supports the claim that this project has indeed transformed the methodology of systems biology in a significant and productive way, we conclude by addressing two closely related questions: (1) How much closer to the goal of understanding biological complexity could the application of general system principles bring us (i.e., a question about the limits of the approach)? (2) What additional, thus far unexplored, options may these theoretical principles offer to experimentalists so as to make progress towards this goal possible?

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INDIVIDUAL PAPERS SESSION – MINAS3

Scientific Explorations

Chair of the session: Eleonore Zulnara Freire Setz (Laboratory of Mammal Ecology and Behavior, Dept. of Animal Biology, Institute of Biosciences, UNICAMP, Campinas, Brazil, ezfsetz@gmail.com)

Papers:

Fauna in Campinas, São Paulo, in the era of sugarcane and coffee cultivation: From 19th century naturalists to 20th century popular and scientific chronicles

Denise de Alemar Gaspar (Faunística Environmental Studies, Campinas, Brazil
denise@faunistica.com.br), Marcos Almir Polettini (Laboratory of Mammal Ecology and Behavior, Dept. of Animal Biology, Institute of Biosciences, UNICAMP, Campinas, Brazil, marcos_polettini@yahoo.com.br), **Eleonore Zulnara Freire Setz** (Laboratory of Mammal Ecology and Behavior, Dept. of Animal Biology, Institute of Biosciences, UNICAMP, Campinas, Brazil, ezfsetz@gmail.com) and Suzana Barretto Ribeiro (Methodist University of Piracicaba, Piracicaba, Brazil, suzana.barretto@yahoo.com.br)

Based on data obtained during a historical survey of four royal land grants decreed between 1792 and 1800, up to the collapse in coffee growing in 1930, we characterized the then-known fauna of Arraial dos Sousas, Joaquim Egídio e Jaguary, Campinas, São Paulo. We used scientific sources such as the collections of the Museum of Zoology of the University of São Paulo (Museu Paulista, 1898 - 1932), records of venomous animals received by the Butantan Institute (1906 - 1930), diaries and collections made by visiting naturalists (1815 - 1835), listings of specimens in the Revista do Museu Paulista (1892 - 1930), the Boletim Agrícola and other agricultural publications (1902 a - 1933), as well as documents, photos and prints retained by the families of land owners, and newspaper clippings. We include data from the main travel route along the Tietê River to the southwest of Campinas and from northward to Goiazes, from municipalities up to 100 kilometers away. Among invertebrates, we recorded 12 species of Lepidoptera, nine being butterflies collected by Burchell, 92 species of solitary bees (Schrottky) and 41 wasps (Ihering), five ants, including one army ant (Luederwald), a myriapod (Bröleman), approximately 16 fresh-water decapod crustaceans, 11 species of scale insects (Hempel), one coccinellid beetle, five spiders and a species of scorpion. Among vertebrates, we found mentions of 22 species of fishes (Piracicaba River Basin), five amphibians, 37 snakes and seven other reptile species, in addition to 354 birds and 70 kinds of mammals. Family photos included songbird cages. At the time, seven regional bird species were valued for their songs. Written accounts of hunting and fishing activities offered precise records of species occurrences. Diaries listed 30 bird species as hunted with birddogs (pointers) and several species of medium to large mammals -- pacas, coatimundis, monkeys, peccaries and deer -- hunted for sport and food. We did not find evidence for the presence of jaguars (except for one reportedly put on display by the newspaper Gazeta de Campinas),

tapirs (except for a photograph without date or locality), or wooly spider monkeys. In spite of the plentiful documentation for the period under study and the economic importance of Campinas, animal records are scattered and difficult to locate. Many of the species mentioned continue to thrive in the Campinas region, but others have become rare or disappeared. This study additionally underlines the important role of research institutions, such as the Agronomic Institute and the Biological Institute, which have made Campinas an important center of agricultural research.

Systematics, history and biodiversity conservation relationships from the assembly of a freshwater fish species topotypes collection

Alexandre Kannebley de Oliveira (Department of Environmental Sciences, Federal University of São Carlos, Brazil, pako@ufscar.br) and Julio Cesar Garavello (Department of Ecology and Evolutionary Biology, Federal University of São Carlos, Brazil, garavelo@ufscar.br)

Specimens collected in the type locality of species, called topotypes, are of great value for taxonomic and systematics studies, mainly if the type material is much old, lost, or in bad condition to be analyzed. Additionally, topotypes may provide information through the application of modern techniques in biological studies, such as those that incorporate molecular or fine anatomical data. In this report, we discuss the possibility of connecting systematics, history and biodiversity conservation using the collection of freshwater fish species topotypes in the upper Paraná River basin, southeastern Brazil. This ecoregion of Neotropical fish fauna has been researched since the beginning of the XIX century, when European naturalists traveled collecting specimens that were used to species descriptions. Surprisingly, after about 200 years of biological studies, there are still novel taxa (genus and species) to be described in the basin. Many of the type series of the species described from the mid nineteenth century to the beginning of the twentieth were housed in European or North American museums. Those series were frequently composed of one or a few specimens and, in many cases, are currently lost or in bad handling condition. In this scenario, topotype collections are welcome to develop studies about fish systematics and diversity conservation, also providing access to historical information of biological studies in Brazil. The material collected in this project is housed in the Laboratory of Systematic Ichthyology of the Federal University of São Carlos (LISDEBE) and is available for the scientific community. We assessed the original species descriptions and data from museum archives in order to map the type localities, which enabled us to research the historical context of the naturalists' explorations. The fish collecting fieldwork provided relevant biological material to the recognition and validity of species from taxonomical research, and to collect tissues for molecular analysis. It was also possible to identify that riverine environments visited by the naturalists were highly changed by anthropogenic activities, including river impoundment for hydroelectric purposes, introduction of species, and pollution, among other impacts, highlighting the necessity of programs for fish diversity conservation. Finally, the process of assembling topotype collections of any taxa may represent an opportunity to develop interdisciplinary knowledge in biological sciences.

INDIVIDUAL PAPERS SESSION – AG-BOT

Philosophy of Ecology I

Chair of the session: Michael Goldsby

Papers:

Conflicting baselines: A crisis in ecology

Michael Goldsby (School of Politics, Philosophy and Public Affairs, Washington State University, USA, michael.goldsby@wsu.edu)

If one were to describe the history of community ecology in the late twentieth century, 'crisis' comes to mind, although 'gang-war' might be more apt. Prior to the late 1970s, niche assembly theory (NAT) dominated the field of community ecology. In the late 70s, however, a group of ecologists expressed their dissatisfaction with NAT. Chief among their complaints was the fact that, by their lights, NAT was untestable.

For that reason, opponents of NAT called for the development of a "neutral" theory against which individual niche assembly hypotheses might be tested. That effort culminated in Hubbel's (2001) Unified Neutral Theory of Biodiversity and Biogeography (UNT). When the UNT fits, its fit is amazing, as Hubbell is quick to note (2006, 1368). However, the success of the UNT is not always so spectacular. Nonetheless, defenders of the UNT maintain that such failures do not warrant its rejection, as such failures merely indicate that something else is acting on the system. For example, Wennekes, Rosindell, and Etienne

(2012) write, “Failure of neutral theory shows that there must be alternative mechanisms” (264). They go on to add that the UNT is nonetheless “well positioned to act as a starting point, a baseline model to which one can later add more ecological mechanisms” (265, emphasis added).

My intent is to examine the structure of scientific baselines, like NAT and the UNT, in order to shed some light on how they are used in scientific practice. Of particular interest is why scientists choose the baselines that they use. More specifically, what warrants the adoption of a particular baseline over another? One might think that baselines can be at least fallibly justified by subjecting them to empirical scrutiny through scientific testing. Considering the history of the crisis in community ecology, this seems to be the prevailing view among scientists, but some philosophers of science apparently also hold this view. For example, Robert Brandon (with his co-author Daniel McShea) maintains that the ZFEL is an empirically testable claim (2010, 129). I will, nonetheless, argue that the adoption of a baseline cannot cite normal testing as part of its justification, because its very use as a baseline makes it untestable. I will further argue that the untestability of scientific baselines goes beyond the two most worrisome failures of testability typically discussed by philosophers of science and that it is just this property of baselines that accounts for the putative irrationality of Kuhnian paradigm shifts where one entrenched theory is exchanged for a new soon-to-be-entrenched theory.

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Law & Order: Ecology

Georgia Rae Rainer (Department of Philosophy, Florida State University, USA,
grainer@fsu.edu)

A continuous debate in the philosophy of science concerns whether or not there are scientific laws in ecology. It has been difficult to demarcate the exact criteria that would be needed to establish a law, as well as to distinguish between accidental regularities and proper laws. While these factors complicate matters, hope is not lost for potential ecological laws. In this paper, my focus will be on the account given by Marc Lange (2005) to define laws of nature. Next, I will argue against Lange's account of ecological laws and demonstrate the inability to constrict laws to their individual fields based on his definition. This move fails because the stability of the set of laws is dependent upon the delimitation of counterfactuals that are logically consistent with the other laws in the set. Once the set is restricted to a particular discipline, namely ecology in this case, then it is vulnerable to counterfactuals that might have otherwise been ruled out by laws that fall into other disciplines. In other words, the laws are dependent upon one another in regards to withstanding counterfactual perturbations and this dependence is compromised when the field is restricted to a single discipline, resulting in a loss of stability for the set. Finally, I will conclude that ecology is not reducible to more fundamental fields, but is also not autonomous in the sense of Lange's usage.

From models to theories: A bottom-up approach to organize propositions into constitutive theories in ecology

Bruno Travassos-de-Britto (Department of Ecology, University of São Paulo, Brazil, bruno.travassos@gmail.com), Renata Pardini (Department of Zoology, University of São Paulo, Brazil, pardinirenata@gmail.com) and Paulo Inácio de Knegt López de Prado (Department of Ecology, University of São Paulo, Brazil, prado@ib.usp.br)

Recently, an explicit structure for ecological theory was proposed: a hierarchical framework in which the general theory of ecology encompasses some constitutive theories, which in turn are structured by semantic propositions (Scheiner & Willig, 2011). However, there is no explicit method to identify constitutive theories and its propositions in a way we can organize widely recognized propositions into this theoretical framework. In this study, we propose a method to identify constitutive theories and the propositions that structure constitutive theories. We argue that a domain of study can be fixed around a community studying a specific type of phenomenon. Members of this community share a set of common views about this phenomenon and these common views are often stated as propositions. In turn, these propositions describe phenomena and support the development of new models concerning the phenomena. The identification of these propositions is actually the identification of the backbone of the theory shared by this community. The method we propose allows the identification of these propositions by analyzing citation structure and the content of the citations within a network. The proposed method can be described as the following steps: (1) the identification of a domain of study, (2) sampling of publications describing relevant models in the domain of study, (3) identification of common propositions assumed by these models, (4) analysis of which assumptions are central in structuring the theory. We discuss practical and conceptual implications of each step of the method and conclude that this approach can make the process of organizing a theory more efficient with regard to its development within the defined domain. The method has the potential to become a common tool shared by scientists interested in organizing propositions within a theoretical framework, what should connect more scientists around questions related to theory structure in biology.

Reference:

Scheiner, S. M., & Willig, M. R. (2011). The theory of ecology. Chicago, IL: University of Chicago Press.

MONDAY JULY 17
15:30-17:00 – Parallel sessions 3

ORGANIZED SESSIONS DIVERSE FORMAT – AG-ZOO

Mini-workshop

Historical, Philosophical, and Interdisciplinary Writing and Publishing

Org.: ISHPSSB Education Committee

Aim: The aim of this mini-workshop is to familiarize PhD students and young scholars with the requirements for publishing in an academic journal. Participants should receive information about the reviewing and publishing process.

Firstly, young scholars should get acquainted with the idea that publishing their work is an eminent part of communicating their ideas. Secondly, information conveyed in this workshop should encourage young historians and philosophers to deal early in their career with the subject of how to get their work published and installing an appropriate workflow for publishing their work. Thirdly, tips and recommendations from the Editors-in-Chief should help to reduce putative threshold fear of submitting one´s work.

Format: 90 minute workshop open to all participants of the ISHPSSB 2017 meeting, especially targeted at PhD students and early post-docs.

Topics:

a. Panel:

o Introduction to the journal by the EiC

o The reviewing process

- How are reviewers chosen

- Open versus single versus double blind reviews

- Acceptance/rejection rates

- Reasons for rejection

o From submission to publication: duration, pitfalls, etc.

o Other issues

o Tips for authors:

- How to select the appropriate journal for your paper

- Differences between writing for philosophical or biological readers

- How to deal with rejections

b. Plenary ("hands-on" part):

- Workshop participants will be invited to send paper excerpts (abstract & maximum of 3 pages of their paper) via email (publicationworkshop@kli.ac.at); papers that can be sent should be either in a final stage (ready for submission to a journal) or have already been submitted and rejected

- the authors of the paper excerpts can remain anonymous

- all invited editors will have access to the submitted paper excerpts

- each editor may pick one or more of these paper excerpts for the plenary discussion to give recommendations (optional) to the author(s)

- general discussion

Chair of the session: Isabella Sarto-Jackson (Konrad Lorenz Institute for Evolution and Cognition Research, Klosterneuburg, Austria, isabella.sarto-jackson@kli.ac.at)

Discussants:

Gregory Radick (University of Leeds, UK, G.M.Radick@leeds.ac.uk)

Michael Dietrich (Dartmouth College, USA, michael.dietrich@dartmouth.edu)
Staffan Müller-Wille (University of Exeter, UK, sewm201@ex.ac.uk)

ORGANIZED SESSION STANDARD TALKS – CD-A1
The Multiple Guises of Value in Biological Science

Orgs.: Adrian Currie (CSER, Cambridge, UK, ac2075@cam.ac.uk), Kimberly Brumble (Dept. of Philosophy, University of Calgary, Canada, kcbrumble@gmail.com) and Joyce Havstad (Dept. of Philosophy, Oakland University, USA, jhavstad@gmail.com)

There is a growing philosophical consensus that the relationship between scientific practice and values is a tight and complex one. However, much remains to be done in articulating just how values of various stripes affect—for better or worse—the production of epistemic goods. Values take on multiple guises, they play a wide variety of roles in science, and our aim is to examine these roles in three contexts. First, we'll look at how model user needs and modeller conceptions play into the co-creation of knowledge required for the integration of paleoclimate proxy data with user applications spanning the historical sciences including biological, ecological and anthropological applications. Second, we'll examine the extent to which 'extrinsic' epistemic values can explain morphological phylogenetics in paleobiology. Third, we'll look at how values about conservation inform and shape debates about good practice in biological specimen collection. These three very different cases are revelatory of the roles values take in science. Values can reveal themselves in the preconceptions which scientists grapple with and seek to control for in their investigations, as is (potentially successfully) achieved in climate modelling. The case of morphological phylogenetics shows how values play a role in structuring scientific investigations themselves. Values also underwrite and inform scientific debates about how to go about doing science, such as conservation values for specimen collection. Reflection on these three cases goes some way to characterizing how science and values are interwoven.

Chair of the session: Adrian Currie (CSER, Cambridge, UK, ac2075@cam.ac.uk)

Papers:

Taxonomic discovery, epistemic standards, and ecological aims in ornithology

Joyce Havstad (Dept. of Philosophy, Oakland University, USA, jhavstad@gmail.com)

In 1988–9, ornithologists in central Somalia identified what looked like an individual representative of a new species of African bush shrike. Because of where the bird was spotted, and what the discoverers of the bird suspected about the (potentially endangered) species it likely belonged to, the ornithologists did not "harvest" the individual specimen. Instead they photographed it; they video recorded it; they audio recorded it; and they captured it—extracting blood samples, collecting molted feathers, and obtaining DNA from feather quills. But eventually they released the animal. By late 1991, the taxonomic discovery of *Laniarius liberatus* had been announced in the journal Ibis (Smith et al. 1991).

To this day the case remains a rich source of ornithological controversy. Informally, it's a ready topic of derisive museum conversation—as in, "they really bungled the handling of that Somali shrike, ha ha." More formally, the decision not to collect the specimen—and to release it where it was eventually let go—has been raised as an example of bad ornithological practice in many a critical publication. Some have stridently defended the way the *Laniarius liberatus* case was handled; still others have called for potential collections to be more often handled in such conservationally-minded ways. And such calls for cautious collecting have themselves been objected to.

At first pass it can seem like this controversy stems from a straightforward dispute between two very different sources of value, which happen to come into conflict with one another in this context. It's a simple clash between scientific knowledge and ecological conservation of a biological species, right? But that's probably wrong—or at least, it's a seriously incomplete analysis. A close look at the debate reveals that both parties for and against calls to curtail specimen collection tend to appeal to conservation-minded reasons when making their arguments. Both sides urge that caution and concern dictate that specimens either should (on the one side) or shouldn't (on the other) be collected. However, those arguing with one another here seem to disagree on how to best achieve their shared aims of conservation. In some instances, they also seem to disagree about the proper way to meet and where precisely to set the correct standards of evidence for novel taxonomic delimitation.

Here I tease apart the variously intertwined disputes, in this debate, between different modes of pursuit of ecological value; between alternative epistemic standards of taxonomic evidence; and between conflicting epistemic and ecological aims. Untangling this knot should be of value to the ornithologists and other collection and conservation biologists involved in the dispute, by straightening out precisely where they do and don't disagree with one another. I also expect the discussion to be of interest to studiers of the relationship between science and values, as this is a scientific episode patently laden with values and of various kinds.

References:

Smith, E. F. G., Arctander, P., Fjeldsa, J. and Amir, O. G. 1991. A new species of shrike (Laniidae: *Laniarius*) from Somalia, verified by DNA sequence data from the only known individual. *Ibis* 133: 227-235.

Extrinsic values, the paradox of material evidence, and crocodiles

Adrian Currie (CSER, Cambridge, UK, ac2075@cam.ac.uk)

I'm going to draw together two threads: the power of material evidence about the past, and values in science. In doing so, I'll argue that historical scientists often structure investigations to indirectly maximize the capacity of material evidence to speak in surprising, powerful ways.

Chapman and Wylie identify a tension between "… how complicated it is to read surviving traces as evidence and yet, at the same time, how stubbornly recalcitrant these data can be, no matter how entrenched their assumed meaning comes to be." (Chapman & Wylie 2016, p5): the paradox of material evidence. Historical evidence is ambiguous, and thus open to 'xeroxing': letting our preconceived ideas determine how we interpret traces (Bell 2015). However, material remains are often epistemically transformative. Despite the epistemic challenges facing historical science, material evidence often refuses to play theory-laden ball.

Many discussions of values in science recognize a gap between our evidence for a claim, and our reasons for accepting it (Brown 2013). For instance, because the results of our investigations make a difference to society, widely construed, values not usually associated with science are required to "plug the gap" (Douglas 2000). If getting it right matters, our standards for getting it right had better reflect that.

Mistakes in historical science rarely bring dire consequences. And yet those interested in the deep past need to make decisions about evidential standards, they must bridge the gap. Moreover, given the paradox of material evidence, it seems that such decisions often avoid xeroxing. So, what's going on?

Steel (2010) distinguishes between intrinsic and extrinsic epistemic values. The former are themselves an indication that truth has been achieved; the latter "… promote that attainment of truth without themselves being indicators of requirements of truth" (18). Although valuing shiny, well-funded laboratories is not in itself constitutive of, or indicative of, truth being achieved, such values likely contribute to truth's generation.

I argue that investigations into the deep past often target extrinsic epistemic values. Sometimes, explicitly stated research goals are unlikely to be achieved, but function to encourage the generation of other goods. I'll look specifically at morphological phylogenetics in paleobiology. I'll argue that although convergence on an agreed, fine-grained picture of ancestry is unlikely, phylogeny-based work plays a role by organizing paleobiological research in a way which structures and promotes work on the evolutionary and developmental features of character traits. This emphasis on indirect value explains how historical scientists navigate the paradox of material evidence.

References:

Chapman, R., and Wylie, A. 2016. *Evidential reasoning in archaeology*. London: Bloomsbury Publishing.

Bell, M. 2015. Experimental archaeology at the crossroads: a contribution to interpretation or evidence of "xeroxing". Pp. 42-58, in: Chapman and Wylie (eds). *Material Evidence: Learning from Archaeological Practice*. London: Routledge.

Brown, M. J. 2013. Values in science beyond underdetermination and inductive risk. *Philosophy of Science* 80(5): 829-839.

Douglas, Heather. 2000. Inductive risk and values in science. *Philosophy of Science* 67(4): 559-579.

Steel, D. 2010. Epistemic values and the argument from inductive risk. *Philosophy of Science* 77(1): 14-34.

ORGANIZED SESSION STANDARD TALKS – CD-A2
Teleology and Organization in Biological Systems

Orgs.: Matteo Mossio (Institute of History and Philosophy of Sciences and Techniques, IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne, France, matteo.mossio@univ-paris1.fr) and Andrea Gambarotto (Superior Institute of Philosophy, Catholic University Catholique of Louvain, andrea.gambarotto@gmail.com)

Chair of the session: Andrea Gambarotto (Superior Institute of Philosophy, Catholic University of Louvain, andrea.gambarotto@gmail.com)

Papers:

Connecting biological inheritance with purposiveness: A new insight into evolutionary theory

Gaëlle Pontarotti (Université Paris 1 Panthéon-Sorbonne/IHPST, France, gaelle.pontarotti@gmail.com)

Mendelian tradition has favored a vision in which biological inheritance mainly refers to the transmission of virtually atomized traits across generations through the duplication of genetic entities. It has also provided a foundation for population genetics and the Modern Synthesis theory of evolution. In this view, evolution is described as a change in allelic frequencies (Dobzhansky 1937). It is mainly explained by the differential replication of genes correlated to stable phenotypic variations on which natural selection can act. Selection, as for it, refers to the dynamic of change of alleles showing differential fitness across generations. Following this vision, Williams (1996) and more especially Dawkins (1976) have rooted the idea according to which evolution and adaptations can be understood as the results of a competition between selfish elements called “replicators” and embodied by “genes” in the biological world.

This talk explores an alternative view of biological inheritance. Following a Kantian tradition, it rests on the principle that biological systems involved in inheritance processes are fundamentally self-organized systems, or natural purposes. As a result, it brings inherited traits and inherited factors such as genes back into a systemic context. It fully takes into account the fact that these elements are not possible but by the whole they belong to (teleology), and that they a priori contribute to maintain each other and the full system they belong to through their interaction (self-determination). In this respect, biological inheritance does not appear as a process of replication of selfish elements correlated to virtually atomized traits, but rather as the process by which variations in organizational patterns are reconstructed from one generation to the next via the collaboration of various interdependent mechanisms.

This organizational perspective on biological inheritance grounds the idea that organization is a condition for the stability of inherited variation, and that replication, as any biological process, cannot be thought but in an organizational context. It is particularly operational to capture the domain of extension of inheritance at a time when this process is thought to involve more than genes (Jablonka & Lamb, 2005; Bonduriansky, 2012) but could, for this very reason, go back to metaphorical and vague approaches. Finally, it could complement studies that contemplate bringing "organicist" perspectives back in evolutionary biology (Laland et al., 2015), reintroducing the concept of natural purposes in evolutionary theory and assessing the explanatory role of the objects falling under this definition in evolutionary dynamics (Walsh, 2006).

The teleological debate at the interface between chemistry and biology

Kepa Ruiz-Mirazo (Dept. of Logic and Philosophy of Science & Biophysics Institute (CSIC, UPV/EHU), University of the Basque Country, Spain, kepa.ruiz-mirazo@ehu.es)

Scientific explanations of the dynamic behavior of physical and chemical systems do not appeal to teleological constructs, whereas there is much debate about whether biological entities/organizations involve some 'intrinsic natural purpose'. I think that the main reason for this relates to the weight that fundamental laws of nature have in the former, leading to highly satisfactory results, while the scientific understanding of living organisms is based on a very different type of reductionist approach (analysis and characterization of molecular mechanisms) that provides notoriously insufficient accounts of their complex behavior and, therefore, calls for complementary answers (i.e., higher-level synthetic descriptions, either dynamic/organizational or evolutionary). Teleology typically 'sneaks in through this backdoor', but it is not clear whether that reflects an ontological feature of biological entities, intrinsically linked to their identity, or an epistemological/heuristic requirement that many of our attempts to explain them seem to demand. In this contribution, I will discuss the dispensability (or not) of teleological reasoning to account for a rather specific transition in the process of biogenesis: the emergence of basic autonomous systems (i.e., minimal 'self-constructing' entities). In line with recent advances in the field of origins of life, I will propose that these systems should appear in a heterogeneous chemical medium with diverse bio-molecule precursors that engage in reaction-diffusion dynamics and involve both self-assembly and self-organization processes, but would progress significantly beyond the latter. In such an intricate --though surprisingly realistic-- prebiotic scenario, there is no doubt that multi-causal processes will be at play, bringing about non-reducible, self-maintaining systems whose dynamic behavior will be anything but deterministic. Rather, it is the local coupling of all those processes and mutually constraining factors that allows for the emergence of entities with their own identity -- radically different from the type of natural entities that one could predict just by means of physical and chemical laws. Thus, relational constructs like function and regulation, in principle idiosyncratic to the biological domain, could actually help us characterize the organization of these basic autonomous systems and their relative robustness. However, does functional integration leading to self-production necessarily entail a ‘natural purpose’?

The organizational approach of ecological functions and ecocentrism

Nei Nunes-Neto (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), nunesneto@gmail.com)

In a recent analysis Sune Holm (2015) suggested that the organized internal teleology of organisms – grounded in the organizational approach from philosophy of biology – can support an organism-centered ethical perspective, avoiding objections raised against biocentrism.

In this line, this work aims to continue these reflections, focusing around possible contributions from organizational approaches in philosophy of biology to the debates about the values of non-human nature, more common in the field of environmental philosophy.

In particular, based both on Holm’s analysis and on the contributions from organizational approaches of function and teleology, for organisms (Mossio et al. 2009; Saborido et al. 2011; Mossio & Bich 2014) and ecosystems (Nunes-Neto et al. 2014; Nunes-Neto et al. 2016; Cooper et al. 2016), we will discuss in more detail the possibilities of grounding ecocentrism in an organizational approach of ecological functions.

For this, we will present the recent organizational approach to ecological functions, with emphasis on the idea of organizational closure of constraints as applied to ecosystems; discuss objections raised against it; and, then, relate this epistemological perspective to the possibility of ascribing intrinsic value to ecosystems as objects of moral considerability, which could support an ecocentric perspective in environmental philosophy.

Based on the reflections advanced in this work, we hope to contribute to the epistemological and ethical debates about the human interactions with ecological and social-ecological systems, and also stimulate a more explicit dialogue between organizational perspectives, on the one hand, and ethical debates in environmental philosophy, on the other.

ORGANIZED SESSION STANDARD TALKS – CD-A3
Models and Theories in Biology

Org. and chair of the session: Pablo Lorenzano (Center of Studies in Philosophy and History of Science, National University of Quilmes/National Scientific and Technical Research Council (CONICET), Argentina, pablo.lorenzano@gmail.com)

Since the 1980’s, there is a tendency in general philosophy of science to emphasize the role of models in diverse scientific practices (conceptualization and theorization included), witnessed by the development of two different approaches: the modelist view–addressing, among others, questions about the relationship between models and experience, and between models and general theories independently of a general metatheory about sciences–and the semantic view–addressing such questions within the framework of a general view on scientific theories.

In addition, these relations highlighted some of the consequences that the practice of model building has for other philosophical questions such as realism – related to the discussion of idealization, approximation and representation in science –, reductionism – even in authors for whom there are no systematic relationships between models and theories –, laws of nature, and of science, mechanisms, and causation and scientific explanation.

However, as Jim Bogen states on the back cover of the book *Scientific Models* in the Philosophy of Science, by Daniela Bailer-Jones, "The standard philosophical literature on the role of models in scientific reasoning is voluminous, disorganized, and confusing."

Yet, one of the axis that would permit to organize at least part of such a literature, and with which the book ends, is what is identified as one of the "contemporary philosophical issues: how theories and models relate each other" (Bailer-Jones 2009, p. 208). The same holds for contemporary special philosophy of biology, in which the importance of models in diverse biological practices has been emphasized, and where modelist as well as semantic views of theories have been further developed and applied to different areas of biology, and where the relationships between models and theories have been discussed.

The aim of this session is to discuss these matters – with a general focus on the issue of the relationships between models and theories, and a special treatment of the issues of animal models and sex/gender (see Bernabé & Giri), causation and mechanisms (see Alleva, Díez & Federico), and laws (see Lorenzano & Díaz). Different fields of biology developed in different countries and periods of time will be taken into account – such as behavioral biology, medical and health sciences, neuroscience (see Bernabé & Giri), biochemistry, molecular and cell biology (see Alleva, Díez & Federico), and Ecology (see Lorenzano & Díaz) –, under the light of one version of the semantic view of theories, namely, metatheoretical, or Sneedian, structuralism.

Papers:

Models, theory structure and mechanism in biochemistry: The case of allosterism

Karina Alleva (University of Buenos Aires/National Scientific and Technical Research Council, Argentina, karina.alleva@gmail.com), José Díez (Universidad de Barcelona, LOGOS Research Group, University of Barcelona, Spain, jose.diez@ub.edu), and Lucía Federico (Center of Studies in Philosophy and History of Science, National University of Quilmes/National University of Tres de Febrero, Argentina, luciafed@hotmail.com)

In the last years, it has been argued that explanatory causal mechanisms in some special sciences such as biochemistry and molecular biology cannot be captured by any useful notion of theory, or at least by any standard notion in the market. Two aspects criticized are the notion of theory as a helpful conceptual tool to account for relevant features of scientific practice in biological fields, and the existence and use of laws in relevant explanatory practice. The goal of this presentation is to show that formal analysis may be useful to discuss and seed light on substantive meta-theoretical issues. We proceed here by exemplification, analysing and reconstructing as a case study a paradigmatic biochemical theory, Monod-Wyman-Changeux (MWC) theory of allosterism, and applying the reconstruction to the discussion of some issues raised by prominent representatives of the new mechanist philosophy. In this presentation we show that: i) a model-theoretic notion of theory, and in particular the structuralist notion of theory-net already applied to other unified explanatory theories, adequately suits the MWC allosteric mechanism explanatory set-up, ii) that the unified aspects of MWC explanations cannot be accounted for merely in a mechanistic terms and are well explicated by the notion of theory-net; and iii) that the notion of law, in the weak sense of non-accidental – and possibly domain specific – generalization, is essential for allosteric explanations.

The conclusion is that particular elements of traditional approaches are not contradictory to but rather complementary with new mechanist philosophy, and together offer a more complete understanding of special sciences and the variety of explanations they provide.

Models, laws and theories in population dynamics

Pablo Lorenzano (Center of Studies in Philosophy and History of Science, National University of Quilmes/National Scientific and Technical Research Council (CONICET), Argentina, pablo.lorenzano@gmail.com) and Martín Díaz (Center of Studies in Philosophy and History of Science, National University of Quilmes/National University of Tres de Febrero, Argentina, biomartindiaz@gmail.com)

One of the most discussed branches of ecology is that of population ecology, in particular population dynamics. Due to the fact that it was the first branch of ecology which made an intensive use of numerical mathematics, it was thought that this area was appropriate for achieving quantitative laws or theories (Turchin, 2001). After almost one hundred years of existence, different equations, or models, representing the dynamical behavior of populations along time (logistic, exponential, predator-prey, etc.) were established. Out of this fact, the issue of the existence of laws in ecology has been discussed. While some authors claim that ecology *doesn't* have *empirical* laws (because the use of mathematics transformed population ecology into an abstract science, whose models don't have any connection to reality and, therefore, do lack empirical value (Cooper, 2003)), others sustain that population ecology *does* have empirical laws similar to those of physics (Berryman, 2003; Colyvan, 2003, Turchin, 2001). Among the latter are also ecologists, who argue that the exponential law of population growth, derived from Malthus' equation, is the general law of population dynamics (Berryman, 2003; Ginzburg, 1986; Turchin, 2001).

The aim of this presentation is to analyze the status of the exponential law of population growth, and other well-known equations or models of population dynamics. The analysis will be carried out with the tools of one version of the semantic view of theories, namely, that of metatheoretical, or Sneedian, structuralism (Balzer, Moulines & Sneed 1987). We will present a sketch of a rational reconstruction of population dynamics made within the framework of such a metatheory. Our analysis will show that: 1) there is a reasonable sense in which we can speak of a fundamental law of population dynamics, different from the exponential law of population growth, which can be seen as a special law of population dynamics; 2) the distinct heterogeneous models of population dynamics can be accommodated under one theory-net, namely, the theory-net of population dynamics; and 3) the last situation is what confers to population dynamics its great unifying power, similar to that of theories belonging to other scientific disciplines, such as Classical Particle Mechanics.

References:

Balzer, W., Moulines, C.U. and, J.D. Sneed. 1987. *An Architectonic for Science. The Structuralist Program*. Dordrecht: Reidel.

Berryman, A. 2003. On Principles, Laws and Theory in Population Ecology, *Oikos* 103(3): 695-701.

Colyvan, M. 2003. Laws of Nature and Laws of Ecology, *Oikos* 101(3): 649-653.

Cooper, G. 2003. *The Science of the Struggle for Existence. On the Foundations of Ecology*. New York: Cambridge University Press.

Ginzburg, L. 1986. The Theory of Population Dynamics: I. Back to First Principles, *Journal of Theoretical Biology* 122: 385-399.

Turchin, P. 2001. Does Population Ecology Have General Laws?, *Oikos* 94: 17-26.

Neither one-sex nor two-sex nodels: Rethinking the general conceptualization of sexual differences and differentiation in biology

Federico Nahuel Bernabé (Center of Studies in Philosophy and History of Science, National University of Quilmes, Argentina, fnbernabeblach@gmail.com) and Leandro Ariel Giri (National University of Tres de Febrero-Argentinean Society of Philosophical Analysis, Argentina, leandrogiri@gmail.com)

Animal models are widely used in contemporary biology, in particular in behavioral neuroscience, behavioral ecology and clinical research. There is a plethora of literature in this field, majority focused on general problems of extrapolation from non-human animals to humans and the scope and validity of results in the laboratory regarding extralaboratory world (see Atanasova, 2015).

However, in the past twenty years a new discussion has emerged on animal models. As neuroscientists (McCarthy et al., 2012), behavioral ecologists (Zuk, 2002) and biomedical researchers (Wizemann & Pardue, 2001) show, females are widely excluded in the design of animal models and even in human medical studies. The main point of their criticism is that there is a dangerous bias in the design of these models supported by the general assumption that males are representatives of the species.

We argue that the bias (and the assumptions implicit in it) is not a mere methodological issue, but the methodological consequence of some general and substantive subjacent theory of sexual differences and sexual differentiation. In this way, we critically discuss the main metatheoretical proposal in this topic, due to Thomas Laqueur (1990). Laqueur's basic idea is that there are two periods on sexual differences conceptualization: a "one-sex-model" (from ancient Greeks to Enlightenment) and a "two-sex-model" (from Enlightenment to nowadays). In one-sex-model male was the proper form of the species, and female nothing but a deviation of the proper form. Instead, the modern two-sex-model conceives the sexual differences in the sense of a radical biological dimorphism.

However, if it is true that modern biology was born and developed under this two-sex-model, how can we explain the assumption that males are representative of the whole species? Our alternative proposal is that the main change in the underlying theory of sexual difference began in mid twentieth century with the emergence of a research program on sexual differentiation that goes beyond the structure and function of reproduction, that is, with the Organizational-Activational Hypothesis (Phoenix et al., 1959). We present the structuralist elucidation of that theory, which will allow us to show precisely how the theory changed the game from a gonad-centrist approach to a mosaic and complex conceptualization of sexual differentiation.

References:
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McCarthy, M.M., Arnold, A.P., Ball, G.F., Blaustein, J.D. and G.J. De Vries. 2012. Sex Differences in the Brain: The Not So Inconvenient Truth, *The Journal of Neuroscience: The Official Journal of the Society for Neuroscience* 32(7): 2241-2247.
Phoenix. C., Goy, R., Gerall, A., and W. Young. 1959. Organizing Action of Prenatally Administered Testosterone Propionate on the Tissues Mediating Mating Behavior in the Female Guinea Pig. *Endocrinology* 65: 369-382.
Wizemann, T. and M. Pardue (eds.). 2001. *Exploring the Biological Contributions to Human Health: Does Sex Matter?* Washington, D.C.: National Academies Press.
Zuk, M. 2002. *Sexual Selections: What We Can and Can't Learn about Sex from Animals.* Berkeley: University of California Press.

ORGANIZED SESSION DIVERSE FORMAT – MINAS1

Panel

Between Plants and Snakes: 100 Years of Botanical Studies at Instituto Butantan

Org.: Luiza Teixeira-Costa (University of São Paulo/Instituto Butantan, luiza.costa@butantan.gov.br) and Erika Hingst-Zaher (Instituto Butantan, erika.zaher@butantan.gov.br)

The history of Botany as a scientific subject is strongly associated worldwide to collections of living plants, such as private gardens and herbaria. The same historical trend can be observed in Brazil, where botanical gardens fostered the study of plants since in its early stages. It was only in the beginning of the 1900's that botanical institutions were founded in São Paulo, and the first one of them was the Horto Oswaldo Cruz (HOC) at Instituto Butantan. Despite the usual association of Instituto Butantan with snakes and other venomous animals, this research institution devoted to human health studies was the birthplace of botany as a science in São Paulo. The HOC precedes the establishment of the São Paulo Botanical Garden, and both institutions are linked by the figure of their founder, the botanist Frederico Carlos Hoehne, who was an orchid enthusiast and self-taught scholar. Considering the relevance of HOC and also of Hoehne's research to the history of botany and of the Instituto Butantan, this session aims to address several aspects related to the HOC. Initially, the institutional context in the early 1900s will be presented as a way to provide a historical background for the creation of the HOC. A general chronology approaching the main events related to the history of the area will be presented next. After that, the following talks will address the social and medicinal value of plants cultivated in the area, as well as the relationship between the plant collections and the public. The final talk will deal with the participation of general public in the research carried out at the HOC, since its foundation to current times. All these topics are also part of Hoehne's broader knowledge of the Brazilian biodiversity, as a pioneer of conservation and public dissemination of science.

Chair of the session: Luiza Teixeira-Costa (University of São Paulo/Instituto Butantan, luiza.costa@butantan.gov.br)

Papers:

Horto Oswaldo Cruz, medicinal plants and health in the XIX Century São Paulo

Paulo Henrique Nico Monteiro (Instituto Butantan, Brazil, paulo.monteiro@butantan.gov.br)

Between the second half of the nineteenth century and the first decades of the twentieth century, the state of São Paulo was experiencing a period of great economic development based on the coffee exportation culture, known as the "Ouro Verde Paulista" (Paulista Green Gold). Due to this development and the accumulation of wealth related to it, São Paulo became a center of attraction for populations living elsewhere. During this period a large number of both Brazilians and foreign immigrants came to São Paulo in order to replace the slave labor in the farms and cities. In this scenario some social and economic challenges were faced by the economic elite as a limitation to the state's development. Thus, the economic elite followed a series of precautionary measures. First of all, it was important to know the economic potential of the São Paulo state territory and to demarcate the productive lands. It was also important to improve and qualify the potential coffee production through plague control and to improve the conditions of the exportation routes (ports and railways). Finally, it was crucial to ensure minimal health conditions for the population in order to guarantee the availability of a workforce. Therefore, the sanitation situation of urban and rural areas (control of urban and rural epidemics), the avoidance of the spread of "exotic" diseases associated with immigrants, and other factors needed to be dealt with. In this context, based on the premise that scientific knowledge is a factor of economic development, several Public Research Institutes were created as a way to respond to such needs. Among these, Instituto Butantan was founded in 1901 due to a need for anti-plague serum production in order to face a bubonic plague outbreak in the city of Santos, where the main harbor for coffee exportation to Europe and the US was located. After this initial period, Butantan was also the stage where new sanitary measurements were undertaken by the state government, which included the study of medicinal plants for the production of medicine against a variety of diseases related to public health issues. This is the background for the creation of the Horto Oswaldo Cruz (HOC), an area within Instituto Butantan dedicated to botanical studies of the so-called “useful” plants. Although little pharmaceutical success was obtained, the HOC became a world reference for toxic and medicinal plants, receiving plants from all over the world and also exchanging some of them with other researchers.

Horto Oswaldo Cruz and the birth of botany in São Paulo

Adriano Dias de Oliveira (Instituto Butantan, Brazil, adriano.oliveira@butantan.gov.br)

The attempt to cultivate medicinal plants for scientific purposes in Brazil dates back to 1865, when Dr. Ladislao Melo Netto – head of the botany section at the National Museum of Brazil – made a speech at the French Botanical Society. In his speech Dr. Netto highlighted that such cultivation would be crucial to the development of science in Brazil. Years later this goal became true, when in 1917 the Horto Oswaldo Cruz (HOC) was opened in São Paulo at the Instituto Butantan. The project behind the creation of the HOC was elaborated by Dr. Arthur Neiva, head of the São Paulo Health Service, who aimed at broadening the scientific scope of Instituto Butantan. In order to do so, the idea was that the growth of medicinal plants at the HOC should be coupled with scientific research and medicine production against some common diseases of that period. The botanist Frederico Carlos Hoehne was hired to be in charge of the HOC. Additionally, Hoehne created the São Paulo

State Botany Section, which included a herbarium that gathered several plant collections – dried plants, wood collection, and spirit collection (i.e., a collection of plant specimens preserved in alcohol). However, the project devised by Dr. Neiva had a brief duration and the HOC was closed in 1922, when the São Paulo State Botany Section was transferred to the Museu Paulista. In 1924, when Dr. Vital Brazil returned to the institute, the HOC ceased to be a part of the Botany Section and officially became part of Instituto Butantan. During the decades of 1930 and 1940 new projects related to medicinal plants were implemented at the HOC, although short success was achieved, thus ceasing this kind of attempt at the institute. In the 1950s construction works were carried out in two buildings located inside the HOC in order to make room for the Parasitology Section, which was installed in the area for ca. 40 year. By the beginning of the 1990s actions of environmental literacy were a growing trend in Brazil, which led to a new institutional interest on the green area within the HOC. The area was then transformed into a public park with ecological trails through which educators would guide the visitors. This was also a short term project, lasting only for two years despite the partnership initially established with the private initiative. Still, the intention to use the area as an education space persisted, and in 2006 the HOC became a part of the Museu Biologico, where different educational activities are offered to the visitors of Instituto Butantan until today.

Social and medicinal use of the botanical collections at the Horto Oswaldo Cruz

Luiza Teixeira-Costa (University of São Paulo/Instituto Butantan, Brazil, luiza.costa@butantan.gov.br)

Previously to the establishment of the São Paulo Botanical Garden; before the creation of the city-gardens by the Cia. City; and even before the neighborhood merged with the urban area of São Paulo capital city, the Horto Oswaldo Cruz (HOC) was founded at Instituto Butantan. Its original purpose was to cultivate toxic and medicinal plants, which could be used for scientific research and the production of medicine against several diseases. Unfortunately, little pharmaceutical success was obtained. However, the study of the species cultivated at the area provided relevant scientific information on popular medicinal use of plants. Besides the area used for plant cultivation, the HOC also fostered other plant collections, such as a herbarium and a wood collection including voucher material of several different areas of Brazil. During its short period of operation as part of the São Paulo State Botany Section, the HOC actually exceeded its initial goal of cultivating plant species with medicinal and toxic properties. Through the work of Frederico Carlos Hoehne, head of the HOC during its operation, a wide variety of plants of economic interest – the so-called "useful" plants – were actually cultivated and studied. The area was also relevant for the construction of the public space in the city during the beginning of the 20th century as it provided contact between an organized (domesticated) form of nature and the urban population visiting the area. From a historical perspective, this type of contact helped promoting the aesthetic value and the sense of well-being related to the presence of vegetation in urban areas. In addition, particularly considering the HOC, most of the plant species originally cultivated in the area are still relevant for the urban arborization of the city nowadays. These observations highlight the importance of the HOC regarding historical, medicinal, and social aspects of Botany as a science in São Paulo.

Hoehne's collection of orchids

Yasmin Vidal Hirao (São Paulo University/Instituto Butantan, Brazil, min.hirao@gmail.com)

Frederico Carlos Hoehne (1882-1959), son of German immigrants, was born and raised in Brazil. His interest in botany as a career began in his early childhood when Hoehne received an orchid from his father. From this first specimen a collection of orchids was formed and years later it became quite famous around Hoehne's home town (Juiz de Fora, Minas Gerais state). This good reputation allied to the skills in handling and growing plants lead Hoehne to his first job as head gardener of the National Museum of Brazil (Museu Nacional do Rio de Janeiro) in 1907. Even though he did not accomplish formal studies as a plant scientist, Hoehne was then hired as a botanist in many expeditions through the forests of Brazil, from where he brought back a great sum of plant specimens. This was the beginning of his efforts in building plant collections that could represent and show the great diversity of Brazil's native flora. Ten years later, in 1917, Hoehne moved to São Paulo, where he installed the first public institution exclusively dedicated to the study of botany as a scientific subject – the São Paulo State Botany Section. The Section fostered a variety of plant collections, including a herbarium, a wood collection, and a collection of living plants cultivated in the area known as Horto Oswaldo Cruz (HOC) within Instituto Butantan. Among the plants originally cultivated at the HOC there were over 30 species of orchids, comprising ca. 17% of the live plants collection. Several other species were cultivated within the greenhouse located at the HOC. During his career Hoehne was responsible for providing the scientific description of over 120 orchid species, many of them originally cultivated at the HOC. Despite having studied other plant groups, Hoehne had a greater interest about orchids, which often require peculiar conditions in order to naturally grow and flower. Thus, his esteem for this group of plants lighted up in him a strong protectionist vision of the flora and fauna of Brazil. Throughout his entire career, and particularly in one of his most important publications, Iconografia das Orchidáceas do Brasil (1949) Hoehne addresses the matter of conservation of natural environments in a period when consequences of massive exploration of natural resources were not yet a concern to public authorities.

Public participation and the research at the Horto Oswaldo Cruz

Erika Hingst-Zaher (Instituto Butantan, Brazil, erika.zaher@butantan.gov.br)

Since 1900 the Instituto Butantan has established a strong relation with the public, notably in aspects related to scientific dissemination but also in the engagement of nonscientists in the production of scientific knowledge. The most well-known example is the program launched by Vital Brazil, in which farm workers sent snake specimens collected in the field along with data regarding the collection, such as locality and date. In return these farm workers received vials of antivenom serum to be used in case of snakebites. Two interesting aspects of this program were the training provided by the team of researchers from Butantan on how to capture the snakes using wooden boxes and a special catching device, and the partnership established between Butantan and the railroads, which allowed the boxes containing snakes to be transported and delivered free of charge. This was a pioneer version of a citizen science project that helped creating one of the most important historical and scientific collections of venomous snakes. This project is also responsible for the image of Instituto Butantan as a pioneer research center for the study of snakes. A lesser known history of engaging the public in the production of scientific knowledge, however, was devised by the botanist of Instituto Butantan and founder of the Horto Oswaldo Cruz (HOC), Hoehne. As Vital Brazil, Hoehne also established a strong relationship with the general public, through the publication of articles in magazines and newspapers dealing mainly with urban trees, planting methods, medicinal plants, and orchid cultivation. Being one of the first conservationists in Brazil, Hoehne also wrote four children's books on tropical animals and plants. At the same time, during his work as head of the HOC and the State Botany Section was the study of medicinal plants. For this purpose, he urged his readers to bring to Instituto Butantan all kinds of plants that they knew to be used for medicinal purposes, so they could be identified, preserved in the herbarium or planted at the HOC, and studied. Unfortunately, differently from his colleague Vital Brazil, who spent many years working at Butantan, Hoehne left the Institute very early, in 1925, and did not leave any successors to continue his research program. This is possibly the reason why the knowledge about his involvement with scientific dissemination and citizen science is not so widespread. The same holds true for the relationship between Instituto Butantan and the study of botany and medicinal plants. Both scientists, however, left an important contribution that transcends their scientific papers and writings: through the communication with the public, they contributed for the image that Butantan has until today, as a traditional research center that has also an affective link with the history of São Paulo and Brazil.

INDIVIDUAL PAPERS SESSION – MINAS2

Evolution Education

Chair of the session: Nelio Bizzo (School of Education, University of São Paulo, Brazil, bizzo@usp.br)

Papers:

The relation between science and religion in the circulation of Darwinism in school biology in Colombia

Gonzalo Peñaloza (Interinstitutional Doctorate in Education, Distrital University Francisco José de Caldas, Colombia, gpjimenez101@hotmail.com)

The history of education in Colombia is linked to the process of evangelization of Catholicism. During colonial times, education in what would become Colombia had as its central purpose, the subordination of native population to the power of the Spanish crown and Church. Then, in the construction of the republic, religion was a key factor in consolidating national identity, unifying the country and "civilizing" people. In other words, education and catechesis instruction always went hand in hand. Colombia was a Catholic country until the last decade of 20th century because in 1887 an agreement between Catholic Church and State was signed. It was known as "Concordat". In this agreement, the Church was granted tax and legal privileges and the control of primary and secondary education. For these reasons, to understand the history of science and the reception of evolutionary ideas it is necessary to take account of the particular relationship between religion and science in the country. This paper shows results of a critical and interpretative research which objective was to study the way how science and religion interacted with darwinism in school science. For it, the research examines biology school textbooks published in Colombia between the second half of the 19th until the 70's of the 20th centuries. With regards to school manuals it should be noted that they are a type of books that systematically and sequentially organizes contents, adapting them to be used in certain school levels. Their content complies with State regulations defining the issues and the depth they should be approached. They condense ways of thinking about what is and what is education for, on each place and time. The study concludes that natural theology and neo-Thomism were a philosophical framework that combined science, and its teaching, with Catholic worldview. The "natural theology", which was developed from neo-Thomism, gained strength within the Catholic Church and took shape in the measures taken by the Vatican Council II. This philosophical device allowed the Church to face the challenges that the scientific development set out. Consequently, the darwinistic thesis of common ancestor, applied to humans, was conditionally accepted to preserve their special nature; the natural selection theory was admitted like an explanation of second causes, preserving the idea of God as primary cause; and the thesis of contingency of evolution was rejected by considering it as a materialistic and liberal ideologized idea.

Why does the Chinese public accept evolution?

Jing Zhu (Department of Philosophy, East China Normal University, P. R. China
jingzhu1@sas.upenn.edu), Mingjun Zhang (Department of Philosophy, University of Pennsylvania, USA, mingjunz@sas.upenn.edu) and Michael Weisberg (Department of Philosophy, Annenberg Public Policy Center, University of Pennsylvania, USA, weisberg@phil.upenn.edu)

Chinese nationals overwhelmingly accept evolution. According to the Chinese National Surveys on Public Scientific Literacy, conducted nine times from 1992 to 2015, between 65.8% and 77.3% of Chinese people accepted the statement that "Human beings, as we know them today, evolved from earlier species of animals." This puts the Chinese public in the company of countries such as Denmark, France, and Germany, and stands in contrast to the low acceptance rate of evolution in the American public. While it might be tempting to explain these figures by appealing to the high prestige of science and technology, or a high degree of scientific literacy in China, this is not the case. It has been well-documented that there is a relatively low scientific literacy rate in China and the population has a poor understanding of the scientific method and the nature of science. Then why does such a population accept evolution so widely? By examining the history of evolution education and knowledge dissemination in China, this paper investigates how the interaction among education, mass media, social and political movements, as well as ideological arguments about evolution greatly influenced the Chinese public's understanding and acceptance of evolution.

The idea of evolution was introduced to China in the late 19th century. Elite and ordinary members of the public paid much more attention to the political, moral and social implications of evolutionary theory for national survival and social reform, rather than its biological meaning. This trend greatly facilitated the dissemination of evolutionary theory in China but also brought about many misconceptions to the public. During the Republican period (1912-1949), evolutionary theory was further introduced to the public through both the formal education system and the flourishing of popular publications. Some intellectuals and scientists began to use it as a theoretical basis for carrying out eugenics and realizing racial improvement in China.

After the establishment of the People's Republic of China in 1949, the education of evolutionary theory was dominantly influenced by Michurin's "Creative Darwinism" in the movement of modelling the Soviet Union, and was also closely tied with the promotion of dialectical materialism. Human evolution was put in a very important position, not only because of Engels' emphasis on the role played by labor in human evolution, but also because of the archaeological discovery of Peking man being connected with national identity. When China ended the Cultural Revolution in 1976, the scientific aspect of evolutionary theory began to get more attention. But at the same time, Darwin and his evolutionary theory were frequently used as examples of how the public should reject superstition.

In summary, since the introduction of evolutionary theory into China, governments, elites and scientists in different periods have used different ways to disseminate the idea to the public, both formally and informally. The purpose of evolution education has moved beyond teaching the basics of scientific evolution, and been closely interwoven with the social and political concerns in different times, which in turn shape how the Chinese public understands and accepts evolution today.

Understanding evidence of biological evolution in a Darwinian perspective: The power of philosophy

Nelio Bizzo (Faculty of Education, University of São Paulo, Brazil, bizzo@usp.br)

Charles Darwin himself (wrongly) admitted that his ideas on adaptation had some roots in Aristotle's natural history. Many people were led to consider the perspectives of both thinkers were in some way compatible. Some educational suggestions have been put forward recently, proposing aristotelic teleology as a complement to the traditional approach to adaptation, highlighting the purposes which would have been fulfilled with evolutionary change. Some objections will be presented, showing that aristotelic approaches to natural history are the basis for the so called "intelligent design", leaving no room for chance, as well as for religious opposition to biological evolution. Some writings of Darwin, including lengthly parts of "Origin of Species", focus on the issue of final causes, and, despite the huge oversight Darwin wrote in the "Historical Sketch", a clear opposition can be seen in later editions of his well known book.

MONDAY JULY 17
18:00-19:30 – Plenary conference

Can Science Be Viewed as ex ante *Authoritative in a Post-Factual World?*

Naomi Oreskes (Department of the History of Science, Department of Earth and Planetary Sciences, Harvard University, USA)

In 2016, a scholar associated with the American Enterprise Institute, a think-tank dedicated to "strengthening the free enterprise system" posed the question: "[H]ow [can] scientific analysis conducted or funded by an agency headed by political appointees buffeted by political pressures be viewed ex ante as any more authoritative than that originating from, say, the petroleum industry?" One might be tempted to dismiss a question like this, posed as it was by someone associated with an institute famous for its attacks on climate science and scientists. But the question is a legitimate one. In a world that many view as "postfactual," how can scientific analysis be viewed as ex ante authoritative? Why should the conclusions of a scientific community be viewed ex ante as more authoritative than that originating from the petroleum industry? Or the tobacco industry? Or Coca-Cola?

This paper addresses the question from the vantage point of the past decades of scholarship in history, philosophy, and social studies of science. I argue that the answer involves the social practices of science—particularly the practices of communal critical interrogation emphasized by feminist scholars of science—and the track records of private enterprise. Despite the various pressures that may buffet scientists—in government agencies, the private sector, or anywhere else—so long as they are participating in scientific communities—presenting their work at conferences and submitting it for peer-review and publication—and so long as the communities in which they practice are diverse, we have a basis for ex ante trust.

The processes of critical interrogation, however, rely on an assumption of good faith: that participants are interested in learning about the natural world and have a shared interest in factual information. History shows that assumption is often violated in the private sector, where fraudulent and misleading claims have been used to defend dangerous products and protect corporate profits. Often these claims have been presented as scientific, yet have not been subjected to the tests of critical scrutiny, or have been so subjected and failed those tests. That is to say, the "scientific" claims of industry are often not scientific, and this is why, ex ante, we have reason to suspect them.

MONDAY JULY 17
19:30-21:00 – Poster session and refreshments

Posters on Biological Education

Mondino de Luzzi, Alfonso Bovero and the birth of a tradition for the Anatomy teaching

Ana Carolina Biscalquini Talamoni (Institute of Biosciences; São Paulo Coastal Campus; São Paulo State University (UNESP), Brazil, ctalamoni@clp.unesp.br)

This work aims to present the historical, epistemological and didactic achievements of the Italian anatomist Mondino de Luzzi (1270-1326) in order to establish parallels between his anatomical practice and Alfonso Bovero´s (1871-1937), his compatriot who came to occupy, in 1914, the position of Anatomy and Physiology full professor in the Medicine and Surgery Faculty of São Paulo/Brazil. Recent studies in the history of science, and more specifically of anatomy, point to the importance of Mondino's achievements in establishing the practice of dissection as a fundamental part of anatomy teaching, which was included in the curriculum of Bologna University, still in the 14th century. This fact enabled that the executions of criminals until the end of 16th century - the only legal source of corpses for study purposes in Bologna - were carried out in the manner chosen by the anatomist, to avoid damaging his work, which can be considered a breakthrough in the use of human body in the process of building knowledge in the Western civilizational scenario (Friedman & Friedman, 2001). Mondino wrote the first anatomy textbook for didactic purposes entitled "Anothomia" (1316), which has been used for more than 200 years as one of the main sources of knowledge about human anatomy, and has played a fundamental role in the planning and accomplishment of his teaching. It is also attributed to him the emergence of two important characteristics for the development of practical anatomy classes: the ostensor, who directed the practice of dissection indicating the incision lines, and the demonstrator, who performed the cutting procedures. The students, in turn, took their places around the corpse to observe and take notes. This arrangement at the anatomy class, consecrated the ritual of the anatomy class as a peculiar space, called "anatomical studio", currently known as "anatomy labs". The use of cadavers for didactic purposes, as undertaken by Mondino, bears much resemblance to the practical studies inaugurated by Bovero in the Brazilian scenario, as well as to those carried out at the present time, especially in the undergraduate courses in biological sciences (Talamoni & Bertolli Filho, 2014). The corpses were thus consecrated as fundamental didactic instruments for teaching and learning in human anatomy, being the empirical basis for the observation and memorization of the content present in textbook. This resource has been considered irreplaceable by the contemporary Brazilian anatomists self-titled "anatomists from

Boverian school", who reiterate the isomorphism that characterizes this school of thought and allows it to be considered the most traditional of the morphological sciences: descriptive anatomy.

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The historical construction of enzymes concept and its use in the Biology teaching

Antônio Fernando Gouvêa Silva (Department of Human Sciences and Education, Center of Human and Biological Sciences, Federal University of São Carlos (UFSCar), Brazil, gouvea@ufscar.br), Paulo Newton Tonolli (Department of Human Sciences and Education, Center of Human and Biological Sciences, Federal University of São Carlos (UFSCar), Brazil, paulontonolli@yahoo.com.br) and **Fernando Faria Franco** (Department of Human Sciences and Education, Center of Human and Biological Sciences, Federal University of São Carlos (UFSCar), Brazil, franco@ufscar.br)

The History and Philosophy of Science (HPS) is considered essential to teaching and learning as it humanize scientists and promotes a better understand about construction of scientific concepts. Unfortunately, for Biological Sciences the HPS is commonly wrong, linear and/or extremely simplified in textbooks. This is especially true for Biochemistry, which has its infancy during the initial building of enzymes concept. Here we perform a brief review about this issue, since the application of enzymes in fermentation in antiquity until its conceptualization in modernity, including vitalistic explanations for enzymes activity, such as “spirit of wine” of Nicolas Lemery (1645 – 1715), to empirical experimentation such as those performed by Sieur de Réaumur (1683 – 1757), Abbot Lazzaro Spallanzani (1729 – 1799) and many others, for example. Further, we analyze nine Biology textbooks printed in Brazil for secondary school in order to investigate how enzymes concepts are presented in this material. To this end, we delineate three analysis categories in textbook: (i) whether and how is made the historically conceptualization/ of enzymes; (ii) how the contents related to Biochemistry are organized in textbook; (iii) whether we might find conceptual errors due the lack of historical contextualization. In summary, we detect a strong lack of interconnection and historicity in Biochemistry issues, in which enzymes is mainly presented within the ahistorical "lock-and-key model". Moreover, we were able to find different conceptual mistakes as a result of absence or deficiency of historical contextualization. In this sense, in this work we reinforce a growing view about the importance of HPC to Biology teaching.

Approach to History and Philosophy of Science in Brazilian Science Textbooks of Middle and High School

Gregory Alves Dionor (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, gadionor.bio@gmail.com), Liziane Martins (State University of Bahia, Campus Teixeira de Freitas, lizimartins@gmail.com) and Neima Alice Menezes Evangelista (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, neimalice@hotmail.com)

Research in Science and Biology Teaching has been seeking, in the last decades, to analyze the textbook as a cultural product; as a vehicle of ideological values; as support of knowledge and teaching methods; and also as a commodity linked to the publishing companies. However, in view of the current landscape of this field of study, we see that it is necessary to go beyond the conceptual contents and analyze how textbooks support (or not) students' learning about the philosophical bases of knowledge and how knowledge has developed over time, so that they understand its meaning, origins, evolution, and social implications. As argued in the literature, this philosophically- and historically-informed approach can humanize the sciences; make science classes more challenging and reflective, enable the development of scientific thinking; improve teacher education, promoting a richer and more authentic epistemology of science. In addition, the inclusion of History and Philosophy of Science (HPS) in teaching enables students to empower themselves, allowing them to distinguish the various arguments and visions that permeate the social circles in which they are embedded. Thus, this study aimed at identifying and analyzing the contexts related to HPS in Brazilian Science and Biology textbooks. We analyzed two widely used high school textbook collections, written by Linhares and Gewandsznajder, and Amabis and Martho, each containing three volumes. We analyzed these textbook collections because they have been evaluated by the Brazilian National Textbook Program and are among the most requested by Brazilian public school teachers in recent years. To conduct the study qualitatively, we opted for content analysis, in which the text was disaggregated into units of analysis – the recording units – and were then reaggregated in categories, allowing us to analyze how HPS is treated in these materials. From the results, we could see that HPS contents are generally found in chapters concerning the Introduction to Biology, Microbiology/Virology and Genetics and Evolution, in Amabis and Martho's textbook. In Linhares and Gewandsnajder's textbook, in turn, they appear in subjects referring to the fields of Chemistry and Physics. Often, HPS contents are reduced to simple data and information such as the name and/or date of birth of the researchers involved, assuming a complementary or even dispensable function for the process of understanding the subjects. The images had a more illustrative function, such as figures of scientists or stages of experiments explained in the main text. HPS was not explored in the activities, even in the chapters that discuss topics about the beginnings of Biology as a field of study, as well as the bases of scientific thinking and procedures of knowledge construction by science.

Structuring concepts in biology: contributions from the philosophy of biology to the high school curriculum

Ítalo Nascimento de Carvalho (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), italonc@hotmail.com)

Philosophy of biology can contribute to high school biology not only as a subject to be studied in the classroom, but also by providing resources for curriculum design. In this work, we are interested in how philosophy of biology can help us define learning goals that, if obtained, will make students able to understand the conceptual structure of biology. We suggest we should teach the structuring concepts in biology, that is, those concepts that once learned allow students to understand many other, less general concepts. By doing so, we can reduce the amount of conceptual contents that currently abound in biology curricula all around the world and bring learning difficulties. It would help students focus on what is most important to know and, furthermore, would grant teachers more time in class to address procedural and attitudinal dimensions of biological contents. In order to identify those structuring concepts, we should rely on criteria other than intuitive appeal or convenience, making clear the steps we follow through the decision process in such a manner that they can be openly discussed and improved. The adoption of a conceptual framework of biology is fundamental to this matter, though few researchers have tried to outline the structure of biological thinking at its most general level, encompassing all its subareas. In order to advance, we opt for a hierarchical framework proposed by Scheiner, composed of an overarching theory of biology to which five general theories (genetics, cell, organism, ecology and evolution) are subordinated. Several lower-level, constitutive theories are derived from each general theory, narrowing the scope of investigation and providing linkage among general theories. At the lowest level are models, where theory meets empirical data. We argue that structuring concepts from the higher levels of the hierarchy deserve more attention in high school biology teaching, especially those who can also help students understand how different areas of biology relate to each other. However, due to the high-level abstraction skills needed to comprehend those concepts, psychological and didactic considerations also should be taken into account and we will briefly discuss them.

Astrobiology as transdisciplinary tool for biology teaching: Searching for structuring concepts in life sciences

Leticia Paola Alabi (Department of Logic and Philosophy of Science, Program Philosophy, Science and Values, University of the Basque Country (UPV/EHU), San Sebastian, Spain/Center of Natural and Human Sciences, Federal Universitty of ABC, Brazil, lalabi001@ikasle.ehu.eus), Tamires Michelle Gallo (Brazilian Synchrotron Light Laboratory, Brazilian Center for Research in Energy and Materials, Brazil, tamires.gallo@lnls.br), Fabio Rodrigues (Brazilian Synchrotron Light Laboratory, Brazilian Center for Research in Energy and Materials, Brazil/Institute of Chemistry, University of São Paulo, Brazil/Institute of Astronomy and Geophysics, University of São Paulo, Brazil, farod@iq.usp.br), Charles Morphy Dias Santos (Center of Natural and Human Sciences, Federal Universitty of ABC, Brazil, charlesmorphy@gmail.com), Douglas Galante (Brazilian Synchrotron Light Laboratory, Brazilian Center for Research in Energy and

Materials, Brazil/ Institute of Astronomy and Geophysics, University of São Paulo, Brazil, douglas.galante@lnls.br) and Verônica de Carvalho Teixeira (Brazilian Synchrotron Light Laboratory, Brazilian Center for Research in Energy and Materials, Brazil, vctbell@gmail.com)

The origin and evolution of life address some pivotal questions regarding the understanding about our place in the universe. Where, when and how did life emerge and evolve on Earth? Does life exist elsewhere and, if it does, how can it be detected and identified? These issues are the main concerns of astrobiology, an interdisciplinary area of research that brings together biology, physics, chemistry, astronomy and philosophy in order to comprehend life as an emerging universal phenomenon. Astrobiology, however, can also be used as a tool for teaching sciences in different scenarios. It allows science teachers to discuss the need for dealing with scientific problems through multifaceted knowledge, transcending the mere repetition of content. Yet, astrobiology stimulates students to perceive science as a process. The present study proposes how to find structuring concepts in biology within a cosmic context using astrobiology as a tool. First, a survey of teachers' preconceptions about astrobiology was carried out, with multi and interdisciplinary topics. We conducted a short course on the theme "Habitable Zone and Habitability" and developed a questionnaire (a) to carry out a focused investigation. This was proposed to 40 natural science teachers of Elementary School Cycles I and II, and High School from the region of São Paulo. After that, a second questionnaire (b) was prepared and answered by the 16 teachers who were active participants in this course. According to our results, most part of the teachers had never worked with interdisciplinary issues in science classes, although they realize the importance of presenting science as a non-fragmentary endeavor. As astrobiology encompasses different scientific domains – in fact, it is a transdisciplinary research field, providing a perspective from a level above the traditional discipline boundaries –, it may be used in science teaching to fulfill the necessity of knowledge integration. In this sense, a theme such as ‘life as we know it’ could be used as the starting point to discuss structuring concepts in biology. Yet, through a problem-based learning approach, astrobiology can arouse interest in science students, being a welcome contribution to scientific literacy.

Teleology and pollination: A proposal for a didactic intervention

Luis Felipe Delsin (Department of Biology, University of São Paulo/Ribeirão Preto, Brazil, luisfelipefadel@gmail.com), Giselle Alves

Martins (Graduate Studies in Comparative Biology, University of São Paulo/Ribeirão Preto, Brazil, gisellealvesmartins@gmail.com) and Fernanda da Rocha Brando (Department of Biology, University of São Paulo/Ribeirão Preto, Brazil, ferbrando@ffclrp.usp.br)

The general aim of this ongoing research is to evaluate perspectives of different authors on teleology in biology and the application of these perspectives in a didactic intervention in higher education, taking the process of plant pollination as a biological example.

A philosophical approach to teaching allows the understanding that Science occurs in slow processes with limited methods and technologies. Understanding these discontinuities in Science can help develop critical views about both scientific work and its value.

Some criticisms regarding the use of teleological language in biology are mainly related to three reasons: I) Teleological explanations involve theological and metaphysical questions that should not be used in science; II) Teleological causality is problematic because it resorts to future events with an end; III) Anthropomorphism. This research had as its starting point two visions: the dispositional approach of Robert Cummins (1973) and the etiological approach of Larry Wright (1975).

From these points of view, it was proposed a didactic intervention that exposes texts of authors who described the phenomenon of pollination at different scientific contexts in order to verify the conception of teleological language from biology students.

The didactic intervention was built based on "teaching-learning sequences", considering the epistemological and pedagogical axes: the first as the relation between the scientific knowledge and the biological phenomenon; the second the relation between the teacher and the student. It consists in the distribution of four texts about pollination with different languages, teleological or non-teleological, and in the choice by the students of one of the four texts, which they could use in the classroom as future teachers. That choice should be based on an argumentative justification.

The justifications are collected through a brief survey. An expository lesson is used to explain ideas from Larry Wright and Robert Cummins and then the students can change their chosen text to another text using a different justification. The arguments used by the students to choose each text both before and after the expository lesson are analyzed using specific literature.

It is expected that this intervention will allow students to reflect on the argumentation process during their choices, considering the pedagogical and heuristic values that permeate the discussion about teleological language in teaching.

The proposed didactic intervention fulfills, therefore, the aim of showing how the Philosophy of Biology can contribute to the understanding of the construction of knowledge in Science during the education of Biological Sciences students.

Contributions of the History of Biology in the teaching of Photosynthesis: A perspective for classroom

Matheus Luciano Duarte Cardoso (Federal University of ABC, Brazil, matheuscardoso.edu@gmail.com) and Thaís Cyrino de Mello Forato (Federal University of São Paulo (UNIFESP), Brazil, thais.unifesp@gmail.com)

Considering the formative aspects that a contextualized approach to the concepts of biology can provide (Allchin, 2011), this research intends to investigate the incorporation of the history of science in high school biology courses, in order to contextualize scientific contents, promoting a conception of science as part of a sociocultural context and discuss the nature of science (NOS). To do so, we seek to develop, implement and analyze the potential contributions of a pedagogical proposal addressing some aspects of the history of photosynthesis. The selected episode focuses on contributions, such as those of Joseph Priestley (1733-1804) and Jan Ingenhousz (1730-1799) to the development of this biological concept. It also connects to other theories from the period, like the Phlogiston Theory, and with interdisciplinary aspects, such as the work of Lavoisier (1743-1794) in chemistry. The methodology for the development of this proposal starts from the delimitation and suitability of the historical approach to the school environment using parameters for didactic transposition of the history of science for high school (Forato et al., 2012). After that, a historical inquiry case study will be developed focusing on science as a process, highlighting epistemic issues, as well as non-epistemic ones (Allchin, 2011). This inquiry-based pedagogical strategy presents activities and discussions that should actively engage students through open-ended questions in thinking about NOS and in articulating their developing perspectives. These classes will promote spaces for interpersonal interaction in educational activities aiming at a reflective transformation (Yanés and Maturana, 2009) and foster a critical education that promotes dialogue and awareness, as an educational praxis for citizen education (Freire, 1996). The data will be collected from video recordings, students' writing, and research field notes. Using a qualitative methodology, the data will be triangulated in order to evaluate students' learning about the concepts and their understanding of NOS aspects (Ericson, 1998). We expect that the empirical results might clarify the potential contributions of this proposal, as well as its limitations, and provide didactic materials that are intended to avoid pseudohistory (Allchin, 2004) and respect the current historiography (Kragh, 1989).

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"What are legume root nodules?" An example of history of science use for designing and evaluating inquiry-based-learning activities

Nathalia Helena Azevedo (Interunit Graduate Studies Program in Science Teaching, University of São Paulo, Brazil, helena.nathalia@usp.br) and Daniela Lopes Scarpa (Institute of Biosciences, University of São Paulo, Brazil, dlscarpa@usp.br)

Due to the possibility of providing a better understanding of the nature of science and scientific concepts, researchers have advocated for the inclusion of the history of science at different levels of science education and, consequently, the approach focused on nature of science has begun to integrate the curriculum parameters around the globe. However, adequate historical contextualization is still rare and the history of science that is usually portrayed is linear, anecdotal, consensual and lacking a wider historical context. Furthermore, empirical research to assess whether a historical perspective can be effective for learning concepts and skills is scarce. Inquiry-based learning is a teaching and learning approach in which both educators and students share responsibility for learning. In this approach, ideas and observations are included in the center of the learning experience, and, by engagement, students are encouraged to develop skills by exploring, explaining, elaborating and evaluating. Thus, the principles of inquiry-based learning can help designing and evaluating activities that aim to explore concepts through the history of science. We present the activity "What are legume root nodules?", designed to 7th Grade students, which has been structured around the principles of inquiry-based learning and uses the history of science to help students come to a final answer. The activity is based on a contextualized situation in which it is necessary to answer guiding questions throughout six texts, enriched with photos, schemes, and figures. The activity texts contain historical episodes which aim to help to establish the relationship between legume root nodules and nitrogen fixation. After learning nitrogen fixation, students work with the concept of mutualism and answer a final question about how legume plants survive in poor nitrogen soils. We performed three applications, carried out in different school contexts and collected students' responses to the two final questions of the activity. The results show that students were able to interpret historical episodes, relate information to construct a hypothesis and evaluate evidence to answer the motivating questions' activity. The answers used to evaluate students' use of concepts and skills provide empirical evidence that encourages the use of both an inquiry-based learning approach and historical elements in the classroom. We emphasize that, although there is a growing literature advocating a contextualized approach to science education that includes nature of science aspects, there is still a need to focus efforts on production and evaluation of teaching materials suitable for use in the classroom.

The gene concept in Cellular and Molecular Biology Higher Education textbooks

Neima Alice Menezes Evangelista (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil.

Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, neimalice@hotmail.com) and Vanessa Carvalho dos Santos (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE). Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, carvalho.st@gmail.com)

The gene concept underwent several changes as advances were made in the fields of genetics, cellular and molecular biology, and -omics. The major problems concern the classical molecular concept, still the most used in biology teaching, according to which a gene is a sequence of nucleotides in DNA codifying a functional product, either a polypeptide chain or RNA molecule, because many findings challenge this concept, such as alternative splicing, RNA editing or long non-protein coding RNAs. Our goal was to investigate how the gene concept and models of gene function are addressed in widely used cellular and molecular biology higher education textbooks. We surveyed syllabi of cellular and molecular biology courses in several countries, searching for 250 syllabi in English, Portuguese and Spanish by means of Google® search tool. We analyzed the five textbooks most frequently indicated as readings in the syllabi through categorical analysis, decomposing their texts into units of recording and then recomposing them into analytical categories according to semantic criteria, that is, to the meaning ascribed to the gene concept and ideas related to gene function. The main findings of this study were: (i) predominance of the classical molecular concept in the analyzed textbooks; (ii) absence of a historically and philosophically-informed approach to genes, which takes into account that one is dealing with models and concepts, not with reality in itself, with the consequence that properties ascribed to genes in different concepts/models are indiscriminately mixed; (iii) promotion of genetic determinist ideas by the approach to genes and their roles in living systems, due to a large extent to the mixture of properties ascribed to genes by different models; (iv) absence in most textbooks of a conceptual discussion of the consequences of challenges to the classical molecular concept to our current understanding about genes, despite the fact that those challenges have been known for more than three decades and are discussed in the textbooks themselves; (v) silencing of non

deterministic views about the roles of genes in biological systems. Given the influence of textbooks on students' education, we conclude the approach to genes in these textbooks diminishes their capacity to position themselves in an informed manner and act as citizens that have knowledge that allows them to be sufficiently critical in the understanding of gene talk in a society increasingly marked by the use of genetic technologies and a social discourse about genes that tends to be strongly deterministic. The way genes are portrayed in the analyzed textbooks provides a cogent example of how things can go badly wrong in scientific education when historical, philosophical, and sociological aspects of science are not taken into consideration. This is shown by the fact that in the textbooks attributes of genes in different historical models are indiscriminately mixed, leading to problems such as a promotion of genetic determinism, as a consequence of the lack of an historically, epistemologically and sociologically informed approach that can support students' learning about and with models.

Teaching and learning Botany with a democratic and collaborative teaching approach: A report with undergraduate students
Rafael Luccas (Botany Laboratory, Federal Institute of Education, Science and Technology of São Paulo - campus São Roque, Brazil, rluccas17@gmail.com) and Fernando Santiago dos Santos (Botany Laboratory, Federal Institute of Education, Science and Technology of São Paulo - campus São Roque, Brazil, fernandoss@ifsp.edu.br)

Botanic knowledge is as important for student training as other biological areas, such as Zoology and Microbiology, for example, as it is present in many routine situations: the air we breathe, the food we eat, the clothes we wear, and the ecological processes that sustain our ecosystems. However, such knowledge seems to be neglected or given little relevance when students are taught botanical contents. Several authors have pointed out that the teaching of botany in basic education is perhaps the most impaired amongst the biological knowledge. Teachers face difficulties when learning and teaching contents of the immense Kingdom Plantae (mostly due to their own deficient background during Undergraduate courses), or, in some cases, report it as being uninteresting, what may lead to bad learning and teaching processes; in contrast, teachers with solid botanical knowledge may lack the practice to supplement teaching. The present experience report aims to present preliminary data obtained with a democratic and collaborative methodological approach applied to undergraduate students in

Biological Sciences at a federal Institution of Higher Education (IHE) during an elective curricular discipline. The methodology focuses on botany and seeks better teaching and learning conditions by developing teaching skills through democratic and group decisions, thus fostering the interest of undergraduate students in improving the teaching of botanical contents. The first phase of the project was carried out during the second semester of 2016 with a group of 20 students of the IHS (4th, 6th and 8th semester students) based on a methodology of collaborative and democratic work with the intention of promoting interaction among students of differentiated semesters, the sharing of knowledge among the committee, and the promotion of the active voice of each and every member. Freedom of expression provided throughout the course was essential for each one to work on specific botanical areas of his/her own interest in the way they thought to be appropriate, producing didactic materials to his/her own learning, to other teachers and to current and future students whom he/she will be responsible for. During the elective discipline, all participants produced and presented a variety of didactic materials, namely: a teacher's guidance booklet, a "Why should I study botany?" booklet, a botanical curiosities booklet, a slide collection of botanical structures, a magazine about seeds and fruits, and botanical Pokémons. All materials were validated and commented collaboratively. At the end of the activities, such productions were exposed to the general public in an event called "Mostra Botânica+Legal" held at the IHS. The event was registered as an institutional extension project, reaching 103 participants in ten hours of activities. Preliminarily, we conclude that it is possible to enhance students' protagonism and production of didactic materials without the mooring of a traditional teaching system that emphasizes lectures, tests and tasks focused merely upon punctual, ranking-based charges.

Contributions from logic to research on science education

Renata de Paula Orofino (Graduate Studies Program in Ecology, University of São Paulo, renata.orofino@gmail.com) and Daniela Lopes Scarpa (Department of Ecology, University of São Paulo, scarpadani@gmail.com)

Argumentation is a prominent subject in science education research. Both students and teachers benefit from acknowledging the role of arguments in science. Different approaches can be found in argumentation research, from epistemic aspects of argumentation to critical thinking. Frameworks to analyse argumentation are just as multiple as are research foci and are grounded on distinct philosophical bases, from Logic to Pragma-dialectic. Formal Logic characterizes an argument as a set of declarative sentences, one marked as the conclusion and the other as premises that support the conclusion. This structure allows logical, material and rhetorical evaluations, which correspond to, respectively, structure, content and persuasiveness of the argument. Most researches about argumentation in science education contexts concentrate on material evaluations, while logical and rhetorical evaluations are scarcer. Here we will discuss two popular frameworks applied to educational research – Toulmin's Argument Pattern (TAP, 1958); and Walton's Argumentation Schemes (1996) – pointing out strengths and limitations to their use. TAP discusses the basic definition of arguments from Logic and gives distinctive roles to the premises of an argument. Also, TAP adopts other logical evaluations for the argument different from the deductive/inductive dichotomy. Both logical and material evaluations are possible using TAP. Walton compiled a set of presumptive reasoning schemes, arguments people in a dialog portray in an attempt to transfer the burden of proof to the other person. The logical evaluation is similar to Logic's but the material evaluations discuss what should or not be considered a fallacy, particularly the types of inference that allow the dialogue to go ahead on a provisional basis or provide tentative solutions to practical problems. This evaluation considers the circumstances of a particular case before classifying an argument as a fallacy. Researchers who rely on Walton evaluate science classrooms as places of dialogical construction of knowledge, presumptive in nature because students select evidence for scientific explanations. Both frameworks have limitations. Several researchers have pointed that it is difficult to define which kind of premise should be considered as Warrant, Backing or even Rebuttal depending on the situation analysed. On the other hand, when one chooses to analyse arguments using Walton's presumptive argumentation schemes, the main concern is to remember that the schemes are context dependent, and the argument may or not be a fallacy depending on the situation. Both TAP and Walton's concerns the material evaluation in scientific contexts, meaning that researchers themselves must create specific criteria for classifying the content of the arguments. Methodological issues posed by these frameworks have already been indicated as a challenge in science education research. TAP is most indicated when one wishes to distinguish empirical from theoretical evidence in arguments whereas Walton's seems to be the best choice when analysing discussions or debates. We suggest that researchers start analysing argumentation using the basic definitions from Logic and weigh the pros and cons before choosing more elaborate frameworks.

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Posters on History of Biology

Commented translation from an original source in the history of science: Claude Bernard's Introduction à l'Étude de la Médecine Expérimental *(1865)*

Christine Janczur (Department of Genetics and Evolutionary Biology, Institute of Biosciences, University of São Paulo, Brazil, christine.jz@ib.usp.br)

Commented translation from an original source in the history of science: Claude Bernard's *Introduction à l'Étude de la Médecine Expérimental* (1865)

Claude Bernard (1813-1878) was a French physiologist, medical scientist and professor at *Collège de France*, in Paris. His work is of great importance not only for Medicine, but also for Biology, due to dozens of books and articles. His texts are in use until nowadays as sources of studies in the areas mentioned above. Many scientists and medical historians have written about him and translated his many works into several different languages. Among all the works published by this scholar between the years 1843 and 1879, the book that is the object of our translation – *Introduction à l'Étude de la Médecine Expérimental* – is the most translated to other languages, given its contribution to the understanding of the scientific method in biology. This book contains several key insights of epistemological and methodological importance. The author compiled this work at a later stage of his career, offering in it very important reflections on the production of scientific knowledge. In addition, the book presents concepts which importance is widely recognized to this day, as the concept of internal environment (milieu intérieur). Despite its recognized importance, this book received only one version in Portuguese, in 1959, written in European Portuguese, a language that presents many differences to the current Brazilian Portuguese. This translation into Brazilian Portuguese revealed many challenges that need to be overcome to reach a text that is accessible to the Brazilian reader public, formed not only of students, but of university professors and of all interested people in the history of biology. We decided to make a translation containing explanatory notes (absent in the translation cited above), in order to take the reader of the 21st century to the scientific context of the nineteenth century, a time when the ways of organizing thought and disseminating it were quite different. In addition to explaining scientific terms from the nineteenth century, the notes also contextualize the events to which the author of the book refers, presenting information about the cited scientists and their contributions and influences to the work under study. We make this commented translation according to the option of taking the reader to the author, a procedure known as foreignization. This option allows us to respect the style of the author, contextualizing his work in the period in which it was written, highlighting the historical aspect of the text. We present some examples of notes extracted from the section already translated. We believe that such notes are the differential that will make this material more attractive and more useful to the intended Brazilian audience.

The cleavage between heredity and development in the early XX century: The importance of scientific practices

Leonardo Augusto Luvison Araújo (Graduate Studies Program in Education, Federal University of Rio Grande do Sul (UFRGS), Brazil, leonardo_luvison@hotmail.com)

The cleavage between heredity and development as well as the split between genetics and embryology are well known in the History of Biology (Amundson, 2005). In the early XX century some researchers such as Thomas Morgan (1926) and Wilhelm Johannsen (1909) established that heredity is the passing of genes between generations. Thereafter genetics proceeded independently of development. The purpose of this work is not to challenge this history, but to move toward studying scientific practice. Philosophers of science neglected a large portion of scientific practice in relation to the cleavage between heredity and development. To explore the scientific practices in which knowledge of heredity was materially entrenched and the philosophical consequences of this move we take as reference the work of Ian Hacking (1983) and the research project into the “cultural history of heredity”

(Müller-Wille and Rheinberger, 2012). The shift from theory to practice allows to understand the role of experimental intervention in the possibilities and constraints of the biological knowledge. We discuss three research strategies of classical genetics that created an incompatibility with the ontogenetic development: particulate inheritance model; population as locus for genetics research; and experimental tools that have been applied to remove "non-heritable fluctuations" from ontogenetic and environmental effects. These research strategies were carried out by practices of hybridization, artificial selection and establishment of pure lines and model organisms. The presence of genes was inferred by experimental manipulation of phenotypes and the notion of the gene as a "difference maker" was a consequence of these experimental practices (Sapp, 2003). But a gene was taken not only to be a difference maker: it was also assumed to be a trait maker independently of development (Keller, 2010). The scientific practices discussed have contributed to the strength of the genetic inheritance, but also excluded the ontogenetic development from the explanation of heredity and evolution. The relation between evolution and development was strongly affected by the cleavage between heredity and development (Amundson, 2005).

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Scientific illustration in early Modern Science and its Impact on the Investigation of the natural world

Marina Clasen Baumann (Department of Ecology and Zoology, Federal University of Santa Catarina, Brazil, marinaclasen21@gmail.com)

The relationship between art and science in the Renaissance is a rarely explored subject, in the context of Modern Science conception. For instance, recent surveys of early Modern Science neither consider the role of visual representation nor include figures in their narratives (BALDASSO, 2006). Rudwick, in his work The emergence of a visual language for geological science (1976), considers that due to the inexistence of an intellectual tradition considering the visual communication as essential for a historical analysis and understanding of the scientific knowledge, the role of images and the visual reasoning in the history of science is undervalued (RUDWICK apud COSTA, 2006). According to Eisenstein (1998), significant events for the development of natural science between the 15th and 17th centuries, although often forgotten or underestimated, were the improvement and spread of image printing methods, as well as the possibility of exactly reproducing graphic manifestations. From the 1st to the 14th centuries, natural history illustrations, before the improvements in woodcut and copper plate techniques, suffered an important decrease of accuracy and definition, as they were exhaustively copied in monasteries, by the copyists (MAGEE, 2009). Another decisive event was the development of perspective, by León Battista Alberti, in 1435, that is to say, the grammar of objects spatial representation in two dimensions (IVINS, 1975). Based on the writings of Ivins (1973), it was in the Renaissance that images started being considered an effective means of expressing scientific knowledge, through a process of vision rationalizing. For this, a direct correspondence between the real world and its visual representation was established. The real became, at this moment, visually demonstrable, which has definitely changed the image role. The evolution of image printing techniques was fundamental for this process, as well as the perspective techniques, which ensured image accuracy. It was through the invention of the printing press, woodcut, copper plate and perspective techniques that Scientific Illustration has fully developed. In turn, as reported by Smith (2006), artistic observation and representation, in the 15th and 16th centuries, were essential for the development of empirical science. Therefore, Scientific Illustration is rather a means of investigation and comprehension of the natural world than a mere visual practice.

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Louis Agassiz's conceptions on the origin of species and his criticisms on Charles Darwin's proposal (1859-1874)

Pedrita Fernanda Donda (Department of Biology, FFCLRP, University of São Paulo, pedritadonda@gmail.com) and Lilian Al-Chueyr Pereira Martins (Department of Biology, FFCLRP, University of São Paulo; lacpm@ffclrp.usp.br)

The Swiss Louis Rodolphe Agassiz (1807-1873) mainly devoted himself to the study of zoology and palaeontology. Although he had provided relevant contributions to Charles Darwin's evolutionary proposal, such as the presence of intermediate forms in the fossil record, Agassiz was a strong opponent to his work considering it as a conjecture. He commented: "Darwin's theory, like all other attempts to explain the origin of life, is thus merely conjectural. I believe he has not even made the best possible conjecture in the present state of our knowledge". The aim of this presentation is to describe Agassiz's conceptions on the origin of species as well as his main criticisms on Darwin's evolutionary proposal in Origin of species (1859). This study leads to the conclusion that, starting from his palaeontological studies, Agassiz was far from the theory of transmutation proposed by Darwin. He considered that Darwin's proposal was not in accord with the palaeontological record. In his view, the whole history of geological succession showed that the lower structures were not necessarily the first in time, neither in vertebrates nor in any other type. What he called the prophetic and synthetic types would have accompanied the introduction of all the primary divisions of the animal kingdom. Agassiz

accepted the existence of embryonic types that were "individuals who never rise, even in their adult state, above those conditions which in higher structures are but the prelude to the adult state". In addition, he believed that a wide variety of types existed from the beginning. Moreover, he admitted the existence of the intervention of an intellectual power in nature diversity because he did not find evidence of other causes. He was aware that the most advanced Darwinians seemed reluctant to recognize this intervention considering it as being unscientific. He also advocated a kind of orthogenesis.

Posters on Philosophy of Biology

The functional language of Neuroethology

Andrea Soledad Olmos (Faculty of Philosophy and Literature, University of Buenos Aires, Argentina, andreaolmos90@gmail.com)

It is often said that the rise of modern science has involved the exclusion of final Aristotelian causes from both scientific vocabulary and explanations. Supposedly, since the scientific revolution of the sixteenth and seventeenth centuries, teleological language that appeals to purposes, objectives or ends in nature has been discarded, and natural phenomena can no longer be legitimately explained with recourse to it. However, apparently teleological language has remained present in various areas of science, particularly in biology. One of the concepts whose legitimacy has preoccupied philosophers the most is the biological concept of "function". The philosophical concern with this concept has given rise to several accounts that attempt to explicate its meaning, explanatory role and legitimacy within biological sciences. In this context, my presentation will address the task of explicating the functional language of a particular biological discipline: Neuroethology (also known as the Neurobiology of Behavior). Within this discipline, the meaning of functional terms is intrinsically related to the history of the discipline itself, and to the way in which it historically addresses its subject. Indeed, since the origins of classical ethology, it has been generally considered that the biological study of behavior must answer four fundamental questions about behavior: (i) what is the mechanism that produces it? (ii) What is its developmental history or ontogeny? (iii) What is its adaptive value or function? And (iv) what is its evolutionary history or phylogeny? Neuroethology inserts in this tradition by attempting to recognize the mechanisms that control behavior, particularly its neural bases. In this presentation, I will show the diversity of uses of the concept of function, and the roles it plays in research and explanation, in a particular case study of this discipline, namely, acoustic communication in the European field cricket (*Gryllus campestris* and *Grillus bimaculatus*).

The role of non-epistemic values in accepting ecological theories

Breno Pascal de Lacerda Brito (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE). Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, brenoplbrito@yahoo.com.br)

This paper aims at evaluating the role that values play in accepting ecological theory. Philosophers and sociologists of science have debated about the influence of values on scientific practice, and the consequences of that influence. This debate analyzes what values should be associated with theories, beyond empirical adequacy, and how these values are related to theories themselves and scientific practice. When we analyze these questions in Ecology, we can see that the debate encompasses two main aspects: if the use of non-epistemic values limits the objectivity of science; and if these values are important to consider for the application of ecological theories to environmental management. When we consider that non-epistemic values can play a relevant role in the acceptance of scientific models, we are not attacking the objectivity of scientific practice, but rather being more critical about the issues surrounding this practice. Doing so would make the understanding of scientific practice more conscious and critical about its limitations. Same authors who defends this kind of vision, also claims that given the impossibility of reaching the amount of data necessary to be sure about the empirical adequacy of any theory, it is advisable to make use of the precautionary principle in accepting theories. That is, given the possible lack of knowledge about the consequences of a given theory, it would be more correct not to accept it, than to accept it and have to deal with unforeseen consequences. Another authors disagrees on this point, and among them we can highlight Hugh Lacey, who presents us a robust model of scientific practice. He argues that non-epistemic values are highly important in scientific practice, but not in the process of theory acceptance, where only epistemic values should operate. Although Lacey's model is able to point out that the argument for the use of non-

epistemic values mostly confuses acceptance and application, I should point out an error in his model when he considers the acceptance process. The error is to consider that the analysis of the use of values occurs at the level of the theory and not the level of the epistemic agent. Some epistemologists when analyzing the question of acceptance of scientific theories argue that the analysis of the importance of values at the level of the theory itself is ineligible. That is because it is virtually impossible to measure how much each value weighs on each theory, much less on rival theories. Based on this, I propose a updating of Lacey's model. The model must consider that acceptance, as a second-level epistemic process, occurs at the level of the epistemic agent, and depends on its understanding of the theory and the associated values to allow this understanding. From this point on, we can take into account the processes that involve the understanding of a theory, and values that guarantee the autonomy of the scientist in this process. In this way, we can have the Lacey model, integrated with a more secure view of the particularities of acceptance process.

The Nature of Change in Evolutionary Biology: Extended Evolutionary Synthesis?

Claudio Ricardo Martins dos Reis (Graduate Studies Program in Philosophy, Federal University of Rio Grande do Sul (UFRGS), Brazil, claudiormreis@gmail.com) and Leonardo Augusto Luvison Araújo (Graduate Studies Program in Education, Federal University of Rio Grande do Sul (UFRGS), Brazil, leonardo_luvison@hotmail.com)

The so-called "Modern Synthesis" (MS) was developed from 1920 to 1950. It provides a framework for several theories in biological sciences. Instead of being considered a "theory of evolution", the MS is better understood as a "research strategy" (Lacey, 1999), a "research tradition" (Laudan, 1977), or a "paradigm" (Kuhn, 1970) for conducting basic studies on evolution. All scientific research is conducted according to an interpretive framework, which guides the investigation and directs the questions to be posed. This interpretive framework establishes the relevant types of empirical data, the descriptive categories appropriate to the observational reports, and the kinds of theories that will come into contact with these data. The MS proved to be efficient in this role; however, researchers in evolutionary biology have criticized it from its initial formulation until now (see Pigliucci & Müller, 2010; Laland et al., 2015).

Müller & Pigliucci (2010) highlight three general positions regarding contemporary evolutionary biology: (1) “nothing substantially new”: no change in the traditional framework is required and, hence, substantial changes to or “extension” of evolutionary thinking is superfluous; (2) “extended evolutionary synthesis”: changes should currently take place as an extension of the framework of the MS; (3) “more changes are needed”: the present challenges to the MS are so substantial that no reconciliation is possible at all: the classical framework must be drastically modified in light of new concepts. These meta-scientific claims combine description and prescription to capture the current stage of evolutionary biology as well certain ways of doing science that are more promising.

Positions 2 and 3 presuppose that the MS may stop being the current paradigm of evolutionary biology and, thus, imply a paradigm shift. Position 3 advocates a paradigm distinct and incompatible with MS, while position 2 supports a wider paradigm than MS by advocating an “extended evolutionary synthesis” (EES).

In this work, we will defend two main theses:

(i) Despite declaring itself an “extension” of the MS, EES reinterprets evolutionary processes by reformulating its conceptual network and denying some assumptions of the MS; therefore, the difference between the EES and the MS should not be understood as a set-subset relation.

(ii) Despite declaring itself a new “synthesis”, the EES leads to a pluralism of strategies in evolutionary biology; if the MS can be understood as overly restricted, the EES should not even be understood as a synthesis, but rather as a broad and plural theoretical framework that combines different approaches.

Therefore, the use of the term “Extended Evolutionary Synthesis” is not adequate to express the changes proposed to the study of evolutionary biology. Its use is better explained by its ends: convincing the scientific community.

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A critique of Norton's anthropocentric approach to sustainability: Linking intrinsic value to an organizational approach to functional ascriptions

Felipe Rebelo Gomes Lima (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE). Graduate Studies Program in Biology and Biomonitoring of Federal University of Bahia, felipelimabio@gmail.com) and Nei Nunes-Neto (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), nunesneto@gmail.com)

Sustainable development is a largely used concept, but it is also largely contested. In its early years, it was commonly expressed in academic circles the fear that this concept would become nothing more than a shibbolet, an oxymoron, in face of its conceptual vagueness. Nowadays, a coherent, pragmatic philosophy developed by Norton gave an operational meaning to this idea and - contradicting such previous forecasts - resignified its most used definition: "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". However, Norton's approach to sustainable development is anthropocentric, in the sense that it prescribes that the final concern to environment management should be the extent of human communities lives, in biological and cultural senses, so that humans should manage their environments to their own ends. This idea departs from most conceptions in environmental ethics about human/nature relationship, which, in a non-anthropocentric way, prescribes that various processes and beings of nature, such as animals, organisms and ecosystems, should be considered directly in our moral actions and not just as means to an external end. This idea is commonly expressed by the expansion of the Kantian concept of intrinsic value, i.e., the idea that a thing can have intrinsic value, a value by itself, which cannot be fully evaluated instrumentally. So, for non-anthropocentrists, the environment should be considered as one of the ends of our actions and should not just be managed (as instruments) to humans ends. To justify his anthropocentric philosophy, Norton refuses to accept that intrinsic value can play an important role to environmental management. According to him, this is a polysemous concept that ranges from strong ontological statements (that nature has an objective value, independent from valuers) to more subtle ones (where all values are subjective and intrinsic is the value that remains when all instrumental values ascribed were drained out). Whereas Norton rejects the objective notions of intrinsic value, pointing out the difficulties of recognizing independent values in nature, he is also suspect of the subjective uses of this concept, because of their appeal to idiosyncratic feelings, which are too imprecise to give good reasons to generate consensus around environmental problems. Moreover, because of the ethereal nature of subjective intrinsic values, he argues that this kind of value tends to separate scientific knowledge from evaluative claims, making it difficult social learning about environment and its characteristics. This paper critiques Norton's anthropocentric approach to sustainable development and indicates alternatives to a non-anthropocentric concept of sustainability that grounds, at least in part, intrinsic value on biological properties through an organizational approach to functional ascriptions in biology. The organizational approaches are kinds of philosophical inquiries that intends to give explanations for two classical problems about functional ascriptions: the notions of teleology and normativity in discourses about function. Through the explorations of these two notions, we intend to discuss possibilities and challenges to the recognition of intrinsic values for organisms, ecosystems and social-ecological systems, mobilizing both scientific knowledge and ethical values.

Edward O. Wilson and human social behavior: A comparative review between On Human Nature *and* The Social Conquest of Earth

Lívia Maria Santos Assunção (Graduate Studies Program in History, Philosophy, and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil. History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), liviamaria.sa@hotmail.com), Mark Borrello (Program in History of Science and Technology, Department of Ecology, Evolution and Behavior, University of Minnesota, USA, borrello@umn.edu) and Juanma Sánchez Arteaga (Institute of

Humanities, Arts and Sciences (IHAC)/ Universidade Federal da Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), juanma.ufba@gmail)

The nature of the human condition is one of the most investigated topics in the humanities and social sciences. In the early 1970s, Edward O. Wilson argued that, in order to give an appropriate description of the human nature, evolutionary biology could not be neglected, as he considered the social sciences were doing. In 1978 Wilson's decision to include evolutionary biology into the analysis of social behavior resulted in the publication of the book *On Human Nature*. In this work, Wilson expanded his ideas on the sociobiological foundations of human nature and focused on the role of genes in the determination of human behaviors. Wilson's second book on human social behavior, *The Social Conquest of Earth* (2012), reached the scientific community thirty years later, at the peak of the controversy about multilevel selection. Historically, both *On Human Nature* and *The Social Conquest of Earth* were notable works, which offered new contributions to an evolutionary approach to the study of human behavior. In this work, we compared these works considering three main topics which summarize the essential differences in Wilson's evolutionary thought between 1978 and 2012: (i) Wilson's changing views concerning the evolution of human sociality; (ii) changes in Wilson's ideas on the evolution of altruism; (iii) modifications in Wilson's view on group selection and multilevel selection. Our results suggest that one of the major differences between On Human Nature and The Social Conquest of Earth is the different approach to the role of multilevel selection as an evolutionary force. The scientific community has rejected the theory of group selection since the mid-1960s and Wilson was one of the major critics of this theory during that time. Now, group selection is considered by Wilson as the main process that led to the evolution of complex social behavior. At the same time, kin selection, which during the 1970s was considered by him as a significant evolutionary force in human evolution, became broadly rejected in his 2012 book. The core of the controversy over the work of Edward O. Wilson changed along the decades that separate the two books, from Wilson's biological determinist approach in On Human Nature to the debate on levels of selection in The Social Conquest of the Earth.

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An integrative and quantitative concept of complexity as a measure of sociality

Lucia Carvalho Neco (Graduate Studies Program in Experimental Psychology, University of São Paulo, Brazil, lucia.neco@hotmail.com), Nicolas Chaline (Department of Experimental Psychology, University of São Paulo, Brazil, nchaline@hotmail.fr) and Hilton Ferreira Japyassu (Department of Zoology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), japy.hilton@gmail.com)

Sociality encompasses a wide range of social phenotypes and kinds of complexity. In the book The Insect Societies, Edward O. Wilson proposes categories (or levels) of sociality that are presented as a landmark unification of terminology in the study of social behavior. Wilson's categories were based on the presence of reproductive division of labor, generation overlap and alloparental care, which restricted eusociality to some bees, ants, wasps and termites. Reevaluations of this proposal were put forward and recent authors have proposed to measure sociality quantitatively. These proposals stem from a debate over the characteristics that are important for the evolution of sociality and were mainly stimulated by the discovery, in many other species, of new sociality patterns that could not be fitted in any of the available categories. Indeed, quantitative metrics that take into account various characteristics of sociality that are not restricted to some social systems would constitute more useful tools for comparative studies of social behavior. The term "social complexity" is being used in the literature to encompass many characteristics of social behavior, but it is frequently undefined. Even though it is intended as a general term, much of the literature mentioning social complexity is restricted to vertebrates and to characteristics such as boundedness, intelligence or culture, which are hardly applicable along the overall range of social animals. Here, we are advocating for a more integrative view of social complexity, taking as a point of departure Freeberg, Dunbar and Ord's (2012) work, in which social complexity is defined in terms of the interacting individuals that compose the social system, the differentiation between those individuals (social roles), and how they are organized in the social system according to the nature and diversity of their interactions. Considering that social interactions are a unifying characteristic that seems to be shared by all social systems, and that many additional characteristics are based upon these interactions, this work proposes the development of a quantitative and multidimensional metric of sociality based on the interactions between individuals of the social system. The kind of interactions considered can include simple proximity relations, or other simple interactions such as engaging collectively in one same activity, and in this way the metric allows the comparison of social complexity over a disparity of social systems, both between and within species. In that way, we can investigate interindividual interactions within different social contexts, evaluating the group attributes that emerge from these interactions, such as group cohesion, compartmentalization and stability. These social attributes describe social complexity and can be used to raise questions about the mechanisms responsible for the social behavior.

An organicist perspective to the Philosophy of Science
Luiz Felipe Reversi (Graduate Studies Program in Science Education, Faculty of Sciences, São Paulo State University "Julio de Mesquita Filho" (UNESP), Brazil, felipe.reversi@fc.unesp.br), Kelly Regina Silva (Graduate Studies Program in Science Education, Faculty of Sciences, São Paulo State University "Julio de Mesquita Filho" (UNESP), Brazil, hzf666@live.com) and João José Caluzi (Department of Physics, Faculty of Sciences, São Paulo State University "Julio de Mesquita Filho" (UNESP), Brazil, caluzi@fc.unesp.br)

The Epistemology of Biology was settled late as a subarea of the Philosophy of Science, especially if compared to the epistemology of other Natural Sciences like Physics. And the Philosophy of Science was, in general, structured from the epistemological and historical analysis of physics, and thus, have kept some of its philosophical positions, such as determinism and reductionism. Therefore, those principles were aplied in the characterization of Science as a whole, including biological sciences, although some sicentists and epistemologists, such as the evolutionary biologist Erns Mayr, have highlighted that such principles are inadequate to the characterization of the biological thought. Mayr describes in his book *What makes biology unique?* the reasons that lead him to consider biology as a single and autonomous science, since it has several specific concepts or principles, thus requiring a specific philosophy for biology, which differs from the philosophy of science, since, according to him, the latter would be more closely related to physics. An example of this is the fact that historically the leading philosophers of science have a background or formation in physics or mathematics, among which we can cite Thomas Kuhn, Karl Popper, Imre Lakatos and Paul Feyerabend. As stated by Mayr, visions of the Philosophy of Science based on epistemological assumptions of the Physical and Mathematical Sciences may present inherent epistemological obstacles to the understanding of the real complexity of Scientific Development. In this sense, agreeing with Mayr, however seeking to go a little further, we aim to discuss the epistemological principles that makes biology unique - which may be expressed by a organicist approach – and how can these principles contribute to a more accurate and comprehensive Philosophy of Science. Therefore, we propose the elaboration of an approach to the Philosophy of Science based on the epistemological assumptions of Biology – expressed by an organicist perspective, such as conceived by the Theoretical Biology Club, which rejects mechanism, reductionism as well as vitalist metaphysics. This perspective could represent a more comprehensive approach to the characterization of Scientific Development, including the new emerging perspectives in Physics, such as Systemic Theory and Complex Systems without giving up material and non-teleological bases, unlike Fritjof Capra, who included mysticism and metaphysics in his interpretation of contemporary physics.

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Photomicrography as a method of visual representation in science: A discussion about objectivity in photomicrography from the standpoint of Robert Koch's contribution

Marcelo Silva de Carvalho Delfino (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil, delfinomarcelo1@gmail.com) and Breno Pascal Lacerda Brito (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE). Graduate Studies Program in

History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil,
brenoplbrito@yahoo.com.br)

Developed in the 1830s, photography revolutionized visual representation in science, reshaping the view of naturalists, and being an important part in the resignification of the concept of objectivity. Visual representation, historically made through drawings and engravings up to the early nineteenth century, had in its early stages the naturalist/observer at the central position of this process - his expertise and experience were synonymous with quality and objectivity in the representation of the natural world. Throughout the nineteenth century objectivity, once understood in an idealized way - the more 'perfect' representation, the more objective - was replaced by a self-regulating neutrality trend of the scientist, with visual representation now based on rigid observation protocols to seek greater objectivity (Daston & Galison, 2010).

Photomicrography emerged early in the photographic era, with important implications for the medical and biological areas. There was, however, resistance from the scientific community to its acceptance as a method of visual representation, due to the peculiarities of this process at that time. The loss of visual quality compared to both the color based and schematic drawings, and the difficulties of direct observation in the laboratory were notorious in photomicrography, which brought black and white images, without depth and focused on a single plane. Moreover, human interference in microscopic preparations and technical adjustments of light and microscope questioned the impersonality of the method (Breidbach, 2002). These factors were only a few of the barriers to be overcome for complete understanding and acceptance of the technique, and for that it was necessary to structure a culture: photographic recognition, where scientists should learn to identify and establish reliable parameters for photomicrography to result triumphant.

Robert Koch was a German doctor who in the 19th century presented unparalleled contributions to the use of photomicrography in science. Koch brought greater reflections about the method, making photomicrography a necessary tool for the study of bacteria, through works that first confidently related certain bacteria with pathologies (Breidbach, 2002). Among them are cholera, anthrax and tuberculosis. In Koch's work, the functional representation of microorganisms - the production of evidence in favor of the causal role of bacteria in pathologies - was inseparable from their visual representation. Such inseparability arose because photomicrography was the method by which Koch could submit his observations to the critique of the scientific community, making his point of view defensible and eventually accepted (Schlich, 2000). Koch used photomicrography to validate the relation between shape and disease, until then discarded in the scientific milieu, being attributed to him, along with Louis Pasteur, the credit for the Theory of Germs.

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Why ELSI research would benefit from (more) philosophy of science

Simon Lohse (Centre for Ethics and Law in the Life Sciences & Institute of Philosophy, Leibniz Universitaet Hannover, Germany, lohse@ww.uni-hannover.de) and Thomas Reydon (Centre for Ethics and Law in the Life Sciences & Institute of Philosophy, Leibniz Universitaet Hannover, Germany, reydon@ww.uni-hannover.de)

Research on the Ethical, Legal and Social Issues ("ELSI research") of biomedicine is a thriving field, comprising the normative investigation of genomics, stem cells research and many other areas of biomedical science. While this kind of multidisciplinary ELSI research that integrates ethics, law, and sociology has been very successful, we believe that it would benefit from the integration of yet another discipline, namely philosophy of science.

This assessment is based on the following three claims:

(1) A number of fundamental normative questions that are relevant for biomedical research do not only have ethical, legal and/or social aspects, but are highly dependent on epistemological and ontological issues.

(2) These issues have not yet been addressed adequately in the context of ELSI research.

(3) Philosophy of science is the go-to-discipline for epistemological and ontological aspects of biomedical science.

In our poster presentation, we will illustrate and support these claims by way of two examples:

a) ELSI research on animal experiments in biomedicine has traditionally focused on the normative status of animals, the legitimacy of using animals in biomedical research and on echoing the 3R-principle ("refine, reduce, replace"). Although these are important topics, the respective discussions are usually quite detached from actual research in biomedicine. At the same time, two (connected) practices of biomedical research that are absolutely central to the normative assessment of animal experimentation have been neglected. Both have a salient epistemological aspect that bears on the normative assessment of animal experiments: First, the practice of severity assessment of animal harm is in many cases based on dubious epistemological assumptions concerning the observation of animal pain. Second, the practice of harm-benefit-analysis in animal experimentation seems to presuppose highly controversial assumptions concerning the feasibility of balancing harms and (often uncertain) scientific benefits in a quantifiable manner. In both cases a clarifying philosophy of science analysis of the relevant issues will show to be highly valuable for ELSI research.

b) For more than a decade, biomedical scientists have been able to create human/animal-chimeras by the introduction of human pluripotent stem cells into non-human animals. ELSI research in the context of chimera production has focused on normative questions such as: Should the production of chimeras be prohibited, as the existence of human/animal-chimeras will lead to the erosion of species boundaries and moral confusion? Pertinent ELSI discussions have, in many cases, been based on oversimplified ontological assumptions concerning the nature of biological species, macro-organisms, etc., leading to a gap between biomedical research and ELSI research, as the normative assessments are disconnected from the actual scientific understanding of such issues as species boundaries or the identity conditions of macro-organisms. We will show that the relevant discussions in the philosophy of the life sciences have much to offer to remedy this situation.

The takeaway point of our poster is, that ethical, legal and social aspects of biomedical research are much more dependent on epistemological and ontological questions than is often acknowledged. Hence, ELSI research would benefit from more interaction with, and even integration of, philosophy of science.

What Biology is all about: Expanding the commognitive approach by examining Biology as a discourse

Vanessa Carvalho dos Santos (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE). Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, carvalho.st@gmail.com) and Jonei Cerqueira Barbosa (Faculty of Education, Federal University of Bahia, Brazil, jonei.cerqueira@ufba.br)

This paper presents the commognitive approach as a theoretical framework for the study of the features of biology, conceived as a discourse, and for investigating the development of biological thinking, viewed as a discursive change, in both history and individual learning. In particular, we begin to specify here what makes biological discourse distinct from others. The mentioned approach is called commognitive because of its foundation on the basic tenet that thinking is an individualized version of interpersonal communication. The commognitive framework has been developed by Anna Sfard, from the University of Haifa, who was mainly inspired by the works of Wittgenstein and Vygotsky. Using the so-called participationist lens, Sfard hopes to contribute to the understanding of the growth of thinking by using the case of mathematics as an example. Her understanding offers insights for the entire fabric of human development and of what it means to be human. Therefore, despite its origins in the domains of mathematics education and the learning sciences, the commognitive approach offers a theoretical view with wider implications, addressing not only issues about teaching and learning. As it takes a theoretical direction in favor of discursivity as the hallmark of our humaneness, i.e., as it assumes that all our activities are purely communicational in nature or are pervaded with and organized by communication, one of its immediate entailments is the claim that not only mathematics, but also all practices, such as what we acknowledge as biology, can admittedly be defined as discourses. According to Sfard, the word discourse refers to a specific type of communication, which is identifiable by its word use, visual mediators, routines, and the narratives it produces. Biology, as a discourse, has these interrelated features: its specific words, for instance, animal, life, gene, evolution, and so forth, used in distinctly biological ways; its visual mediators, such as pictures of biological

phenomena, phylogenetic trees, cell models, biochemical diagrams, genetic symbols as “Aa”; its distinctive routines, i.e., regularities in the performance of tasks by discourse participants; and its generally endorsed narratives, such as theories. In our preliminary application of the commognitive framework to understand biology, we attend to these directly observable properties to better define the idea of biological communication. As we argue, the phenomena observed by biologists are not what biological discourse is all about. Rather, these tangible, perceptually accessible material entities should be seen as discourse mediators that are used in narratives and routines to create biological objects, which are therefore discursive constructs. The latter are the so-called models which are ultimately what biology is all about. Specifying them is a task which we cannot do without scrutinizing the kinds of mediators of this discursive practice. The phenomena observed by biologists should not be considered as free of any communication as well. Despite the possible question about whether there are ‘things in themselves’, the phenomena already come before us as discursive, since we only perceive them as signs of objects engendered by other discourses in which we participate, for instance, the colloquial discourse.

Occupational therapy and alternative treatment in relation to disorders of the psyche

Victor Hugo Oliveira (Graduate Studies Program in Education, Fluminense Federal University, Brazil, victor.gotico@bol.com.br)

The objective of this proposal is to elucidate the importance of aesthetic education in the cognitive development of people with intellectual disability and psychiatric disorders, as an alternative method to the treatment of electroshock for patients in psychiatric hospitals. This is the research part of a project that existed in Rio de Janeiro, from the Nucleus of Culture Science and Health (NCCS), between 2012 and 2016. During the 1950s and 1960s it was common to use sedatives and electroshocks as a means of calming patients in psychiatric hospitals. In that context, the Brazilian psychiatrist Nilse da Silveira criticized the violent method to which the patients of psychiatric hospitals were submitted. By conducting joint studies with psychotherapist Carl Gustav Jung, he concluded that the visual, sonic, and tactile stimulation brought about by aesthetic education stimulates the cognitive development of the disabled person and causes them to have less disorders than when undergoing shock treatments. From the work of Nilse da Silveira, this article seeks to understand its legacy for the treatment of people with psychiatric disorders such as schizophrenia, bipolar disorder and mental retardation and the contribution of play and cultural activities as an alternative to sedative treatment. In order to deal with this legacy, the research addresses the work of an experiment that occurred recently, between 2012 and 2016. An experimental project, known as "Hospital of madness", was elaborated in the city of Rio de Janeiro, at the Nilse da Silveira Psychiatric Hospital (former Dom Pedro II Psychiatric Hospital), by actor and psychiatrist Vitor Pordeus in which his patients were not medicated with sedatives. Instead of the use of medicines, patients exercised various activities of entertainment and culture related to the exercise of theater and painting. Of the inmates diagnosed with mental retardation and schizophrenia, all did not use sedatives or remedies and had developmental levels faster than inpatients in other hospitals with sedative and controlled drug treatment. In view of this experimental research, it is verified that education and the exercise of the senses through artistic activities contribute to the stimulation of cognition through play activities. Therefore, aesthetic education and play activities have therapeutic properties that may represent new perspectives in the medical treatment of people with psychiatric disorders, insofar as the use of sedatives or therapeutic remedies is not necessary. Therefore, it is important to emphasize that culture is also necessary for mental health treatment issues because disorders such as bipolar disorder, schizophrenia and even Alzheimer's disease are attenuated through socialization promoted by the development of play activities. Besides these elements, the treatments made through play activities contribute to the construction of new research fields in relation to psychiatric treatment, through the interdisciplinary relationship between culture and medicine.

TUESDAY JULY 18
09:00-10:30 – Parallel sessions 4

ORGANIZED SESSION STANDARD TALKS – AG-ZOO
Weldon's Legacy Revisited: From an Integrated Historical and Philosophical Perspective

Org. and chair of the session: Yafeng Shan (Department of Philosophy, Durham University, UK, yafeng.shan@durham.ac.uk)

The significance of W.F.R. Weldon in the history of genetics is, to a great extent, still underrated. Much of Weldon's work (especially his unpublished book) is yet to be explored and articulated. This session aims to reexamine Weldon's work and explore its implications to the history and philosophy of biology.

In the talk 1, Pence will provide a systematic reconstruction of Weldon's work on a synthesis of Galtonian and Mendelian ideas. In the talk 2, Radick will explore the differences between Weldon and Pearson's visions on biometry, and examine how, on Weldon's side, they made for a biometric ideal with room for experimentation, the postulation of unobservable entities, ambitiously causal explanations, and other elements that would not survive into posterity's idea of "biometry." In the talk 3, Shan will aim to discuss the philosophical implication of the Mendelian-Biometrician controversy to the problem of choice in science.

Papers:

Syntheses that weren't: W.F.R. Weldon's abandoned 'synthesis' of Biometry and Mendelism

Charles H. Pence (Department of Philosophy, Louisiana State University, USA, charles@charlespence.net)

As the standard story goes, the debate between the biometricians and Mendelians, spanning roughly 1892 to 1907, pits Francis Galton, Karl Pearson, and W.F.R. Weldon against William Bateson and a steadily growing cast of converts, including Darbishire, Shuster, Yule, Shull, and Pearl. The debate ends, we are often told (e.g., by Provine 1971), when Weldon's death drives Pearson away from the study of evolution entirely, leaving the Mendelians firmly holding the field. Thus is the state of affairs until the work of Fisher, Wright, and Pearson starting in the late 1920s, which fully synthesizes the statistical picture of population change with.

But this is not the whole story. Several scholars have drawn our attention to proto-syntheses, such as those of George Udny Yule (cf. Tabery 2004). Another such proto-synthesis was, in fact, under preparation by Weldon himself at the time of his death. The details of this work, while reconstructed by Pearson in 1908, still remain poorly understood. I will endeavor to offer a reconstruction of Weldon's work here, working from an archival study of Weldon's notes, Pearson's reconstruction, a reconstruction by Bernard Norton (1979), and unpublished work of Gregory Radick.

Biometry without Positivism: The means and ends of Weldon's mathematized Biology

Gregory Radick (School of Philosophy, Religion and History of Science, University of Leeds, UK, G.M.Radick@leeds.ac.uk)

Along with his collaborator and friend, the UCL mathematician Karl Pearson, W. F. R. Weldon in 1901 became founder and co-editor of the journal BIOMETRIKA, dedicated to "the statistical study of biological problems." Despite their hopes for the new science, over time it acquired a reputation for unilluminating, measurement-for-measurement's-sake empiricism -- a reputation only encouraged by the science's close identification with the long-lived Pearson and his influential, austerely positivist philosophy of science. But Weldon's vision for biometry was very different from Pearson's, for reasons stemming from the two men's very different intellectual, professional and personal trajectories up the point where they joined forces in the 1890s (as admirers of Francis Galton's 1889 book NATURAL INHERITANCE). In this talk I want to explore those differences and how, on Weldon's side, they made for a biometric ideal with room for experimentation, the postulation of unobservable entities, ambitiously causal explanations, and other elements that would not survive into posterity's idea of "biometry."

Choice in the Mendelian-Biometrician controversy: Why Weldon was not a Mendelian

Yafeng Shan (Department of Philosophy, Durham University, UK, yafeng.shan@durham.ac.uk)

Choice in the Mendelian-Biometrician Controversy: Why Weldon was not a Mendelian

The Mendelian-Biometrician controversy is not a typical case concerning choice in science (or, theory-choice). What was at issues was never whether the Mendelian theory or the Biometrician theory should be favourable. Rather it was to some extent a debate on the significance of the Mendelian theory in the study of heredity. William Bateson, the leading figure of the Mendelians, contended that Mendel's work would be the foundation of the study of heredity. In contrast, W.F.R. Weldon, as the pioneer of the Biometricians, though never tried to dismiss

Mendel's laws or its empirical findings, his position is clearly reflected by the title of his paper "Mendel's laws of alternative inheritance in peas." Weldon regarded Mendel's findings as a special case of alternative inheritance framed in the context of the Galtonian theory of heredity. Moreover, Weldon had begun a project to incorporate Mendelian ideas with the Galtonian framework. As Bernard Norton (1979) correctly points out, Weldon's opposition to Mendelism was based on a commitment to the Galtonian theory. This talk will aim to discuss the philosophical implication of the Mendelian-Biometrician controversy to the problem of choice in science. I shall review the debate between Bateson and Weldon. Then I shall show that this examination sheds some light on the problem of choice in science.

ORGANIZED SESSION STANDARD TALKS – CD-A1

From Biological Practice to Scientific Metaphysics: Prospects and Challenges

Org. and chair of the session: Alan C. Love (Department of Philosophy, University of Minnesota, USA, aclove@umn.edu)

Scientific metaphysics is based on the idea that metaphysics—the study of what the world is ultimately like—should be informed by the remarkable success of science. Opponents argue that the rejection of fundamental scientific claims through history undermines the assumption that science can provide a reliable basis for drawing metaphysical conclusions. A different approach analyzes successful scientific practices that depend on modest theoretical claims but nevertheless undergird advances across sciences that deal with complexity, especially in biology. This approach probes the metaphysical implications of stable forms of practice in situations where partial theories of complex phenomena do not yield comprehensive outlooks across different levels of organization. Our symposium examines three different areas of biology—ecology, experimental evolution, and molecular biotechnology—that span levels of organization and exhibit stable forms of successful individuation, modeling, and manipulation practices for complex phenomena. Baxter scrutinizes experimental practices in biotechnology and the use of "fine-grained influence" as a standard for selecting some causes as ontologically significant. She identifies a range of standard variation in biological systems and shows how technological changes to fine-grained influence can make actual what was once possible variation. Liu examines modeling practices in experimental evolution and distinguishes between using and building models. Instead of focusing on the fit of a simple model to complex phenomena, we see how building simple models helps biologists learn about complex phenomena (i.e., what modeling practices tell us about the real world). Dresow analyzes how the units "ecosystem" and "community" are used in ecological practices. Their actual role in successful research suggests very different answers to questions about the nature and reality of these "units."

Papers:

Changing the degree of fine-grained influence with biological technologies

Janella Baxter (University of Minnesota, jbaxter@umn.edu)

Fine-grained influence or INF-specificity is widely recognized as a criterion for singling out some causes from all other relevant causal conditions as explanatorily significant (Waters 2007; Woodward 2010; Griffiths et al. 2015; Weber forthcoming). The criterion for fine-grained influence not only provides a basis for causal selection, but also yields an intuitive way of estimating a causal variable's degree of causal or explanatory significance. A variable's degree of fine-grained influence is determined, in part, by its number of causal states that systematically pair with an effect state. However, biologists do not recognize all possible cause/effect pairings as genuinely illuminating or relevant to their domain of inquiry. Instead, they privilege pairings that are compatible with the processes of life in their domain of inquiry. For example, when estimating a gene's degree of fine-grained influence, some biologists only count gene variants that determine protein sequences that can participate and interact with metabolic processes. It turns out that a causal variable's degree of fine-grained influence can vary quite a bit depending on the biological system one is considering (Griffiths et al. 2015). For example, some types of human immunity-related genes have a great number of cause-effect pairings (Choy and Phipps 2010). By contrast, Drosophila's DSCAM gene has very few alternative gene variants, but has a rather large number of possible variants due to splicing (Celotto and Graveley 2001). This means what counts as an explanatorily significant cause depends on specific details related to the practices used to investigate biological systems. Even more significant, the range of what counts as compatible with the processes of life can be altered by biological technologies like the

CRISPR-Cas gene-editing system and orthogonal tRNA. These tools enable researchers to make life-sustaining cause/effect pairings that might not otherwise have existed. Thus, when biologists engineer new life-sustaining cause/effect pairs, they change a causal variable's degree of fine-grained influence. And, as a consequence, successful practices of experimental manipulation can change whether or not a cause is explanatorily significant.

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Uncovering the complex "real" world through simple models?

Katherine Liu (University of Minnesota, USA, liuxx971@umn.edu)

It is often assumed that scientific models are judged based on how well they fit the "real world." Though this goodness of fit only needs to obtain in some (specified) respects, a common mentality is that scientists should seek models that increasingly match the world's complex and diverse properties. However, in practice, scientists work with models that are intentionally simplified, and frequently it is the simplicity for which the models are praised. For example, simple models let researchers more easily isolate the signal from noise or more specifically manipulate individual causal factors. The goal of modeling in these cases is typically not articulated in terms of seeking a better fit with the real world. In order to understand these modeling practices and their significance, I use the successful modeling practices of experimental evolution to show how we learn about the real (complex) world from simple models. These practices have been praised for their simplicity because they allow researchers to tease apart complex causal processes in evolution and ecology that were previously difficult to study and understand. However, the simplicity also has led to some skepticism about whether they tell us anything about the real world (e.g., is that how evolution works "in the wild"?; see, e.g., Carpenter 1996). I argue that these criticisms are unwarranted and arise from misconceptions about the goals of experimental evolution. These practices are better understood as contributing to an enterprise of model-building as opposed to model-using. Once this distinction is in place, we get a better picture of how researchers use experimental evolution in laboratory settings to understand evolution in natural environments. This helps us begin to grasp how particular practices that rely on simple models are successful at uncovering the complex "real" world.

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Communities and ecosystems: The view from scientific practice

Max Dresow (University of Minnesota, USA, dreso004@umn.edu)

Recent work in philosophy of ecology has been characterized by a strenuous investigation of ecological theories and concepts, often to the neglect of ecological practice. (Formal modeling practice is a notable exception.) This orientation has given rise to a familiar program of research, the aim of which is to identify and articulate the basic theoretical concepts or fundamental units (e.g., niche, ecosystem, community) in a domain of inquiry (e.g., population ecology, community ecology). Common questions include: what is an ecological niche? are communities and ecosystems mind-independent objects (as opposed to mental constructs)? what are the necessary and sufficient conditions for ecological stability? These questions concentrate on the world that ecological theory 'sees,' and assume that an important function of philosophy is to identify the fundamental theoretical concepts and principles in a particular scientific discipline (Waters 2014). However, given the amount of ecological research that is seemingly unengaged with the project of testing and extending ecological theories, a potentially illuminating strategy is to ask what world (or worlds) ecological practice sees. I recommend this maneuver as a way of reinvigorating old debates about the nature and reality of ecological communities and ecosystems. My method in this talk will be historical. Throughout the 20th century, the concepts of “ecological community” and “ecosystem” functioned primarily to provide coherence to a diverse set of methods and approaches in the ecological sciences. Accordingly, their exact representational content was not of the essence. Nonetheless, these concepts underwrote a number of successful practices, which enabled ecologists to interrogate and learn about “the diversity of form and functioning of Earth’s physical and biological processes” (Chapin et al. 2011). I argue that by attending to these practices, significant light can be thrown on both the epistemic function of community and ecosystem concepts and the different kinds of (unexpected) metaphysical implications we might draw from them.

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ORGANIZED SESSION STANDARD TALKS – CD-A2

On the Evolutionary Debunking of Reasons and Morality

Org. and chair of the session: Alejandro Rosas (Philosophy Department, National University of Colombia, Bogotá-Colombia, arosasl@unal.edu.co)

Do we have justified reason to do anything at all? Skepticism about reasons gives a negative answer. Evolutionary explanations of value or reasons generally (Street 2006) or of moral values/reasons specifically (Joyce 2006), seem apt to debunk reasons of any sort. One way to save at least a small realm of value within evolutionary presuppositions is to defend that evolutionary explanations do not debunk selfish reasons. Reasons or values, as subjective or intersubjective realities, might well have evolved to promote fitness-enhancing behavior. If this is our view of their origin, the value of one’s own survival and flourishing can hardly be disputed. The problem is how to get to the universal validity of moral norms starting from the particular validity of egocentric values. The first paper proposes the notion that humans, as naturally social beings, need a social environment to promote their health and flourishing. And this gives each agent a reason to promote the flourishing of other persons.

But critically, reasons to promote the survival and flourishing of others might fall short of being moral, if they are instrumental to one's own welfare. The alternative is to promote the flourishing of others for their own sake, without abandoning self-interest. Basically, it means seeing oneself and others as members in a community of equals. Evolutionary anthropologists believe that human cooperation, from very early on, occurred within a community of equals, as in extant hunters and gatherers (Boehm 1999). Examples of such cooperation are also ubiquitous in our modern lives, from friendship and marriage to market interactions. Cooperation seems to be at the crux of social behavior: it is a special type of sociality that enhances the fitness of all agents involved. Nature abounds in examples of cooperation where all interacting organisms benefit equally and unilateral exploitation is absent (Connor 1995). But only among humans, cooperation has become a conscious and habitual goal of sociality. If morality facilitates cooperative interactions, then, perhaps, moral concepts should be understood as tracking cooperative facts, the reality of which cannot be reasonably doubted. This is the proposal of the second paper.

The third paper turns its back to the realism-antirealism debate regarding values or moral values and takes a look into our psychological constitution, as it probably underlies moral thought. It assumes that morality did not arise de novo, but emerged from the interaction between pre-existing psychological capacities; an evolutionary by-product, as it were, that proved adaptive in facilitating cooperative interactions in the small groups in which our ancestors lived. And because it proved adaptive, it was subsequently selected as an integrated multi-component mechanism. The paper explores how a sense of equality and fairness may have evolved in the context of the capacity to share intentions with others.

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Papers:

Can metaethical constructivism overcome the evolutionary debunking?

Jorge Oseguera Gamba (Philosophy Department, Florida State University, USA, joseguerag amba@fsu.edu)

A thought experiment will be presented to set up the problem posed by evolutionary debunking arguments in Metaethics. The thought experiment should lead to skepticism about reasons for action. I will analyze how two types of metaethical constructivism deal with this problem. Kantian constructivism, as developed by Christine Korsgaard, attempts to extract reasons for action from our nature as rational agents. Humean constructivism, as proposed by Sharon Street, suggests that we have to create a coherent network of our motivations in order to decide how to act. I will argue that both constructivisms fail to satisfactorily respond to the problem as posed by the thought experiment. The reasons that Kantian constructivism extracts from practical rationality—I will argue—are not warranted, which leads the Humean constructivist to offer an alternative. Nevertheless, even if the particular reasons for action advocated by Kantian constructivism cannot be derived from the nature of practical rationality, other reasons can be. If so, Humean constructivism looses its raison d'être. An essential part of practical rationality is means-end rationality, therefore, I will argue that independently of the ends we endorse we have a reason to procure the necessary conditions of our practical rationality, since is it is a necessary mean to achieve those ends. One of these necessary conditions is being alive, which gives us a reason to procure our own life. This also opens the door to other "duties to oneself," like physical and mental health. There can be objections to this way of justifying reasons for actions, which will lead to some modifications in order to address this worries, but the basic idea of how reasons to care for oneself are justified will remain untouched. This is not yet enough to justify moral reasons, but the fact that every rational agent can go through the same process to justify caring for oneself, plus the fact that we are social beings that cannot fully develop outside a society, give us a reason to procure other's necessary conditions for practical rationality, taking us to the moral domain, as I will argue. The result is a type of constructivism that presents advantages over the other constructivisms. The reasons for action are not unwarranted, as they are in Kantian constructivism; and it can respond to skepticism about our motivations, unlike the Humean constructivism.

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Evolutionary explanations and the Darwinian dilemma
Maximiliano Martínez (Universidad Autónoma Metropolitana, Mexico, D.F.,
mmartinez@correo.cua.uam.mx)

Debunking arguments against moral realism have been recurrent in the past decades (Ruse 1986; Joyce 2001; Street 2006). They are usually grouped into two types: the parsimony argument and the scientific argument. Street (2006) has combined them, arguing that the moral realist faces a dilemma: to choose between an implausible skeptical result and a scientifically implausible explanation. To avoid both horns of the dilemma, moral realism must be abandoned. Contra Street, my aim in this paper is to defend a realist explanation that can avoid the dilemma.

According to Street, the second horn involves an evolutionary explanation where our moral psychology tracks moral facts: “It is actually quite clear, the realist might say, how we should understand the relation between selective pressures and independent evaluative truths (…) we may understand these evolutionary causes as having tracked the truth” But, she continues, this explanation is implausible given an alternative, more plausible, evolutionary explanation that doesn’t postulate any tracking relation between our moral psychology and moral facts: “Tendencies to make certain kinds of evaluative judgements rather than others contributed to our ancestors’ reproductive success not because they constituted perceptions of independent evaluative truths, but rather because they forged adaptive links between our ancestors’ circumstances and their responses to those circumstances.” This explanation is simpler and has more empirical support, which makes it more plausible that the one based on the tracking relation.

My strategy is twofold: (1) To argue that there is a necessary relation between cooperation and morality and (2) to defend that our basic moral terms refer to cooperative facts. With regard to (1) it seems that morality is an efficient tool to promote cooperation: the function of morality is to foster and sustain cooperative interactions (Frank 1988; Gintis 2005; Haidt 2012; Greene, 2015). I'll claim that it is possible to identify a basic structure of cooperation, i.e. some facts and relations that are inherent in it. This takes me to (2): once we understand the necessary relationship between cooperation and morality, it is possible to argue that our moral terms refer to the basic features of cooperation. In other words, our moral terms correspond to cooperative facts. In my view, this evolutionary explanation is scientifically plausible: our moral terms are determined by cooperative facts that exist in nature and that are independent of our evaluative attitudes. Moreover, our moral cognition has evolved to track those cooperative facts.

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Shared intentionality co-evolves with a sense of fairness

Alejandro Rosas (Philosophy Department, National University of Colombia, Bogotá-Colombia, arosasl@unal.edu.co) and Juan P. Bermúdez (Philosophy Department, Universidad Externado de Colombia, juan.bermudez@uexternado.edu.co)

An evolutionary perspective on moral thought has provoked an intense meta-ethical debate regarding the debunking of moral values (Street 2006; Joyce 2006). Less effort has been expended on the ways in which an evolutionary perspective can shed light on the underlying cognitive structure of moral thought. We argue that shared intentionality is at the core of this structure. Shared intentionality is an ability that humans have developed beyond any other species (Tomasello & Carpenter 2007). It is crucial for joint action and cooperation. We assume that morality did not arise de novo, but is rather an adaptive output of the interaction among shared intentionality and other pre-existing psychological capacities.

We first briefly argue that shared intentionality is a precondition of moral thought: moral thought is impossible without understanding norms flexibly (subject to revision and modification) and understanding norms flexibly is impossible without shared intentionality. Therefore, moral thought presupposes shared intentionality.

In the rest of the paper we attempt to explain the way in which moral attitudes, judgments and expectations emerge from the interplay of shared intentionality and other psychological capacities. We circumscribe our exploration to the conditions sufficient for the emergence of an attitude of equality or fairness within the ability to share intentions. We take the view that morality is an evolved and adaptive psychological mechanism with several sub-components. It is possible that the sub-components fulfilled other functions long before morality emerged as a distinctive adaptive output of their interaction. Despite being thus by-product, the moral mechanism evolved with the function of boosting a wide spectrum of cooperative enterprises (Trivers 1971; Frank 1988; Fehr and Gächter 2002; Joyce 2006; Tomasello 2016). In cooperative contexts, shared intention and joint action had to include a shared rule of distribution of the costs and benefits of joint production. Assuming no one can be forced to join the cooperative enterprise and everyone's contribution is necessary, a distribution rule that all can accept and publicly share states that equal costs are to be compensated with equal benefits. Deviation from this criterion leads to the failure of joint action, unless the deviation is deceptively masked. In time, a disposition to moral equality and to punish deviators from the norm of equality evolves as the most reliable means to support cooperative interaction.

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ORGANIZED SESSION STANDARD TALKS – CD-A3
Contraceptive Controversies: Perspectives on Birth Control

Org.: Kate Grauvogel (Indiana University, Bloomington, USA, kgrauvog@indiana.edu)

The papers in this session on birth control and knowledge explore topics ranging from informed consent and drug-labeling to the potentially deadly side effects of various birth control methods, including the morning after pill. In particular, Chris ChoGlueck's paper examines the value of knowing the morning after pill's mechanisms of action. He cites Supreme Court cases and U.S. Food and Drug Administration documents to argue that the pill's mechanisms matter. Ashley Kennedy's talk addresses the roles that mechanistic reasoning and informed consent play in a woman's decision to take birth control. Finally, Kate Grauvogel focuses on the benefits and side effects of hormonal birth control in women and men, and the way in which the risks of these methods are communicated unevenly to women and men. Together, the papers in this session create a picture of some of the ethical and medical issues surrounding hormonal birth control, and tackle these issues by critically assessing the risks and benefits of birth control from philosophical and historical perspectives.

Chair of the session: Sophia Efstathiou (Department of Philosophy and Religious studies, Norwegian University of Science and Technology (NTNU), Norway, sophia.efstathiou@ntnu.no)

Papers:

Why 'how It works' has mattered: The values of knowing the morning-after pill's mechanism

Christopher ChoGlueck (Indiana University, Bloomington, USA, cglueck@indiana.edu)

Since the debut of the morning-after pill in the mid-1960s, how the drug works to prevent pregnancy (i.e., its mechanism of action) has remained a valuable piece of information. Interestingly, the value of this knowledge has differed for those with vastly different interests, namely (1) creating a safe and effective means of preventing pregnancy and (2) avoiding inhibitory action after fertilization, which some consider an abortion. Despite sustained scientific, medical, and societal interest in how it works, historians have not explored the role of mechanistic knowledge in the history of the morning-after pill.

Regarding the first of these interests, birth-control researchers and advocates have sought to develop drugs that work after ovulation to increase the safety and effectiveness of contraception. For instance, during early stages of research and development in the 1960s, American biologists such as Min Chueh Chang actively targeted fertilization and implantation. During the following two decades other researchers in Peru and Canada and at the World Health Organization used their knowledge of the mechanism to further refine morning-after pills.

In contrast, anti-abortion advocates, especially Roman Catholics, who consider post-fertilization action to be unethical, have eschewed and opposed the pill because of their understanding of its post-fertilization mechanism. Thus, unlike Chang, John Rock avoided research on how to inhibit implantation, and other Catholic physicians contested the emerging terminology in obstetrics and gynecology that did not define action after fertilization to be abortion. At Catholic hospitals in the U.S., physicians and bishops disputed the potential value of the morning-after pill as treatment for rape survivors because of their different evaluation of the risk to fertilized eggs. These two divergent sets of interests came into direct opposition during the pill's regulatory approval at the turn of the century. Contraceptive advocates in Chile designed studies to cast doubt on the post-fertilization potential of the pills to challenge anti-abortion resistance empirically. Unconvinced, anti-abortionists advocated for the importance of labeling the drugs per their possible mechanisms at the U.S. Food and Drug Administration, and this had widespread effects for health-insurance coverage because of the Burwell v. Hobby Lobby Supreme Court case in 2014.

In addition to the historical and historiographical import of accounting for these differing and sometimes competing interests in the mechanism, this narrative offers us philosophical insight into the ways in which values and interests manifest in medical research, development, treatment, and regulation. During different time periods, these two interests played a key role in whether researchers and physicians avoided or targeted implantation, how they defined and refined the pill, whether they provided it to patients, and how they engaged regulators and policy-makers. By tracing the various ways these two interests have materialized over the past half-century, we can better understand the role of abortion concerns in the history of this contraceptive, as well as the nuanced ways in which groups with different interests value knowledge differently.

Controversial contraceptives: Uncoupling the pill and social progress to assess risk

Kate Grauvogel (Indiana University, Bloomington, USA, kgrauvog@indiana.edu)

Although the dangers associated with hormonal contraceptives for women have been known since the FDA approved it in 1960, women who take contraceptives often do so without being fully aware of the potential health risks. Recently, a hormonal birth control shot developed for men received a lot of media attention because studies conducted in 2011 and 2012 showed that it was (perhaps) associated with an increase in depression and sterility in some men. The serious side effects of hormonal birth control for women include stroke, deep vein thrombosis, pulmonary embolisms, an increased risk of developing certain cancers, and depression. By comparison, hormonal birth control seems much safer for men than for women. It is important to alert everyone to the possible health risks associated with hormonal birth control, but the amount of media coverage the comparatively mild side-effects pose to men is not proportionate to actual risk, which is small. The inverse is true for women. Women who take hormonal birth control (potentially) risk their lives, but the Pill is often portrayed as a safe method for preventing pregnancy (and early warnings by activists like Barbara Seaman who published, The Doctor's Case Against the Pill (1969) did not receive enough attention).

This paper explores these asymmetric standards by analyzing the social environment in which hormonal birth control for women was developed and approved for use (1940-1960s), particularly the tensions that emerged between feminist groups who supported the Pill because it gave women greater control over sexual freedom and family planning and the researchers who warned of the deleterious side-effects of hormonal birth control. Focusing on these tensions will uncover some of the reasons why taking hormonal birth control despite the risk became a sign of freedom for women. Iconic feminist activists like Margaret Sanger and Mary Ware Dennett campaigned for hormonal birth control, and Katharine McCormick funded much of the Pill's research and development. The Pill not only represented a form of birth control, but also an important moment for feminists: the ability to prevent pregnancy could free women to enjoy sex without worrying about unplanned pregnancy, to pursue careers, and to have more control over the size and timing of their families.

I argue that while the social benefits of the pill tremendously benefited women, they eclipsed the health risks associated with the pill. Even today, critics of the pill's health risks often face hostility from feminists who associate criticism of the pill with criticism of social progress. Separating the social and the medical aspects of the Pill allows us to rethink hormonal birth control without inadvertently attacking feminism and positive social change for women. This approach invites more fruitful discussion of viable alternative methods of birth control for both men and women. Making birth control a human issue rather than a feminist issue might also finally end the disparity in perceived costs and benefits of taking hormonal birth control, making its use safe and more widespread in both women and men.

Panel discussion

ORGANIZED SESSION STANDARD TALKS – MINAS1

The Power of One: The Individual in Neuropsychology, Psychology, and Psychiatry

Org. and chair of the session: Rob Wilson (University of Alberta, Canada, rwilson.robert@gmail.com)

The aim of this symposium is to explore the role of the individual in biomedical psychology and psychiatry. Like any other science, biomedical psychology and psychiatry aims to discover general truths about, regularities in, the structures of the human mind and human behavior. Such general truths are the basis of explanation, prediction, and control. Yet for many reasons, those with a biomedical orientation to psychology and psychiatry also frequently focus in on the individual. The point of this panel is to investigate the role of the individual in domains involving human behavior: neuropsychology, psychiatry, and eugenics. Each of the papers focuses on the epistemic power of data about individuals. Carl Craver is particularly interested in the historicity of individual case studies: how their being bound to a time and a place invariably leaves them frozen in time and at crucial junctures unresponsive to the epistemic demands of the present. Şerife Tekin explores the importance of the first-person perspective as uniquely valuable in devising interventions to treat psychiatric disorders. Finally, Natalia Washington is concerned with the very act of psychiatric classification and its tendency to downplay the significance of individual lives in the process of envisaging a psychiatric classification that honors the individual.

Papers:

Mr. B as science in amber: Some historical perplexities of Neuropsychiatry

Carl F. Craver (Washington University, St. Louis: Philosophy and PNP Program, USA,
ccraver@wustl.edu)

I will discuss the neuropsychiatric case study of Mr. B (Störring 1926; Craver et al. 2014), a victim of coal-gas poisoning described as being unable to hold anything in memory for longer than 1.6 seconds. These deficits are on display in a video to be used in my presentation (Graham et al. 2014). The historical context of the case helps us to appreciate the dependence of neuropsychiatric case description, including the methodologies on which those descriptions are based, on prior scientific theory. For Störring, the case of Mr. B involves the near-surgical excision of the capacity for “registration” (die merkfähigkeit). Mr. B lived through the 1980s, and scientific controversy arose over both the extent of Mr. B’s deficits and the appropriateness of Störring’s interpretation of the case (as opposed to, for example, psychodynamic explanations). The case offers a unique window on how the passage of time can influence data in neuroscience: both as the subject under investigation changes and as the prevailing scientific attitudes shift around the case. The trajectory of Mr. B offers some interesting parallels to recent events in the transition of the case study, H.M., from a source of scientific evidence to an historical figure (Dittrich 2016).

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First person perspectives in Psychiatry

Şerife Tekin (Daemen College, USA, serife.tekin@gmail.com)

One of the fundamental concerns about contemporary medical psychiatry is that biological approaches to mental disorder act as a source of oppression, and that the power and authority of medical psychiatry functions to marginalize and disempower people who experience mental distress and use mental health services; a concern shared not only by the scholars in the critical psychiatry movement, but also philosophers of psychiatry, patients (or survivors) themselves, and those care about them. One way to respond to this problem is to incorporate the first- person perspectives of those living with mental disorders into psychiatric science and clinical treatment methods, as well as mental health ethics and policy decisions.

There is an increasing acknowledgment among philosophers and psychiatrists that the first person accounts of mental disorders offer a unique window for understanding the person with a mental disorder because they afford a deeper appreciation of how psychopathology impoverishes a person's relationship with herself and her community by causing disturbances in self related phenomena, such as self-conceptualization, self-esteem, and self-control. Traditionally, patients' experiences of mental disorder were communicated through their clinicians' case reports, i.e., third person accounts. A worry about such accounts is that they do not fully reflect Goffman's "tissue and fabric of patient life". Today, on the other hand, thanks to the increased accessibility of multiple media (particularly internet technology, but also to a lesser extent publishing), there are various ways in which first person perspectives offered by mental health service users can be incorporated into mental health research, care, and policy making.

Because such first-person accounts illuminate the intimate connection between psychopathology and personal identity, e.g., gender, race, socio-economic status, interpersonal relationships, they offer unmatched resources for clinicians and policy makers to develop successful treatments and effective policies.

Despite the recognition of the value of first person accounts, little systematic work had been done to develop a methodology that incorporates first person perspectives of mental illness in science, clinical practice, ethics and policy. In the proposed talk, I review three existing approaches that aim to integrate the first-person perspectives into psychiatric knowledge and policy making, and evaluate their strengths and limitations.

The first approach promotes the use of first person accounts – usually available in the form of mental illness memoirs – as a resource for patients to better understand their experiences, for clinicians to better engage with the phenomenology of mental disorders and develop clinical treatments, and for policy makers to develop policies responsive to experience of mental disorders. The second uses the first-person accounts of mental disorders, to develop a diagnostic scale for clinicians to assess the severity of a patient's condition (e.g., Examination of Anomalous Self-Experience (EASE). The third approach promotes the development of "amateur/citizen/user-led" research conducted outside of traditional academic settings by the mental health users themselves.

My evaluation of these three methods embraces pluralism about the methodology of incorporating first person perspectives into psychiatric science and aims to answer whether such pluralism can avoid collapsing into relativism about scientific knowledge in psychiatry.

Diagnostic kinds as human kinds

Natalia Washington (Washington University, St. Louis: Philosophy and PNP Program, USA, nataliawashington@wustl.edu)

Over the past few decades, diagnostic constructs in psychiatry which rely on accounts of mental disorders as natural kinds—like those in the DSM—have failed to be empirically validated. In response to this failure, a new consensus is emerging in the philosophy of psychiatry which stresses the seriousness of the discipline's multiple, and inherently normative goals (cf: Tekin, 2016; Tabb, 2016; Murphy, 2015; Theurerer & Hartner, ms; Friesen, ms). Under consideration is a kind of pluralism about diagnostic constructs which may, for example, taxonomize phenomena based on statistical atypicality in one arena, and on impacts on well-being in another. In this paper, I consider an additional way of schematizing psychiatric phenomena. Following Ron Mallon's work in his 2016 book The Social Construction of Human Kinds, I examine the possibility that familiar diagnostic categories like 'depression' and 'bipolar disorder' are shaped by our psychological, social, and environmental practices of representing psychiatric kinds. I argue that these practices are so deeply entrenched and causally powerful that accounting for diagnostic constructs without accounting for how we understand them individually and collectively, is both practically impossible and theoretically misleading. At the same time, while diagnostic categories—like racial categories—share the relevant properties to be considered real, natural, socially constructed kinds, the speed at which our practices and the phenomena they represent coevolve presents a special problem for explanation, prediction, and intervention.

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INDIVIDUAL PAPERS SESSION – MINAS2

Visual Representation and Science

Chair of the session: Erica Torrens (Dept. of Evolutionary Biology, Faculty of Sciences, National Autonomous University of Mexico (UNAM), Mexico, torrens@ciencias.unam.mx)

Papers:

Pictures in Biology: Representing human evolution in Mexican visual culture

Erica Torrens (Dept. of Evolutionary Biology, Faculty of Sciences, National Autonomous University of Mexico (UNAM), Mexico, torrens@ciencias.unam.mx)

During the 1990s a change in the Studies of Science and Technology known as 'pictorial turn' occurred (Mitchell 1994). This change implied a renewed interest in the study of scientific representation to show not only its relevance in the construction of scientific knowledge, but also in its validation process, its dissemination and teaching. This growing interest in the visual side of science generated a series of theoretical and methodological precepts which offered new ways of thinking and writing about the history of science. Some of these new narratives have illuminated not only science but other human activities, and more importantly, the strong role of visual scientific representations as vehicles of power and ideology.

This paper explores some representational practices related to the reconstruction of human history in Mexican popular visual culture (specifically in textbooks –which are free and universal in Mexico; monographs -which are one of the most employed educational resources in this country-, and murals in public buildings). Its aim is to show, on the one hand, the lasting impact and power that both early and biased Western visualizations of human ancestry have had in contemporary scientific education in Mexico; and, on the other hand, the influence of non-Darwinian thinking of early twentieth century in Mexican representation of evolutionary theory. This in turn seeks to enlighten the global dynamics that shaped and reshaped local narratives.

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Representing biology as process

Gemma Anderson (Egenis (Centre for the study of Life Sciences) and Living Systems Institute (LSI) University of Exeter; School of Art, Falmouth University, UK, gemma.anderson@network.rca.ac.uk) and **John Dupré** (University of Exeter, UK, j.a.dupre@exeter.ac.uk)

The growing interest in processual approaches in the philosophy of biology (Dupré 2012; Nicholson and Dupré, 2017) raises pressing questions about how best to represent biological process visually. This question is addressed in the AHRC-funded project ‘Representing Biology as Process’, a collaboration between Philosopher of Biology John Dupré, Biologist James Wakefied and Artist Gemma Anderson.

Any visual representation is an abstraction from the complexity of living process, and requires selecting some point of view, and the recognition that living systems are essentially four- rather than threedimensional greatly exacerbates the problem of selecting the most appropriate abstraction.

Historically, images of processes such as cell division, embryogenesis and ontogeny have been presented as distinct and isolated stages, suggesting gaps between the stages (Hopwood 2015, Wellmann 2015). In fact there are no gaps, creating a need to represent biological processes as continuous and connected. Established (textbook) ways of representing the multi-level, four-dimensional reality almost inevitably contribute to the misinterpretation of momentary states of a process as static things. Although the development of computerized simulations and techniques for real-time filming at microscopic, temporal and spatial scales provides partial solutions to these problems, the viewer becomes removed from the production of the representation, negatively affecting the insight and inference that the image can facilitate. This problem, we argue, can be addressed by the practice of drawing as a way to enhance the quality of connection with, and observation of, the phenomena under investigation.

Implementing this solution requires serious and sustained collaboration between scientists, philosophers and artists, and we believe that the emerging field of process biology provides the ideal conceptual context for this collaboration. Although, over the last thirty years, drawing has been in a state of decline in scientific practice (Anderson, 2014), recently, encouraged by the growing interest in inter-disciplinary research, drawing has been recognized to provide unique epistemological benefits as a method of biological representation. In this paper, we will draw from examples of our recent art/science collaborations to highlight drawing as an epistemological tool in the context of the emerging field of process biology.

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Beyond depiction: Aesthetics & images in the Life Sciences

Laura Perini (Philosophy Department, Pomona College, USA, laura.perini@pomona.edu)

There is a growing philosophical literature investigating visual representations in science, but there has been little exploration of how distinctively aesthetic properties of scientific images intersect with their uses in the process of conducting scientific research, in the articulation and defense of new conclusions, and in pedagogy. Philosophers have analyzed the visible features of images, often focusing on how the visual array facilitates comprehension of certain kinds of information, such as grasping relations among component parts of a biological system. Such work has made use of one area of aesthetics: the literature on depiction. However, philosophers of science have had little to say about how the experience of looking at visual displays matters, and to date have not used other areas of aesthetics to make sense of the use of images in science. It might seem that whether an image is engrossing or not, or whether it elicits a particular type of visual engagement, is irrelevant to understanding scientific reasoning with images, and that only comprehension of the content of the image ultimately matters. In this presentation I will draw on concepts from the philosophy of art and aesthetics and show how these can be usefully applied to illuminate epistemic issues concerning visualization in the life sciences.

INDIVIDUAL PAPERS SESSION – AG-BOT

Social, Historical and Philosophical Studies of Ecology

Chair of the session: Thomas Michael Lewinsohn (Department of Animal Biology, Institute of Biology, Unicamp - University of Campinas, Brazil, thomasl@unicamp.br)

Papers:

The onset of Brazilian ecological science in the 20th century

Thomas Michael Lewinsohn (Department of Animal Biology, Institute of Biology, Unicamp - University of Campinas, Brazil, thomasl@unicamp.br)

Ecological science became academically established in Brazil from the mid 1970s onwards, with the rapid increase of new departments, graduate programs and research groups. Earlier activity is less evident and has not been properly surveyed to date. This presentation focuses on the period from the instutionalization of ecological science in the early 20th century (viz. the inception of the British and American Ecological Societies and their journals) up to the 1970s, when ecology became popular as a scientific whistleblower of global environmental crises. In Brazil, since the 1920s "ecology" with increasing frequency designated some researchers and publications, but these mostly contained general descriptions of species' habitats or life cycles. With such a loose usage, ecology did not represent a well-defined scientific domain, but rather a fuzzy appendage of studies within botany, zoology, agronomy or parasitology. Several institutional initiatives in the early 1950s deserve attention, such as two research groups which had fairly narrow concerns: (i) in the Department of Botany, Universidade de São Paulo, Mário Guimarães Ferri led ecophysiological studies, especially in cerrado; (ii) in the Museu Nacional of Rio de Janeiro, an "Ecology Sector" in the Department of Botany produced floristic accounts of some habitats. Initial plans for an Amazonian research institute had a broad environmental framework, but when the INPA (National Research Institute of the Amazon) was founded in 1954, ecology was again appended in sectors of zoology, botany and forestry; the Department of Ecology was only set up in 1975. Meanwhile, however, applied demands impelled original ecological research which was not labelled as such. For instance, significant studies in several areas of application (such as biological control) and even in theoretical ecology were produced from the 1930s to 1960s in the Instituto Oswaldo Cruz in Rio de Janeiro, which never had a department or sector of ecology. Thus, early research activities in ecology in Brazil cannot be traced through quick searches on current keywords; rather, they demand a careful sorting of publications, institutional records and grey literature.

A conceptual framework for understanding the causes of the science-practice gap in Ecology

Diana Bertuol Garcia (Institute of Biosciences, University of São Paulo, Brazil, dia.bertuol@gmail.com), Carla Morsello (School of Arts, Sciences and Humanities, University of São Paulo, Brazil, morsello@usp.br) and Renata Pardini (Institute of Biosciences, University of São Paulo, Brazil, pardinirenata@gmail.com)

Despite public confidence in science, applying scientific knowledge to solve real-world problems and confront societal challenges is a difficult task in many disciplines, an issue known as the science-practice gap. Multiple causes of the disconnection between science and practice are scattered in the ecological literature, hampering the understanding of this multifaceted and urgent problem. To grasp this complexity, identify distinct perspectives on the problem, and help to identify effective solutions, we draw on an extensive bibliographic search and text analysis techniques from the social sciences to develop a comprehensive conceptual framework of the causes of the science practice gap in Ecology. Through a systematic review of ecological papers, we identified 122 articles from which we selected 1563 sentences describing the causes of the science-practice gap. By sorting a sample of these sentences by perceived similarity, eight scientists independently produced their own classification of causes. One of the classifications was chosen based on explicit criteria, refined to encompass all sentences, and assessed for reliability through the pairwise agreement between one author and two outside evaluators in the allocation of 150 sentences into the categories of causes. The resulting process-based framework describes three perspectives on which knowledges and actors are important in the science-practice interface, and identifies, for each perspective, the flawed processes linking science and practice. The most common perspective assumes only scientific knowledge should support practice, establishing a linear flow of knowledge from science to practice, and recognizes flaws in knowledge generation, communication, and/or use. The second perspective assumes both scientists and practitioners should contribute with knowledge to support practice, emphasizing knowledge integration and considering that this process, for several reasons, infrequently occurs. The last perspective was very rare, and assumes scientists themselves should put their results into practice, but they rarely do so. Some causes, such as cultural differences between scientists and practitioners, find parallel in other disciplines, while others, such as research being conducted at inadequate scales, are specific to Ecology. The unchanged predominance of the first perspective over the years suggests debates in Ecology lag behind a trend towards more interactive models of the science-practice interface that has been observed in other disciplines. Distinct types of solutions are envisioned depending on whether a given causal factor can (e.g., academic evaluation systems) or cannot (e.g., scientific uncertainty) be changed, or if misconceptions (e.g., undervaluing abstract knowledge) should be solved. Our work paves the way for a better understanding of the science-practice gap in Ecology and for identifying effective solutions to bridge this gap.

Ecological Psychology and the environmentalist promise of "affordances"

Guilherme Sanches de Oliveira (Department of Philosophy, University of Cincinnati, United States of America, sanchege@mail.uc.edu)

Recent research at the intersection of ecology and psychology refers to "affordances" to explain human response to deforestation and climate change (Casey 2003, Blok 2015). This paper reclaims the concept of "affordance" as originally articulated by psychologist James Gibson. As is argued here, a proper understanding of Gibson's vision for "ecological psychology" in the 1970s reveals how his notion of "affordances" foreshadows and contributes to current concerns relating to the anthropocene, humans' status as a hyperkeystone species, and postnaturalism.

Gibsonian ecological psychology was an alternative to both behaviorism and cognitivism, and had as its theoretical focus the reciprocity and complementarity between organism and environment. Rather than placing all explanatory burden on the environment (behaviorism) or on the processing of internal mental representations (cognitivism), ecological psychology sought to explain perception and action as constituted by the organism-environment system. For Gibson, the environment is informationally rich, particularly informing organisms of their "possibilities for action"—or "affordances," as he called them.

While aiming strictly at advancing psychological science, Gibson's thought was "ecological" in the yet little-understood sense that it was deeply attuned to environmentalist concerns. In talking about how organisms transform their surroundings to exploit affordances, Gibson claimed: "we human animals have altered [the world] to suit ourselves" and "[w]e have do so wastefully, thoughtlessly, and, if we do not mend our ways, fatally" (Gibson 1979, p. 130). As I propose, in this and other passages Gibson foreshadowed contemporary discussions about the "anthropocene" as a distinct epoch marked by human influence on the environment (Lewis & Maslin 2015) as well as the idea that humans are a "hyperkeystone" species, "a species that affects multiple other keystone species across different habitats, and hence drives complex, potentially connected interaction chains" (Worm and Paine 2016, p.

601). At the same time, however, Gibson rejected dividing the world into the “natural” and the “artificial” or “cultural”: affordances cut across these dichotomies, applying equally to destructive and to conservative or constructive human interactions with the environment. This, I suggest, anticipates “postnaturalism” (Vogel 2015) as the view that the concept of “nature” is too vague to be useful for environmental studies. In this sense, Gibson's ecological framework of “affordances” provides rich conceptual tools with which to make sense of pressing environmental issues, also contributing to current debates about human responsibility in light of such issues.

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TUESDAY JULY 18
11:00-12:30 – Parallel sessions 5

ORGANIZED SESSION DIVERSE FORMAT – AG-ZOO

Panel

Innovative Proposals to Introduce History and Philosophy of Biology in Biology Education

Org.: Maria Elice Brzezinski Prestes (Institute of Biosciences, University of São Paulo, Brazil, eprestes@ib.usp.br) and Paulo T. Sano

(Institute of Biosciences, University of São Paulo, Brazil, ptsano@usp.br)

In the recent years, much research has been conducted on the introduction of history and philosophy of science (HPS) in science education (Schwartz, 2007; Hudge and Howe, 2009; Lederman, 2015; Dagher, Erduran, 2016). Some of these initiatives are designed to use an explicit and reflective HPS approach as a tool to facilitate the learning of current biological knowledge, as well as to promote informed conceptions of the nature of science among students. Different episodes of the history of biology can be developed as occasion for the active engagement of the students under an inquiry learning approach (Allchin, 2013). Among others, activities for students may include inquiry structured historical narratives, counterfactual histories, replication of historical experiments, virtual learning objects. This section will present proposals of multiple didactic strategies and instructional materials to introduce HPS to different levels of biology students, in basic and higher education.

References:

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Dagher, Z.R. and Erduran S. 2016. Reconceptualizing the nature of science for science education. Why does it matter? *Science & Education* 25(1-2): 147-164.

Lederman, N. G., and Lederman, J. S. 2015. What is a theoretical framework? *Journal of the Science Teacher Education* 26(7): 593-597

Rudge, D. W., and Howe, E. M. 2009. An explicit and reflective approach to the use of history to promote understanding of the nature of science. *Science & Education* 18(5): 561-580.

Schwartz, R. S., Lederman, N. G., and Crawford, B. 2004. Developing views of nature of science in an authentic context: An explicit approach to bridging the gap between nature of science and scientific inquiry. *Science Education*, 88(4): 610-645.

Chair of the Session: Paulo T. Sano (Institute of Biosciences, University of São Paulo, Brazil, ptsano@usp.br)

Papers:

Students' perceptions about relevant elements to prepare teachers to deal with history and nature of science

Thaís Cyrino de Mello Forato (Departament of Exact Sciences and the Earth, UNIFESP-Diadema; Institute of Biosciences, University of São Paulo, thaiscmf@gmail.com) and Maria Elice Brzezinski Prestes (Institute of Biosciences, University of São Paulo, Brazil, eprestes@ib.usp.br)

This work presents results of a larger study devoted to identify some relevant elements to prepare teachers to deal with history and nature of science in their professional practice. The object of analyses is the course "Teaching history and nature of science", which was implemented at the University of Sao Paulo, in 2015, for undergraduate and graduate students of different courses of the University. The results presented here are based on analysis of responses to a questionnaire, data collected through the researcher field notes, interview with the teacher, and the content of teaching materials provided by him. This analysis is based on a qualitative perspective, guided by an autobiographic narrative. Despite presenting different perspectives, it was possible to identify some adequate and useful aspects to be implemented in different contexts for historical and epistemological approaches in the High School.

Where do they come from? The 18^th century puzzle of aphids in a virtual historical narrative

Filipe Faria Berçot (PhD student at Biological Science Program (Biology), Institute of Biosciences, University of São Paulo; Institute of Biosciences, University of São Paulo, Brazil, bercot@ib.usp.br) and Maria Elice Brzezinski Prestes (Institute of Biosciences, University of São Paulo, Brazil, eprestes@ib.usp.br)

This work aims to present a prototype of a historical narrative developed in a virtual platform to be used to science or biology teaching. The subject of the narrative are the studies on aphid's reproduction carried out by the Genevan naturalist Charles Bonnet (1720-1793) in 1740, which culminated in the identification of a new mode of animal generation – multiplication without mating (later called parthenogenesis). The episode of the history of biology portrayed in this work represents a good opportunity to foster the so-called "contextual teaching" of science, which objective is to permit citizens to make well-informed decisions on scientific subjects that pervade everyday life. Among other benefits, the historical approach contributes to the understanding of current scientific content and to the development of informed conceptions about how science works. Through studies such as those performed by Bonnet, students might be able to learn asking fundamental questions about animal reproductive modes and becoming more motivated to understand all varieties of reproduction currently known. In addition, by discussing the research questions formulated by the naturalist (and others fictionally proposed), students will be able to know science in a comprehensive way (Allchin, 2011), not only by their results. Through an "explicit and reflexive discussion" of aspects of the nature of science (Adúriz-Bravo & Izquierdo-Aymerich, 2009), the historical narrative is punctuated by "moments of interruption" (Allchin, 2013). Throughout the text, these breaks, or "Think questions", are comprised by open-ended and problem-solving questions. Students are invited to consider implications of their own scientific reasoning and procedures for resolving the posed problems (Rudge & Howe, 2009). In addition, in these moments it is possible to work the tension between inquiry teaching, characterized by the openness that provides students the opportunity to think on different possibilities of investigation, and the documented historical route, with its own decisions and ways that have been effectively traced. Such as any instructional material, this resource sets as a prototype, a model that enable adaptations, alterations and rearrangements, in order to fit the teaching-learning goals of the school culture in which it is applied. The narrative presented in this work is part of the PhD research of the first author and likewise, as it happened in his thesis, might be associated to other activities leading to a meaningful application of the history of science in teaching.

References:

Adúriz-Bravo, A., and Izquierdo-Aymerich, M. 2009. A research-informed instructional unit to teach the nature of science to pre-service science teachers. *Science & Education* 18: 1177-1192.

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Norris, S.P., Guilbert, S.M., Smith, M.L., Hakimelahi, S. & Philips, L.M. 2005. A Theoretical Framework for Narrative Explanation in Science. *Science & Education* 89(4): 535-563.

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Panel discussion

ORGANIZED SESSION STANDARD TALKS – CD-A1

Thinking the Organic in German Idealism: Life, Time, and History

Org. and chair of the session: Juan Felipe Guevara-Aristizabal (National Autonomous University of Mexico (UNAM), Mexico, juanfgapro@gmail.com)

Scholarship in the philosophy of biology has long recognized the deep impact of German idealism on the nascent life sciences of the early 19th century. This relationship has been almost entirely confined to one concept in particular: the organism. However, such a confinement might be an obstacle to acknowledge the many topics and concepts which engaged thinking about the living beyond an explicit commitment to organization. Of course, self-organization has been a central tenet of modern biology, whether we look at it from a scientific or philosophical perspective. Our session challenges such a restricted commitment in order to think the living otherwise than through its organizational capabilities. We prefer to emphasize organic life, as a means to decentralize organization and to bring to the fore the profound entanglements between the organic and metaphysical concepts such as life, time, and history. In contrast to a focus on the organism or organization, thinking about organic gives us an alternative qualitative framework: instead of focusing on the whole and the parts and their disposition, the organic emphasizes the powers and capacities that make up the living and its dynamics. Hence, life presents itself at the boundaries of the conceptual constraints of reproduction and heredity, where it can meet with questions that do not pertain solely to biology.

Papers:

Epigenesis and the rupture of Kantian time

Juan Felipe Guevara-Aristizabal (National Autonomous University of Mexico (UNAM), Mexico, juanfgapro@gmail.com)

Kant’s presentation of the concept of a natural purpose in the Critique of the Power of Judgment brings to the fore some of the problems that natural science faces when dealing with organized beings. In particular, Kant emphasizes how the simultaneous and reciprocal relationship established between the parts and the whole is different from the notion of causality he discussed earlier in the Critique of Pure Reason. In the latter, Kant introduces causality in a context that relies heavily on his previous understanding of time as a succession. However, one of the difficulties with the concept of natural purpose is that it does not conform to the causality of the first Critique and, hence, introduces a shift in Kant's temporal understanding of nature: not all natural entities conform to a temporality in which all events appear in a successive fashion, even if this statement is only valid for the power of judgment in Kant's approach to the problem.

Although this peculiarity is only fully exposed in the third Critique, there are traces of it in the first. Highlighting this particular aspect of natural purposes may allow us to offer an alternative reading of Kant's use of epigenesis at the end of the Transcendental Deduction of the Categories in the second edition of the Critique of Pure Reason. Instead of looking at reason as a self-organizing entity—with its vital forces, germs and predispositions—, I would like to argue for a different reading of Kant's appeal to epigenesis. The analogy between the system of epigenesis and that of pure reason culminates in a section of the first Critique that not only deals with the provenance of the categories, but also with the radical nature of time as that which brings together intuition and understanding. Following such a thread, epigenesis seems not to be a mere analogy used to describe a genetic process; rather it embodies the complicated temporality that underlies this genetic process, while, at the same time, it exhibits this temporality as different from a mere succession of events. The phenomenal representation of time as drawing a line, an illustration introduced by Kant himself, appears at odds with the temporality of epigenesis, because the latter, unlike the line, cannot leave its traces behind, at a time that has already passed and that is different from the present. The epigenetic development of organized bodies signals the ever active character of the past in the making of present and future states.

Schelling: Epigenesis and Philosophy

Violeta Aréchiga-Córdova (Universidad Autónoma Metropolitana - Cuajimalpa (UAM-C), violetare@gmail.com

According to Gambarotto, the emergence of biology as an autonomous science involved a break with the Kantian notion of teleology as merely regulative and postulated it as constitutive. This was a shift "most strongly endorsed in Schelling's Naturphilosophie." Treviranus' Biology would be, in this sense, the result of a conceptual process that, beginning in the 18th century with the Haller-Wolff debate, had at its center the construction of both a definition of life and an explanatory framework for the way living nature is capable of organizing itself. This development, Gambarotto maintains, “culminates with Schelling’s idea of nature as a “universal organism,” i.e. as a dynamical system capable of organizing and regulating itself.” The aim of this paper is to show how the concept of an organism, of a living thing, shapes Schelling’s philosophy. Specifically it examines: (1) his theory of matter as it appears in Ideas for a Philosophy of Nature; (2) his notion of the relationship between inert and living matter in On the World-Soul; and (3) his concept of time in The Ages of the World. In these works, Schelling strives to demonstrate, versus Kant, that a certain knowledge of the living realm is possible, that the material is not equivalent to the inert, and that the truest science is history. Behind all these stands a specific conception of the living being characterized by its epigenetic development, in the sense of the notion of epigenesis proposed by Blumenbach.

Schelling’s Natural History of the World Soul

Joan Steigerwald (York University, steiger@yorku.ca)

What is the history of nature that Schelling offered, and what meaning might that history carry today? His invocation of a world soul might be read as offering a re-enchantment of nature. The world, he claimed, “is simply the original, as yet unconscious, poesis of the spirit.” Yet his insistence on history as a natural history might be read as giving priority to nature, and his philosophy rooted in nature countering the annihilation of nature in traditions of idealism. Perhaps, however, it is thinking of terms of priority or roots that perpetuates the standoff between the human and natural worlds. Discourses of origins inevitably succumb to the logic of supplementarity, in which the constitution of an origin depends on additions which pervade and undermine any purported purity or fullness of the original.

The reading of Schelling’s natural history proposed here is “that it is the development of a living actual being that presents itself within it.” We are necessarily in a world of our own thinking and making, even as we as thinking and acting beings are constrained and produced by that world. The world soul figures this being in the world as embodied mind or animated matter. It is both the opposition and intussusception, the involution and evolution, of mind and matter, or productivity and constraint. At each moment in Schelling’s natural history of the world soul we find this complex recursive dynamic. The appearance and preservation of life, for example, depends on an excitability that is consisted by an involution in two directions—an involvement of the organic with itself, and an involvement of the organic with world. The world, like all life, is constituted through an involution that is at once an ascension and a retraction, and is always already historical. The appearance of the conscious mind depends on an involution of the real and the ideal at another level of activity and analysis. Indeed, Schelling presented nature philosophy and transcendental philosophy as both foundation and critique of one another, each at once prior to and a reflection on its other. He argued for philosophy to turn to history, not only to recover its past, both its human and natural history, but also to recognize its own historical positioning. Schelling's natural history of the world soul provided a critique of purported origins in nature or spirit, and challenged the philosophical pretensions of his time to grasp the ends of history or to grasp a nature beyond human history. The different renderings of his natural history all worked towards an acknowledgement of where we are, as finite human souls, in history and in the midst of a world inevitably inflected with difference.

ORGANIZED SESSION STANDARD TALKS – CD-A2

Modeling Individuality: Organisms, Stem Cells, and Cancer

Org. and chair of the session: Melinda Bonnie Fagan (Department of Philosophy, University of Utah, USA, mel.fagan@utah.edu)

Questions about biological individuality and the nature of organisms have recently come to the fore in philosophy of biology (e.g., Guay and Pradeu (2016); Biology and Philosophy Special issue 'Biological Individuality' (November 2016); Lidgard and Nyhart (in press); Chen, Bueno and Fagan (in preparation). Important trends in this new literature are openness to pluralism about criteria or modes of biological individuality, consideration of a broader range of biological fields and theories, and interest in connecting accounts of individuality grounded in biological practice with those grounded in other scientific disciplines (e.g., physics) and areas of philosophy (e.g., analytic metaphysics). The papers in this session build on these trends, with a particular focus on models. The philosophical literature on biological individuality has been profoundly influenced by David Hull's dictum that incisive accounts of this phenomenon must be "theory-based," with the only available such theory being that of evolutionary biology (1992). In the past few decades, however, philosophy of science has made great progress in clarifying the nature and roles of diverse kinds of models in scientific practice (e.g., Magnani et al 1999, Morgan and Morrison 2001). The three papers in this session, in different ways, challenge theory-centrism in discussions of biological individuality. A focus on models opens up new domains of scientific practice to philosophical investigation of biological individuality. Two such domains, which are interestingly linked to one another, are stem cell and cancer research. Melinda Fagan presents a lineage model of stem cells as developmental entities mediating between cell and organismal levels of biological organization. Anya Plutynski defends a pluralistic, model-based approach to understanding cancer, engaging its developmental, evolutionary, and genetic aspects. On this approach, questions of biological individuality are addressed within a contextualist framework of 'models as mediators.' Anne Peterson critically examines analytic metaphysicians' accounts of individuality, arguing that their generality and static assumptions have inhibited productive connections with model-based accounts in philosophy of biology.

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Papers:

Stem cells and lineage models of development

Melinda Bonnie Fagan (Department of Philosophy, University of Utah, USA, mel.fagan@utah.edu)

Philosophical study of organisms and biological individuality often think of organisms in their 'fully developed' mode. But an organism's existence is marked by development: regular processes of change from a single cell (zygote) to the mature organism, and eventually its senescence and death. Stem cells highlight organisms' developmental aspect. The original (Haeckel's) definition of 'stem cell' was the cell that gives rise to the whole organism; the fertilized egg. Although the term is used differently today, the concept of a stem cell remains entangled with ideas about biological development and individuality. Often these ideas remain implicit, realized in the experimental practices of stem cell research. By focusing on key experimental methods and standards in the field, I identify a 'common core' model of stem cells, which builds on and extends my earlier view (Fagan 2013). This common core is the form of a lineage. A lineage is a complex biological entity, composed of multiple generations of other, lower-level entities. Stem cells are individuated as such not only by their measurable traits at a given time (morphological, molecular, and functional), but also (indeed, primarily) by their developmental potential – the range of cells they can transform into. A full understanding of a given stem cell amounts to a model of the lineage processes it can give rise to. Drawing on key experimental systems spanning more than 50 years of stem cell biology, I propose an abstract model of 'the stem cell,' which defines this entity as: (i) the starting point of a potential lineage (ii) that can be realized by one or more developmental processes, and (iii) which is 'bookended' by an organismal context. The lineage concept is built into the very idea of a stem cell, and has been since the term was introduced (Dröscher 2014). Stem cell models over the past 50 years show increased inclusion of the process of development, from zygote to whole (sustained, maintained, healthy) organism. Going forward, we should seek a modeling framework that continues this trend – particularly one that brings the organism into the frame. In terms of my lineage model, this amounts to characterizing the relation between cell developmental termini and construction of a multicellular organism – modes of organization that go beyond cell-cell interaction. I show that recent experimental innovations in stem cell research and bioengineering (organoids and embryo-like in vitro structures) offers insights into the ways stem cell lineages can give rise to (or encompass) key aspects of organismal organization. Study of stem cells' developmental capacities, across a variety of experimental contexts, helps distinguish between and offers a study platform for different modes of organismal organization.

The last part of the talk explores contrasts between stem cells and cancer. Both are cell lineage concepts (today). Cancer cells emerge in the course of organismal development and are somehow 'isolated' or 'split off' from organismal identity: one's cancer is from oneself, but is not oneself. Stem cells do not evince this split. They are (or become, which is part of what they are) parts of the organism, subsumed into its individuality.

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Individuality, generality, and change in Metaphysics and Philosophy of Biology

Anne Siebels Peterson (Department of Philosophy, University of Utah, USA, anne.peterson@utah.edu)

The many fruitful models of biological individuality that have been developed provide motivation to move beyond a purely theoretical basis for this concept. Different models can be useful in different contexts; a models-based approach thus undercuts the pressure to seek a completely general understanding of biological individuality. Such an approach also motivates us to investigate interdependencies between biological individuals, since important models of one such individual may reference others. For example, in the cases of stem cells and cancer there is increasing motivation for models that reference the organism as a whole—and therefore for models that reference the dynamic processes of development giving rise to the organism over time. In analytic metaphysics, by contrast, investigations into individuality have differed in two ways: 1) they have operated at a fully generic level, and 2) they have investigated individuality as a static phenomenon. These differences, in my view, arise in large part from the focus metaphysics has placed on the question of when our claims involve ontological commitment and on Quine's criterion as the standard answer: we are committed to the existence of exactly those items to which our bound variables must be able to refer in order for that our claims to be true (Quine 1948). One upshot of this fully general criterion is its implied view of being: to be is just to be the value of a variable bound by a quantifier. Investigations into the metaphysics of time and modality have shown that it is difficult for something to be able to become or cease to be the value of a bound variable; that is, given the Quinean notion of being it is difficult for something to be able to come into or go out of being. A surprising number of metaphysicians have thus adopted views of individuality on which no individual can come into or go out of being—that is, views on which individuality as such remains entirely unaffected by processes of development and senescence (Linsky and Zalta 1994, Sullivan 2012). Most such metaphysicians mitigate the apparent conflict between their views and the views of others by claiming that we can understand processes of development and senescence in terms of individuals gaining or losing their spatiotemporality, rather than gaining or losing their individuality. But to say that all the work in philosophy of biology apparently on theories and models of individuality is really work on spatiotemporality is a good way to cut off dialogue. I argue that metaphysics should move toward a models-based approach to individuality. A static notion of individuality may be a powerful model in the context of discussions centered around logical considerations, but in other contexts such as that of biology it may be irrelevant. Moreover, focusing on full generality has obscured a different and dialectically important role for metaphysics: to investigate the relationships between divergent models of individuality, static or dynamic, as embedded in the contexts where those models have flourished.

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Panel discussion

ORGANIZED SESSION STANDARD TALKS – CD-A3

Science and Ethics on the Application of Biogenetic and Chemical Technologies to Large-scale Agriculture in Argentina and Brazil

Orgs.: Luciana Zaterka (Center of Natural and Human Sciences, Federal University of ABC, Brazil, zaterka@uol.com.br), Pablo Rubén Mariconda (Department of Philosophy, Faculty of Philosophy, Letters

and Human Sciences, University of São Paulo, ariconda@usp.br) and Guillermo Folguera (Group of Philosophy of Biology, Universidad de Buenos Aires/ National Scientific and Technical Research Council (CONICET), Argentina, guillefolguera@yahoo.com.ar)

In recent decades, there have been numerous debates on the commercial release of genetically modified organisms (GMOs). The main question that permeates this discussion concerns its risks to health and the assessment of environmental impacts of the release in large-scale planting of GMO monocultures which are resistant to chemical pesticides. This session aims to discuss scientific, economic and ethical aspects of commercially oriented technoscience in South America, specifically in Brazil and Argentina. We focus the discussion on the epistemological relations between science and technology, on the distinction between science and non science, and on the ethical level of responsibility in the use of scientific and technological knowledge.

Chair of the session: Pablo Rubén Mariconda (Department of Philosophy, Faculty of Philosophy, Letters and Human Sciences, University of São Paulo, ariconda@usp.br)

Papers:

Epistemology and Ethics in large-scale biotechnological applications
Pablo Rubén Mariconda (Department of Philosophy, Faculty of Philosophy, Letters and Human Sciences, University of São Paulo, ariconda@usp.br)

It is common for restrictions to be imposed on access to data that are needed to assess the products and innovations of current biogenetical and pharmaceutical technologies (mainly seeds and drugs). I will argue that these restrictions, which are justified by appeal to patent rights, and the consequent refusal of chemical and pharmaceutical companies to permit access to these data, amount to an anti-scientific attitude that compromises the impartiality and objectivity of scientific practices.

Two epistemological requirements must be satisfied in order to obtain objectivity: (1) that effects be able to be reproduced under relevant initial and limiting conditions; (2) that there is public disclosure of the data that constitutes the experimental evidence for alleged effects. Meeting these requirements presupposes that certain ethical values are in play in science, values such as correctly disclosing experimental data obtained in research, and making all relevant data available so that experimental replication can be carried out and risks can be soundly assessed.

I will show how these values are transgressed in what is said to be responsible use of the scientific method in studies connected with large-scale biotechnological applications. In reaching this conclusion I draw mainly from two sources: first, scientific findings of independent toxicological research that show that the introduction of genetically engineered crops (soybeans, sugar cane, corn etc.) in large monocultures occasions harmful effects to human health, due to the extensive use of agrochemicals (herbicides, pesticides etc.), and severe chemical and genetic impact on the environment; and, second, the fact that regulatory bodies permit the use of agrochemicals without taking into account scientific evidence of imminent risks; or, even worse, they may withhold access to the data obtained in risk evaluations, so that independent scientific scrutiny is not possible. Withholding access to data in this way (and sometimes juridical decisions require withholding it) enables ignorance to be maintained. This is not only contrary to science; it is also against rationality, it opens up the way to arbitrary decisions.

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Genetically modified organisms: The scientific inadequacy of the principle of substantial equivalence

Luciana Zaterka (Center of Natural and Human Sciences, Federal University of ABC, Brazil, zaterka@uol.com.br)

With the exponential increase of foods derived from genetically modified organisms (GMOs), developing procedures and scientific techniques that can serve to ensure the safety of these foods has become a matter of urgency. Since the early 1990s, the 'principle of substantial equivalence' has been highlighted in mainstream developments. It has been put forward in opposition to the precautionary principle. The principle of substantial equivalence maintains that, if the chemical characteristics of GMOs are essentially the same as those of their conventional analogies, there is no reason to anticipate that they will occasion greater risks. When this principle is adopted, research connected with food safety becomes focused on: 1. Phenotypic characteristics; 2. Molecular characterization of the genetically modified organism; 3. Analytical comparison between the composition of GMOs and its derivatives and the composition of analogues. Limited to these three components, research is not able to investigate the presence of some toxic components and unknown allergens while research that is not limited in this way can reveal the insertion of a new gene into the genome of plants that can cause unexpected effects, such as pleiotropic ones. Thus, research constrained to accordance with the principle of substantial equivalence is not able to address all the possible effects of the interaction of GMOs with plants, animals and the environment. Research framed by the principle of substantial equivalence deploys reductionist strategies - limited to investigating effects that have exclusively chemical origins - and is not adequate for testing newly introduced foods. This suggests that the principle of substantial equivalence (as currently formulated), rather than being soundly based on science, is a device for agribusiness and government regulators to counter resistance to the introduction of GMOs and the foods derived from them.

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Biotechnology, technoscience and theoretical simplification. The case of genetically modified organisms (GMOs)

Guillhermo Folguera and Christian Francese (Group of Philosophy of Biology, Universidad de Buenos Aires, National Scientific and Technical Research Council (CONICET), Argentina, guillefolguera@yahoo.com.ar)

Different authors have proposed a hybrid status of technoscience. For instance, Linares (2008) expresses it as a combination between “scientific knowledge” and “technological production.” In the same vein, Latour stresses it being a mixture between epistemic and artefactual aspects. Hottois (1999) also mentions technoscience should be considered as a body of integrated knowledge in which scientific and technical aspects are articulated in every stage in the process of construction. In spite of these proposals, the epistemic dimension of technoscience has not been analyzed with proper care. Another characteristic of technoscience is associated with the idea of social and environmental risks. In this sense, Beck (1998) and Illich (2015) propose that it is professionals and academics who characterize, delimit and recognize risks and their magnitude (Beck, 1998; Illich, 2015).

One of the major projects of technoscience is Biotechnology (Echeverría, 2005). In recent decades genetically modified organisms (GMOs) have been one of the most important technoscientific products. GMOs have presented different uses as medical, oil, food, etc. In this work we analyze what is the relationship between technoscience risks and the theoretical framework in the particular case of GMOs. Our hypothesis is that the associated discourse with the production of GM plants presents processes of epistemic simplification, minimizing the magnitude of risks. In our analysis, we focus on the genotype-phenotype relationship, the consideration of ontogenetic and evolutionary dimensions, and the role of epigenetic factors.

In order to answer this question we analyzed five textbooks and twenty articles associated to GMOs in plants. The main results show that in Molecular Biology, DNA, RNA, Protein and their relationships are considered in a more complex way than in papers directly associated to GM plants. In the latter case there is an assumption, in general terms, of a linear relationship among DNA, RNA and Protein and a general omission of other biological factors. Therefore, we recognize an important level of theoretical simplification and/or omission, which in some cases is directly associated to risk factors.

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ORGANIZED SESSION STANDARD TALKS – MINAS1

Population Genetics and Mechanics

Orgs.: Jean Gayon (Institute of History and Philosophy of Sciences and Techniques, IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne, France, jean.gayon@gmail.com) and Maël Montévil (Laboratory Matter and Complex Systems, University of Paris 7 Diderot, and IHPST, University of Paris 1, France, mael.montevil@gmail.com)

Theoretical Population Genetics examines the consequences of Mendelian inheritance at the level of populations. This discipline is one of the fields of biology where Mathematics are most necessary. The analogy between this corpus of models and Classical Mechanics is a matter of debate. For example the notion of a potential function is central to the mechanics of conservative systems. By contrast, the relevance of this mathematical and theoretical notion in population genetics led to a major debate between Fisher and Wright in the early forties [Fisher, 1941; Gayon & Montévil, in press].

In this session, we examine the analogy between the structure of models in Population Genetics and the theoretical structure of Classical Mechanics. We evaluate this comparison by focusing on the issue whether some remarkable features are shared or not by the two fields. Such a comparison should help to assess the validity of the transfer of notions and ideas from one field to the other. We will argue that models in Population Genetics have key conceptual and mathematical differences with Classical Mechanics, although, in certain cases (esp. random drift) the two domains share a similar theoretical structure.

This symposium is the outcome of strong interactions between the three speakers, which means that the authorship of the three papers is largely shared.

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Chair of the session: Matteo Mossio (Institute of History and Philosophy of Sciences and Techniques (IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne), France
matteo.mossio@univ-paris1.fr)

Papers:

Invariance and reversibility in theoretical Population Genetics

Jean Gayon (Institute of History and Philosophy of Sciences and Techniques, IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne, France, jean.gayon@gmail.com)

Invariance laws and reversibility have long been considered as characteristic features of scientific knowledge. In theoretical population genetics, invariance is illustrated by a number of genetic equilibria realized under specific conditions. Since these equilibria are maintained despite a continual flux of changes in the course of generations (reshuffling of genes, reproduction…), it can legitimately be said that Population Genetics reveals important properties of invariance through transformation. This is what J.B.S. Haldane called the "Statics of evolution", as opposed to a "Dynamics of evolution". Reversibility, since it presupposes change through time, is about evolutionary dynamics. With Maël Montevil, I distinguish two different notions of reversibility, "retrodictability" and "time-reversibility". Deterministic models (esp. mutation and selection) are retrodictable, but not time-reversible. Some important models of random genetic drift are time-reversible, but, by definition, no stochastic model allow for retrodictability.

What counterpart to the principle of inertia in Population Genetics?

Maël Montévil (Laboratory Matter and Complex Systems, University of Paris 7 Diderot, and IHPST, University of Paris 1, France, mael.montevil@gmail.com)

In this paper, we will discuss the notion of inertia in Classical Mechanics and its possible counterparts in Theoretical Population Genetics. We will show that, in Population Genetics, changes take place in a mathematical space whose structure is not compatible with notions such as the conservation of momentum or of angular momentum. In spite of this difference, we will argue that there is a fundamental analogy holds between the two fields. The principle of inertia describes the behavior of a system when nothing acts upon it. In Mechanics, this behavior is described by the conservation of momentum. We will show that different situations may be analogous to inertia in evolution. In particular, Theoretical Population Genetics uses a similar line of reasoning in at least two cases: random genetic drift, and geometric growth. However, we will argue that genetic drift is mathematically very different from mechanical inertia as it is far richer in contingent events having lasting consequences.

Panel Discussion

INDIVIDUAL PAPERS SESSION – MINAS2
Scientific Practices: Philosophical Perspectives I

Chair of the session: Bettina Bock von Wülfingen (Institute for Cultural History and Theory/Cluster of Excellence Image Knowledge Gestaltung, Humboldt-University Berlin, Germany, bettina.bock.v.wuelfingen@hu-berlin.de)

Papers:

The history of DNA synthesis: Ways of knowing and making in biology

Dominic Berry (University of Edinburgh, UK, dominic.j.berry@ed.ac.uk)

In the past few decades an effort has been made to establish a new field of the biological sciences under the broad umbrella of synthetic biology (SB). While there are many reasons to question what this field actually equates to, and many scholars have contributed to discussions of its novelty or lack thereof, this paper approaches the prospect of SB differently. I take seriously the suggestion that synthetic biologists seek to bring engineering into biology, and therefore take the opportunity to address SB's practices and material conditions of work. In this investigation I am inspired in particular by John Pickstone's ways of knowing and making (Pickstone, 2001). Indeed, for some of the earliest scholars in the history and philosophy of biology to address synthetic biology, such as Evelyn Fox Keller, the differences and connections between making and knowing have already proven illuminating (Fox Keller, 2009).

I contribute to an expansion of the historical understanding of SB through attention to the origins and development of nucleotide synthesis machines. If, as mentioned above, one of the primary ways in which SB might be thought novel is through its commitment to a biological engineering, then it seems likely that the physicists, chemists, and engineers that made automated nucleotide synthesis possible were some of the primary routes by which engineering ideas, language, and practices entered into the biological laboratory. Intriguingly some of the earliest such machines were designed for mass production, apparently intended to become part of the repertoire of molecular biology (Ankeny and Leonelli, 2016), a DNA synthesis machine for every researcher. Yet their uptake was clearly limited, the preferred solution for most laboratories being to have DNA synthesised to order by organisations outside of the lab. My paper explores the origins and historical development of the DNA synthesis machine, from 'gene machines' as they were first called, to 'foundries' as the largest models have come to be referred to. I look at the ways in which different ways of making DNA mattered for practitioners with very different epistemological commitments and epistemic goals.

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Evaluating scientific detection instruments: The case of Positron Emission Tomography

Rick Shang (Department of Philosophy, Washington University in St. Louis, USA, zshang@wustl.edu)

In this paper, through an integrated history and philosophy of science case study, I want to bring philosophers' attention to a less-discussed criterion of evaluating the integration of scientific detection instruments. Contemporary philosophers are interested in both the ways inter-field, scientific integrations take place and the criteria for successful integration. But contemporary philosophers pay their primary attention to the scientific integration of theories and models. Theories and their more specific instantiations – models – are tools to represent, explain and predict phenomena. Unsurprisingly, the criteria for successful integration of theories and models are their representative, explanatory and predictive prowess. For example, Mitchell and Gronenborn point out that scientists acquire knowledge of how proteins fold in vivo through an inter-field integration of gene-sequencing, X-ray crystallographers, the study of the surrounding biological and chemical environments of proteins, etc. The resulting, integrated theory is successful precisely because it is better at representing, explaining and predicting how proteins actually fold. But the aforementioned approach does not apply to scientific detection instruments, such as Positron Emission Tomography (PET), an indispensable biological (in particular, neuro-) imaging technique. Detection instruments, in themselves, do not explain or predict. Scientists use PET and other detection instruments in experiments to represent, often with a very particular concern. In this paper, I review the history of PET, all the way from the introduction of its first proto-type to its current CT/PET combined form used in neuroimaging. Based on the historical review, I make the philosophical case that the evaluative criterion for PET and perhaps for many other scientific detection instruments has long been and should be the signal-to-noise ratio.

Annotating, retrieving and reactivating: the epistemic role of labels on micro-preparations within bioscience recovery systems (using the example of Alzheimer's disease preparations)

Bettina Bock von Wülfingen (Institute for Cultural History and Theory/Cluster of Excellence Image Knowledge Gestaltung, Humboldt-University Berlin, Germany, bettina.bock.v.wuelfingen@hu-berlin.de)

The annotation, labeling, listing and retrieval of research objects – in short: their systematic organization – is an important and often time-consuming part of bio-scientific research, although seldom mentioned in the section of articles where methods are explained.

This study discusses the role of labels in the process of the reactivation (Rheinberger 2005) of micro-preparations. Labels on slides and corresponding lists, recorded on cards or sheets, constitute what will be termed a 'recovery system' within life sciences. In the 'sciences of the archive' (Daston 2012) the disciplinary memory, together with this recovery system, allow the sciences today to reactivate neurological preparations dating back to the beginning of the last century. The case of Alzheimer's micro-preparations of the brain parts of Auguste D. – which he used to show that hers was a specific, hitherto unknown brain disease – serves as an example that allows the problem of the recovery system in the biosciences to be explored. Comparisons are made with slides and labels prepared by other neurological researchers between the 1890s and 1920s and between the respective recovery systems. As an epistemologicum the micro-preparation, combining data and, in its hybrid status, image and material, straddles the boundary between icon and index.

This is shown by the reactivation of Alzheimer's Auguste D. preparations in molecular biological studies, more than one hundred years after their production.

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INDIVIDUAL PAPERS SESSION – MINAS3
Biology, Philosophy And Anthropology

Chair of the session: Elliot Hollingsworth (Department of Sociology, Philosophy and Anthropology, University of Exeter, UK, eh388@exeter.ac.uk)

Papers:

Towards a naturalist philosophical Anthropology

Pedro Henrique Pereira (Center for Natural and Human Sciences, Federal University of the ABC, Brazil, pedrohp94@outlook.com), **Victor Ximenes Marques** (Center for Natural and Human Sciences, Federal University of the ABC, Brazil, marques.v@ufabc.edu.br) and Amanda Soares de Melo (Center for Natural and Human Sciences, Federal University of the ABC, Brazil, amanda.soares@aluno.ufabc.edu.br)

Philosophical anthropology is a field of philosophy that has been remarkably interdisciplinary since its foundation. Scheler constructed his philosophical-anthropological theories taking into account parts of the scientific development of his time, but adopting the position that natural science had little role in the definition of the so-called “human nature” - developing his conception mainly through speculative philosophical reflection, with subsidiary assistance from the social and human sciences. Plessner, the co-founder of the field, had a somewhat different position: it is necessary to give a solid empirical foundation to the philosophical-anthropological view exploring and assimilating all the available biological evidence. We believe that Plessner's choice is the most reasonable one. Much has developed in biology and also in the social and human sciences since the time first generation of philosophical anthropology. The project needs to be updated. We argue that it is intellectually relevant and realistic to formulate a new philosophical synthesis about human nature, inspired by contemporary scientific discussions, seeking to bring to light new insights to epistemology, ethics and moral theory, giving a renewed life to some remarkable paths opened by the philosophical-anthropological tradition. Here we presente the framework, as a basis for further research, of a strictly naturalistic philosophical anthropology: a philosophical anthropology that seeks to define our humanity from the study and survey of the core properties of the organic body in general and the human body specifically, as shaped by both evolution and development. As part of the definition of our proposal, we will seek to defend the importance of giving the human body a central role in philosophical anthropology, as well as the importance of philosophical discourse for a thesis on human nature and also justify our choice to adopt a biological basis for it is. A good articulation between philosophy and the natural sciences around the understanding of the human body seems to us, not only a lucid path forwards, but also a necessary way to understand the link between natural and cultural evolution at a time when mankind is increasingly tinkering with the biological constraints and fresh cultural dilemmas emerge with the rapidity of a click.

Helmuth Plessner's excentric positionality and schizophrenia
Elliot Hollingsworth (Department of Sociology, Philosophy and Anthropology, University of Exeter, UK, eh388@exeter.ac.uk)
I provide a philosophical anthropological analysis of the fragility of personhood in schizophrenia within the context of phenomenology of schizophrenia. Two central focuses of this paper will be Helmuth Plessner's philosophical anthropology, and Sass and Parnas' Ipseity Disturbance Model of Schizophrenia, situated on the background of Moss' 'Hybrid Hominin'. For Plessner, our excentric positionality is what constitutes us as human beings; we are constantly oscillating between being a living body (Leib), a self-monitoring being, and being a body as object (Körper), an 'automatic' being. However, we are never solely one or the other in this oscillation -- we are hybrid beings. Drawing from Plessner's excentric positionality and phenomenological insights into schizophrenia, I propose that schizophrenia is the ontological fragility of personhood via a breakdown of the person's excentric positionality, particularly during psychotic episodes. Rather than oscillating between Leib and Körper, the person with schizophrenia flies to either being solely hyper-reflective, or to solely non-reflective/hyper-automatic, and hence a break in their hybridity. This commonly results in people with schizophrenia reporting having the feeling of being 'not really human', as ontologically distinct from people who do not have schizophrenia. This analysis of people with

schizophrenia provides insight into the fragility of their personhood, via incorporating philosophical anthropology within the context of the phenomenology of schizophrenia. Additionally, this breakdown of personhood offers to shed some light on the foundational inquiry of philosophical anthropology of what is it to be a human being.

TUESDAY JULY 18
15:30-17:00 – Parallel sessions 6

ORGANIZED SESSION STANDARD TALKS – AG-ZOO
Dreamers, Visionaries, and Revolutionaries in the Life Sciences
Org.: Michael Dietrich (Dartmouth College, USA, michael.dietrich@dartmouth.edu)

This panel on Dreamers, Visionaries, and Revolutionaries in the Life Sciences explores biologists who had grand ideas that went beyond the "run of the mill" science of their peers. They each espoused theories, practices, or applications of science that were visionary, sometimes fantastical or even quixotic, but always challenging, and even threatening and destabilizing. Our goal is to understand the conditions that fostered such scientists as they advanced genuine novelty, the challenges and imaginations that, from the nineteenth century and forward, helped to shape modern biology.

Chair of the session: Oren Harman (Bar-Ilan University, Israel, oren.harman@gmail.com)

Papers:

Perchance to dream: Fostering novelty in the Life Sciences
Oren Harman (Bar-Ilan University, Israel, oren.harman@gmail.com)

Dreamers, Visionaries, and Revolutionaries in the Life Sciences offers a comparative analysis of historically significant novelties in the life sciences, whether they were enshrined within the realm of scientific consensus, discarded, or remain pushing at the gate. How do different historical contexts, institutional circumstances, and the state of research at a particular time allow such novelties to occur in a scientific community? In this overview presentation, I will introduce this comparative project and distill some of the thematic lessons from this analysis. For instance, one common thread among dreamers in biology has been a willingness to question orthodoxy, sometimes rooted in a deep-seated skepticism. A second is an abiding persistence or loyalty to their ideas or perspectives, and a third - the capacity to seek out institutions and situations that will allow them to pursue their vision.

David Sloan Wilson: Visionary, idealist, ideologue

Mark Borrello (University of Minnesota, USA, borrello@umn.edu)

When Richard Dawkins published *The Selfish Gene* in 1976 he opined “Be warned that if you wish, as I do, to build a society in which individuals cooperate generously, you can expect little help from biological nature. Let us try to teach generosity and altruism because we are born selfish.” This solidified the prevailing view of a Darwinian nature as deeply individualistic and competitive. There were, however, alternative perspectives. David Sloan Wilson began developing mathematical models of altruistic populations as a graduate student at Michigan State University in 1975. Over the succeeding four decades, against the current and with a tenacity that can only belong to a true dreamer, Wilson has continued the development of these models and expanded his thinking into the evolution of human societies and the application of evolutionary models to solve contemporary issues like urban racial segregation and income inequality. What began as a theoretical challenge to a highly specific theory has morphed into a complete rethinking of the foundations of evolutionary biology, and an expansion of the ambit of Darwin’s theory to current human problems. In his 2015 book *Does Altruism Exist?* Sloan Wilson continues his challenge to the standard picture. Through the application of his group selectionist models he dreams of rebuilding modern urban environments in more harmonious and sustainable ways. This presentation will examine the long road of an evolutionary visionary whose life-long dream continues to be controversial today.

Neanderthals in space: George Church’s modest steps toward possible futures

Luis Campos (University of New Mexico, USA, luiscampos@unm.edu)

Harvard synthetic biologist George Church has long envisioned possible futures for his field, from the development of MAGE (multiplex automated genome engineering) to the encoding of Shakespeare, the Bible, and his own writings into DNA. With the publication of his Regenesis: How Synthetic Biology Will Reinvent Nature and Ourselves in 2012, however, Church dreamt up the futuristic (and yet atavistic) next step: the cloning of Neanderthals. Such efforts would enable us to recover and understand the nature of "true human diversity," he noted. All that would be needed was a "surrogate mother chimp—or... an extremely adventurous human female.” Such resurrected Neanderthals might "create a new neo-Neanderthal culture and become a political force" and offer new ways of thinking that “could be beneficial." What’s more, this "modest step" could be an important next step in the human colonization of the universe, helping to "get at least some of our genomes and cultures off of this planet.” Indeed, only by “shooting our SCHPON [sulfur, carbon, hydrogen, phosphorus, oxygen, nitrogen] into the void,” as Church envisions the final ejaculation of his seminal techniques, will we successfully seed outer space—not only "with ourselves or our descendants," but with our de-extincted hominid ancestors, the original alpha males. This presentation will take a critical look at the dark side of visionary innovation in biology, exploring the routes to path breaking science while highlighting how dreams may lead to nightmares.

ORGANIZED SESSION STANDARD TALKS – CD-A1

Teaching Brazilian Biology: Historical Case Studies for Nature of Science Education

Orgs.: Nathália Helena Azevedo (Interunit Graduate Studies Program in Science Teaching, University of São Paulo, Brazil, helena.nathalia@usp.br) and Thiago Marinho Del Corso (Graduate Studies Program in Education, University of São Paulo, Brazil, thiagodelcorso@usp.br)

The defense of the use of History and the Philosophy of Science in science education is remarkable in the biological education research and favorable positions to the use of this approach are relatively old, dated from the end of the 19th century. This is due to the expectation that it can make it possible to overcome problems related to the teaching-learning process. Historical cases allow highlighting, for example, the slow processes related to the development of scientific concepts. They also allow analyzing science as a human construct strongly influenced by the sociocultural context, and contribute to the development of a critical understanding of science. However, there is a shortage of didactic materials that portray historical contexts and relate them to the everyday situations and the scientific advances. This gap may hamper the creation of learning environments in which students can build hypotheses, reflect and establish relationships between the scientific concepts studied and the situations experienced in everyday life. To this discrepancy is added the fact that most Brazilian students do not have contact with the contributions and history of our main national scientists, since regional factors related to scientific practice are rarely taken into account. Addressing Brazilian science in science classes can contribute to the students constructing empathy with science, which would allow them to recognize the nature of science (NOS) aspects related to the construction of scientific knowledge. Thus, talking about the history of biological research in Brazil can offer a critical and formative contribution, providing the students with subsidies for a better understanding the directions and paths of research, which are rarely brought into the classroom. In this organized session, it will be presented three historical cases involving scientific research developed in Brazil and designed to promote discussions and thoughts about NOS aspects. The historical cases particularities presented make it possible to explicitly explore certain NOS aspects and can contribute to undoing the image of a ready and finished science originated exclusively from richer and more developed countries. The development of historical cases that address biology research in Brazil contributes to the recognition of a national scientific culture that is currently forgotten in didactic materials in general.

Chair of the session: Nathália Helena Azevedo (Interunit Graduate Studies Program in Science Teaching, University of São Paulo, Brazil, helena.nathalia@usp.br)

Papers:

Carlos Chagas (1879 – 1934) and the triple discovery: A teaching-learning sequence with historical inquiry case and nature of science

Nathália Helena Azevedo (Interunit Graduate Studies Program in Science Teaching, University of São Paulo, Brazil, helena.nathalia@usp.br) and **Thiago Marinho Del Corso** (Graduate Studies Program in Education, University of São Paulo, Brazil, thiagodelcorso@usp.br)

Several countries now include nature of science (NOS) in their curricula, towards helping scientifically literate citizens address everyday issues involving scientific claims. The historical cases are one of the approaches to work with NOS in the classroom, since they contextualize scientific concepts as student engagement, as well as create favorable environments to discuss NOS aspects and highlight misconceptions. Given this scenario, we present "Carlos Chagas (1879-1934) and the triple discovery", a teaching-learning-sequence elaborated as a historical inquiry case for high school students. The narrative presents true and fictitious episodes about Carlos Chagas and his 1909 fieldworks in Lassance (Minas Gerais, Brazil). The researcher's importance in an international scientific context is associated with the triple discovery of one protozoosis (vector, pathogen, and human disease), now known as Chagas disease. His discovery had a great national impact by exposing the bad sanitary conditions of interior country populations, exerting a large influence on the Brazilian sanitary movement that began around 1916. During his investigations, Chagas encountered challenges for interpreting data and observations and relied on significant collaboration from other scientists and the local population of Lassance. By bringing contextualized historical information like these, the historical inquiry case aims to make explicit NOS aspects. Eleven questions aim to promote students' engagement throughout the narrative. The questions are open-ended and allow several answers, favoring students' participation and demanding teacher's ability to listen, consider and continue the narrative in the adequate moment. The NOS aspects included are: (1) the role of economic factors in scientists' work, (2) personal motivations, (3) the analogy between a new disease and others described earlier, (4) the local knowledge in opposition to systematic research, (5) the randomness in scientific discoveries, (6) the interaction among scientists to validate a finding, in contrast to personality conflicts, (7) the complementary roles of laboratory and field studies, and (8) the gap between medical/scientific knowledge and public health actions. This historical inquiry case has been applied in different educational contexts in an effort to make it more robust and clear to students and teachers, especially given its unusual and differentiated approach. Our preliminary results indicate that this is an appropriate option to address Chagas disease and other protozoosis in the classroom, given the lack of instructional materials that contain both a historical and investigative approach to the subject. Such results contribute to the view that the use of historical narratives that focus on the NOS aspects can allow learning science, learning about science, and doing science.

Case study: Johanna Döbereiner and the nitrogen biological fixation

Rodrigo Ponce (Master Student in Science Education – University of São Paulo, Brazil, rodrigopnce@usp.br) and **Ursula Simonetti Lovaglio** (Biology Student – University of São Paulo, Brazil, ursula.lovaglio@usp.br)

Historical case studies are often regarded as important resources for teaching about the Nature of Science to students of different ages. They help develop the understanding of how scientific knowledge is produced and allow us to evaluate different contexts in which it occurs through concrete cases of science production (Allchin, 2013). Understanding the of Nature of Science is one of the three structuring axes of Scientific Literacy (Sasseron, Carvalho, 2011). The present historical case study focuses on the development of Johanna Döbereiner, one of the most important Brazilian scientists. For almost 40 years, Johanna researched soil microbiology and her findings were vital for Brazilian agriculture. Because of her research of Nitrogen Biological Fixation on leguminous plants, the financial costs of soy production were largely reduced, and Brazil was able to reach the position of second worldwide soy producer. Contradicting the world tendency of agriculture production, imposed by the Green revolution, Johanna faced a lot of disbelief and skepticism before her research could contribute to the development of Brazilian agriculture. Throughout almost 20 years, she struggled to prove her findings, gathering evidence and convincing other researchers of such findings. There are important aspects of the Nature of Science which interfered in her work, among others like motivation for researching, getting funding, the lack of scientific literature supporting her claims and the political and economic world and Brazilian contexts. In this case study, we evaluate the observational, conceptual and sociocultural dimensions of science reliability as proposed by Allchin (2013) in an open view of the Nature of Science, instead of the traditional consensus of Views of Nature of Science (VNOS). By focusing on this open view of the Nature of Science, we provide the students with an understanding of how scientific knowledge is produced, highlighting specific aspects that are inherent to the process. The other two axes of Scientific Literacy (Sasseron, Carvalho, 2011), which includes the understanding of concepts and the relationships among science, society, technology and environment can also be strengthened by the use of this case study as a resource for teaching.

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Case study: Different aspects of the nature of science present in a historical case study about Vital Brazil

Adriano Dias Oliveira (Instituto Butantan, Brazil, adriano.oliveira@butantan.gov.br) and **Fernanda Pardini Ricci** (Instituto Butantan, Brazil, fernanda.ricci@butantan.gov.br)

This work aims to identify which aspects of the nature of science (NOS) are present in a case study – Vital Brazil and the specificity of the antiophidic serum – that intends to approach NOS through the history of science using an investigative methodology. The case describes the research carried out by the scientist Vital Brazil, between the end of the 19th century and early 20th century in the city of São Paulo – Brazil –, which resulted in the discovery of the specificity of snake antivenoms. Before the studies made by V. Brazil and initial development of the serum, made by French researchers, there was no effective medical treatment for combating poisoning. The insertion of history and philosophy of science in the teaching of science has been supported by authors who understand that, currently, science education cannot be reduced to the understanding of scientific content, but also it is essential to educate citizens able to act actively in modern society, making decisions linked to their future, as well as the planet where they live. In this context, the history and philosophy of science are important recourses to approach NOS, since they also address political and cultural issues that are part of the science, and which the science is a part of. Allchin (2013) defends that the three main ways to develop the understanding of the NOS are: research or laboratory activities carried out by the student; contemporary case studies on issues of science and technology; historical case studies. The case of the discovery of the specificity of snake antivenoms falls into the third way, which, according to the author, is an excellent resource for students to learn different aspects of the NOS, considering that they are examples of concrete and fully developed scientific cases. From this standpoint, Allchin (2013) developed a framework composed of the main aspects of the NOS divided into three broad categories: observational, conceptual, and sociocultural. Within each category there is a list of elements that interfere in the reliability of a scientific research, and, because of that, they are an essential part of the case studies. The case here analyzed highlights, besides the role of the scientist's personal motivation in determining the course of his research, the importance of empirical evidence to refute popular beliefs and previous scientific knowledge. By systematizing the study of venomous snakes and their poisons, V. Brazil proved the ineffectiveness of popular medications and of the universal serum – supported by the French researcher, Albert Calmette. Thus, it was necessary to use knowledge from different areas of biology in order to establish a new experimental method capable of proving the efficiency of a specific serum for snake bites. The case also develops the idea of the practical application of scientific discovery, demonstrating the social responsibility of scientists.

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ORGANIZED SESSION DIVERSE FORMAT – CD-A2

Dialogue and informal roundtable

Toward a Theory of Organisms: Two Proposals and Three Aims: Using the Theory to Construct Objectivity, Provide Intelligibility and Frame Observations and Experiments

Org.: Carlos Sonnenschein (Tufts University, School of Medicine, Boston, MA, USA, and Centre Cavaillès, Ecole Normale Supérieure, Paris, France, carlos.sonnenschein@tufts.edu)

There is no science without theory. Theories construct objectivity, provide intelligibility and frame observations and experiments. Theories dictate what can be observed. In biology, however, some practitioners claim that facts are what we observe, and thus they dismiss a need for theory. Indeed, because in biology theoretical constructs are so embedded within experimental design, they are kept implicit and thus are seldom reviewed critically. Typical examples are provided by the use of mathematical concepts such as information, program and signal, which have been introduced in biology without proper critical analysis.

Biology has only one broad general theory, that of evolution; which covers long time scales. The success of this theory is demonstrated by the fact that since its inception it has been updated as observations challenge some of its components. In contrast, an overarching theory covering the shorter scale of ontogenesis and the life cycle is lacking. Independently, two groups have proposed principles for the elaboration of such a theory of organisms; both teams will briefly expose their proposals.

Ana Soto will present the work done by the ORGANISM group.

Samuel Scheiner will present the work he has done in collaboration with William Zamer to develop a general theory of organisms that is part of a larger theory of biology.

These presentations will be followed by both a "dialogue" between the members of the 2 working groups and an extended roundtable.

The objective of this session will be to establish a dialogue between these theories and to stimulate a discussion about the principles and the use of a theory of organisms. Theories, like organisms, evolve, adapt, and even die…

Chair: Charbel El-Hani (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), charbel.elhani@gmail.com)

Papers:

Principles for a theory of organisms

Ana M. Soto (Tufts University School ofMedicine, Boston, MA, USA, ana.soto@tufts.edu)

The ORGANISM group proposes that organisms are agents capable of creating their own norms; harmonizing their ability to create novelty and stability, and combine plasticity with robustness. Here, three principles for a theory of organisms are articulated; namely, a) the default state of proliferation with variation and motility, b) the principle of variation and c) the principle of organization. These principles provide an understanding of the organism's ability to create novelty and stability and to coordinate these apparent counterparts. These principles profoundly change both biological observables and their determination with respect to the theoretical framework of physical theories. This radical change opens up the possibility of anchoring mathematical modeling in biologically proper principles.

A general theory of organisms

Samuel M. Scheiner (U.S. National Science Foundation, sscheine@nsf.gov)

The overall structure of the theory of organisms proposed by Scheiner and Zamer is conceived as hierarchical; the general theories consist of sets of fundamental principles that serve to make explicit assumptions that are contained in more specific constitutive theories and models. This hierarchical theory structure, and the explicated principles, organize our knowledge in a way that makes the development of new models simpler and more transparent and allows for a unification of seemingly disparate models.

Dialogue and extended roundtable

ORGANIZED SESSION STANDARD TALKS – CD-A3

Collaboration in Contemporary Bioscience: Sociological and Philosophical Approaches

Org.: Phillip Honenberger (Department of Biological Sciences, Dartmouth College, USA, Phillip.Honenberger@Dartmouth.edu)

Contemporary bioscience is frequently if not essentially a collaborative enterprise. While much philosophy of biology treats the cognitive and observational agency of single scientists, or an idealized subject, rather than collective activity, as paradigmatic, recent work has argued for shifting to a social-level perspective in the analysis of contemporary science, a perspective within which collaboration would figure more prominently. In this session, we seek to advance theoretical discussion of collaborations in contemporary biology. Questions to be addressed include: What motivates collaborations in biological science? What are the effects of collaboration on topics addressed, methods utilized, and patterns of publication and citation? How do collaborative projects work – for instance, how are labor and epistemic authority divided among collaborators? Are there structural differences between interdisciplinary and intra-disciplinary collaborative projects in biology, and if so, what are they and what are their effects? Papers in this session draw from both sociological and philosophical resources; indeed, understanding scientific collaboration poses challenges for which an integrated sociological and philosophical approach is especially promising.

Chair of the session: Sabina Leonelli (University of Exeter, UK, S.Leonelli@exeter.ac.uk)

Papers:

Collaborative science and the epistemic consequences of project management (or its lack thereof): Insights from an interdisciplinary research collaboration and data infrastructure development project
Niccolò Tempini (University of Exeter, UK, n.tempini@exeter.ac.uk)

This research is concerned with highlighting and discussing the role of project management in interdisciplinary scientific collaborations. The problem domain of project management is the organization of collaborative process. Project management is an organizational function concerned with the coordination and division of labour, and the resourcing, scheduling and pacing of collaborative work. In project management work, these aspects are evaluated in relation to the broader institutional context in which the activity is embedded, including, for instance, funding programmes and an organization's strategic directions. The paper argues that project management is not merely a support function of scientific collaboration with no power to shape the trajectory of a project. On the contrary, project managers, despite they are not directly involved in scientific research activity as usually intended, can play a crucial role in ensuring that collaboration ensues consistently, and shared goals in untested grounds of scientific exploration are identified and worked towards. The paper builds on a case study of the Medical and Environmental Mash-Up Infrastructure (MEDMI), a multi-partner, interdisciplinary research project set up to 1) investigate relationships between weather and environmental factors and human health through the sharing and linkage of large datasets, and 2) explore the development of state of the art computational tools for distributed analysis of interdisciplinary linked datasets.

The paper shows, by documenting how project managers, and their lack thereof, have a role in the evolution of MEDMI, that project management turned out to have a fundamental role in coordinating and pacing interdisciplinary communication and collaboration. Events in the history of MEDMI associated with project management (or its lack thereof) changed aims, expectations and execution of both scientific research and infrastructure development. The need for robust project management was exacerbated by some of the challenges that the organization of data-centric science today pose for interdisciplinary projects. The paper argues that project management is instrumental and crucial to start the development of new interdisciplinary repertoires, especially so when separated and parallel enactment of established, disciplinary repertoires would not suffice to successfully tackle the problem at hand and meet a project's expectations. Project management can be a fundamental, structural feature at the centre of interdisciplinary, collaborative science.

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On the dynamics of collaborations in contemporary Biosciences, with lessons drawn from Nature

Phillip Honenberger (Department of Biological Sciences, Dartmouth College, USA, Phillip.Honenberger@Dartmouth.edu)

I sketch a general model of the fine-structure of collaborative dynamics in science that incorporates parameters such as degree of co-local activity, degree of intra- or inter-disciplinarity, and degrees and types of division of labor, authority, and responsibility. Such a model of collaborative dynamics may be situated within broader functional-sociological models and may prove useful in characterizing the outcomes of scientific collaborations of different types. In constructing this model, I draw relevant parameters, distinctions, and open empirical questions from the accumulating theoretical literature on scientific collaborations, including sociological and philosophical sources (e.g. Andersen 2015; Ankeny and Leonelli, 2016; Gerson, 2013; Jacobs and Frickel, 2009; Maienschein, 1993). I also use data drawn from the author affiliations and "contributions" sections of Nature, Nature

Genetics, and Nature Plants (mandated for all co-authored research articles published in those journals since 2009; see Editors, Nature, 2009) to inform and test this model. In addition to information about co-location and intra- or inter-disciplinarity contained in author affiliations, "contributions" sections briefly describe each co-authors' practical contributions to collaborative teams including such activities as design of experiments, conduct of experiments, data analysis, contribution of data or raw materials, study conception, and writing of papers. The breakdown and overlap between such individual contributions in samples from Nature, Nature Genetics, and Nature Plants (both individual articles and calculated averages) are described and discussed in detail.

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INDIVIDUAL PAPERS SESSION – MINAS1

Reductionism: Philosophical Perspectives

Chair of the session: Tudor Baetu (Department of Philosophy, University of Bristol, UK, tudor.baetu@bristol.ac.uk)

Papers:

Getting over atomism

Daniel C. Burnston (Philosophy Department and Tulane Brain Institute, Tulane University, USA, dburnsto@tulane.edu)

Functional decomposition—the division of a biological system into functionally defined parts—is one of the most important epistemological aims in biology and neuroscience, and it is central to mechanistic explanation. However, many deny the possibility of functional decomposition. Skeptics base their views on the idea that biological systems are context-sensitive, dynamic, and interactive in their behavior: the intuition is that if what a given part does depends on dynamic, contextually shifting interactions with the other parts of the system, we cannot use the function of the part to explain what that system does. These arguments have historical analogues in debates about holism, emergence, and reduction.

I contend that these properties do not tell against functional decomposition as such, but only against a particular version, which I call "atomism." Atomism is the conjunction of two related theses, namely that a part's function is something that it does intrinsically, and that function ascriptions cannot make reference to the broader system in which the part operates. I argue that, despite the falsity of these individual theses, a robust notion of functional decomposition is defensible. That is, atomism is false, but decomposition is possible anyway.

The argument walks through the three properties—context-sensitivity, dynamics, and network-dependence—and shows that while they are incompatible with atomism, they are compatible with decomposition. I base my argument on current results from systems neuroscience. A variety of recent studies have shown that neural signals are multi-plexed. While the activity of any given cell or group of cells can carry multiple distinct types of information, its frequency can be used to disambiguate the multiple potential meanings. Put simply, the very same signaling unit can represent different information at distinct frequency bands. As such, a decoding system with sensitivity for the correct frequency can extract a particular sort of information from a signaling unit whose overall semantic properties are multiple and contextually varying. An important mechanism for this selective readout is synchronized oscillation: one area receives a signal encoded at another by sharing a phase relationship with the sender. Sometimes (for instance, in the case of working memory) this synchrony is mediated by further parts of the brain. However, in each case different functional roles can be given to the distinct parts—for instance, the part that mediates the context-appropriate synchrony, compared to the parts that represent the relevant information. Decomposition is only questioned if we adopt atomism, which, I suggest, we should reject.

Once atomism is rejected, we can see that, far from being incompatible with decomposition, network interactions and dynamics function to help implement functionally specific, decomposable interactions between parts whose behavior is generally context-sensitive. I will conclude by suggesting that this kind of decomposition is sufficient for the project of mechanistic explanation in neuroscience.

Human behaviour, reduction and the lack of lower-level warrants

Nahuel Pallitto (Philosophy of Biology Group, University of Buenos Aires/National Scientific and Technical Research Council, Argentina, nahuelpallitto@gmail.com)

Nowadays, several research programmes focus on giving biological explanations of human behaviour. For example, areas such as Behaviour Genetics, Behavioural Ecology, Neurobiology and Evolutionary Psychology, intend to understand why and how certain behaviours manifest in human beings from a biological perspective. Most of these explanations involve the recognition and characterization of distinct entities, properties, phenomena or processes at different levels of organization, together with a description of their relationships. However, one commonality between the fields mentioned above is that they all give explanatory privilege to genetic entities or processes. Therefore, it seems that genetic understanding have become the last and unquestionable level at which all explanations must aim. But which entities, properties, phenomena or processes should be considered and which role they occupy in human behaviour explanations are not obvious and had been at the core of many biological and philosophical discussions.

One the main discussions in Philosophy of Biology focuses on the possibility and convenience of what is called explanatory reduction. What is a stake in these debates is whether behaviours (higher-level phenomena) can, and to what extent, be explained by physiological or molecular processes (lower-level features). Several requirements have been postulated to be necessary in a successful explanatory reduction. For instance, for a reductive explanation to be effective, there must be lower-level warrants, some sort of validation from theories or experiments of research programmes which focus on such lower-level themes. Under this criterion, for example, a genetic explanation of human behaviour could not violate any knowledge about how genes operate or are used at the cell level, nor any knowledge of the several levels of organization between the genes and the organism.

The purpose of this work is to analyze whether biological reductive explanations of human behaviour have lower-levels warrants. In order to accomplish this aim, I will first characterize reductive explanations in four different research programmes which make use of biological explanations of human behaviour: Behavioural Ecology, Behaviour Genetics, Neurobiology and Evolutionary Psychology. To do so, I will explore some late papers of the main research programmes' journals considered in this work. Among others, the papers will be selected from Behavioral Ecology, Behavior Genetics, Neuron and Evolutionary Psychological Science. Which entities, properties, processes and relationships among them are considered in human behaviour explanations will be established by these readings. Furthermore, a characterization of the different models of explanatory reduction will be offered. Secondly, I will confront these assumptions with knowledge from other lower-level research programmes, such as Physiology and Molecular Genetics. Some of the questions I will try to answer are: Are the assumptions behavioural explanations make about the role of genes warranted by actual knowledge in molecular genetics? Are there any differences between the warrants needed by the different research programmes considered?

One of the main conclusions of this work is that none of these approaches have actually the proper lower-level warrants to succeed in explaining human behaviour reductively.

Omics in cancer research: Winds of change or same old story?

Nicolás José Lavagnino (University of Buenos Aires/ National Scientific and Technical Research Council (CONICET), Argentina, nlavagnino@gmail.com), Marta Bertolaso (Campus Bio-Medico University of Rome, Italy, m.bertolaso@unicampus.it) and Guillermo Folguera (University of Buenos Aires/ National Scientific and Technical Research Council (CONICET), Argentina, guillefolguera@yahoo.com.ar)

Since the conception of the Human Genome Project in the mid-1980s and the subsequent development of Omics, it is not an exaggeration to affirm that these areas of knowledge have become relevant within the natural sciences. Also, from the very beginning, Genomics and Omics have presented a clear intention of generating knowledge and technologies to intervene in socioeconomic aspects of human societies, especially within the health sector. For example, there are two consortium-type research initiatives, "The Cancer Genome

Atlas" and "The International Cancer Genome Consortium", entirely dedicated to genomic investigation of cancer.

In this context, the main concern in the present work is to analyze whether the novel aspects brought about by Genomics have an influence, and how they are embodied, in Cancer Research. We will address two issues that are of relevance both to Genomics and Cancer Research. Firstly, we will inquire if explanations of biological phenomena are constructed from a complex perspective and, secondly, if the hierarchical view of life is included or excluded.

Our intended analysis has a 2-step structure: (i) the analysis of Genomics itself, then moving to (ii) studies where Genomics is used in Cancer Research.

In the case of complexity, even if Genomics has incorporated complex conceptualizations of the action of genes in the genotype-phenotype relationship, when it comes to its usage in Cancer Research these complex conceptualizations are not frequently found. Studies show that after a genomic-scale analysis, the focus is turned toward previously known "cancer genes" as elementary isolated units, leaving aside systemic interactions between them and external factors that influence both the elementary units (their form, action or state) and also their interactions.

In relation to the inclusion of a hierarchical view of life, given the particular characteristics of Genomics, a new level of the biological hierarchy could be proposed: the "genomic" or "genome" level, independent from the traditional "gene" level. Nevertheless, in traditional Genomics this novel "genome" level is not clearly conceptualized, at least not in an ontological and epistemic dimension. When we look at genomic investigation performed in Cancer Research there is a peculiar situation. Even when there is a recognizable tradition of Cancer Research which considers the neoplastic process in a hierarchical configuration, this hierarchical view is set aside when Genomics intervenes.

In conclusion, we have found that when Cancer Research meets with genomic investigation, the particular aspects found in Genomics regarding complexity and hierarchy are not recovered in their original form. The analysis performed demonstrates that, as expected when two areas of knowledge relate, the relationship between Genomics and Cancer Research is far from being simple and straightforward. Finally, we will mention some current epistemological discussion that contributes to this analysis and debate.

INDIVIDUAL PAPERS SESSION – MINAS2
Primate Evolution: Theoretical and Philosophical Perspectives
Chair of the session: Oren Bader (The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel, oren.bader@gmail.com)

Papers:

The sexual selection of Hominin bipedalism
Michael Dale (Department of Philosophy, The University of Texas at Austin, USA, michaeldale@utexas.edu)

In this paper, I advance a novel theory on the evolution of hominin bipedalism. I begin by arguing extensively for how the transition to bipedalism must have been problematic for hominins during the Neogene. Due to this and the fact that no other primate has made the unusual switch to bipedalism, it seems likely that the selection pressure towards bipedalism was unusually strong. With this in mind, I briefly lay out some of the most promising theories on the evolutionary origin of hominin bipedalism and show how most, if not all, fail in the face of the need for an unusually strong selection pressure. For example, some theories maintain that hominins became bipedal so they could use their hands for carrying infants, food, or other valuable objects. But extant apes are able to carry objects in one of their front limbs (while walking with the other three), and thus it does not seem plausible that our hominin ancestors went through the troublesome transition to bipedalism just so they could carry objects a little more efficiently. After I show that past theories are wanting in the face of this challenge, I argue that there is only one selection pressure powerful enough to instigate a strange and problematic evolutionary adaptation like bipedalism, and that is sexual selection. Specifically, from the fact that bipedal locomotion is an important strategy for intimidating others and ascending the dominance hierarchy in extant apes, I argue that for no particular selective reason bipedal locomotion became a signal for high fitness (much as a large and intricate tail became a signal for high fitness for peahens), and this led to the trait being continuously reinforced in spite of all its deleterious fitness consequences.

Cognitive complexity in primates: The social mind

Alba Leticia Pérez-Ruiz (Center of Philosophical, Political, and Social Studies Vicente Lombardo Toledano (CEFPSVLT), Mexico, aletper@gmail.com)

One of the subjects of attention in the study of non-human primates focuses on explanatory hypotheses on the evolution of primate cognitive capabilities. In this regard, it has been noted the importance of complex social interactions that arise within primate groups, as it is the case of triadic interactions, which may involve: third-party recruitment, redirection of aggression, and reconciliations with third parties, among others. Recognition of the relationship between other individuals is also a relevant topic when speaking of social complexity. On the other hand, the study of cognitive abilities highlights the evidence on social learning and the use of tools. In addition, it is worth mentioning evidence about behaviors that could involve deception strategies in some species. In the study of primate behavior, speaking of cognitive abilities in the social context, relevant questions arise: what is the relationship between brain size and social complexity?, is there a relationship between demands of group life and evolution of cognitive abilities?, could we talk about social intelligence vs ecological intelligence?, are there differences in cognitive skills between different species of primates?, is there a greater cognitive complexity in primates with respect to other species?, what is the social function of the mind?, do non-human primates have a theory of mind?, what can be said about the intentional states in higher primates?, what is known about metacognition?, at what level can one speak of cultural behavior in non-human primates?. These are some of the questions that have been the subject of great controversy in recent years. The purpose of this paper is to analyze the explanatory proposals around the complexity of social behavior and cognitive abilities of non-human primates in relation to the evolution of a social mind, as a tool to understand the evolutionary origins of human social cognition.

'Being in a group' – The emotional scaffolding of the evolution of collective intentionality

Oren Bader (The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel, oren.bader@gmail.com)

Michael Tomasello (2008; 2009; 2014) argues that the evolution of human social cognition mirrors children's developmental stages. On the basis of his studies on the cognitive and social development of children, he recently suggested (2014) that humans first evolved individual cooperative intentionality and then developed distinct social capabilities and collective intentionality. My position, which is based on considerations from evolutionary biology and phenomenology, is diametrically opposite: I underscore the priority of the group level in the evolution of human sociality and suggest that early humans first evolved a basic sense of being-in-a-group, which I characterize as primary collective intentionality, and this enabled the fostering of refined socio-individual capacities such as those evident in Homo sapiens. Specifically, I argue that the evolution of a primary communal sense, already occurred in small Homo erectus groups, and this had a profound influence on early humans' activities, practices, and cognitive-emotional traits, encouraging the construction of shared experiences and group skills in early human societies. This primary collective intentionality was later broadened and refined through co-evolution with other communal capacities, leading to the construction of the forms of collective intentionality and advanced social skills that we see in modern humans.

My model is based on the following assumptions: first, I suggest that group experiences had a profound influence on humans' relationships with their environments, in particular on the construction of the human social niche. Second, I propose that these experiences were based in early human populations on basic collective intentionality. Following Hrdy's (2009) view, I suggest that this primary capacity for a group perspective was grounded in the construction of emotional traits, and this in turn enabled the human intellectual evolution. Third, on the basis of archeological evidence and comparative data I argue that Homo erectus hominins were already highly cooperative and manifested collective intentionality, which significantly affected the way they attended to and cooperated with the other members of their group. Finally, I argue that these considerations suggest that the group preceded and enabled the fostering of human modern social cognition.

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INDIVIDUAL PAPERS SESSION – MINAS3
Gender and Race: Historical and Philosophical Studies
Chair of the session: Donald Luke Opitz (School for New Learning, DePaul University, USA, dopitz@depaul.edu)

Papers:

Victoria domesticates Amazonia: Gender and Botany in nineteenth century British surveys of Guiana

Donald Luke Opitz (School for New Learning, DePaul University, USA, dopitz@depaul.edu)

In the early decades of the nineteenth century, a series of British-sponsored expeditions in Guiana resulted in a range of botanical acquisitions, most emblematically the sensational discovery and domestication of the gigantic water lily named "Victoria regia" (today, Victoria Amazonica). In this paper, I will reexamine this case of British colonial botany through the lens of gender to ask the following questions: How did colonial botanists invoke gender to describe and illustrate their observations of the Guianan landscape and its specimens, such as the Amazonian lily? Conversely, how did the reconstruction of those observations as British botanical objects shape British ideas about gender, especially within the context of the empire's expansion and the ascension of the lily's namesake, Princess Victoria, to the throne? To answer these questions, I will focus on analyses of the texts and imagery of the colonial botanists involved in this case. I will suggest that the lessons from this analysis may broaden our historical understanding of the interrelationship between gender and botany, principally through a consideration of the political context in which that interrelationship has taken shape. In short, this paper gives a rereading of the Victoria regia sensation through the lens of gender and argues for a more nuanced, contextualized interpretation of the relationship between gender and botany in the early nineteenth century.

A fruitful field for women: Oral histories of 20th century women biochemists

Benjamin Rylie Palmer (Department of Science and Technology Studies, University College London (UCL), London, UK, benjamin.palmer.15@ucl.ac.uk)

Women are underrepresented in all areas of UK science, but the disparity is least in the life sciences and fields allied to medicine.

Biochemistry has been a particularly strong field of excellence for British women scientists, with nearly 900 women publishing in the Biochemical journal in the 25 years succeeding the Second World War. The existing body of literature of women's involvement in science in the 20th century presents identifies the presence of supportive male leaders, the expansion of employment prospects in the postwar welfare state and identification with 'feminine' skills as prevailing theories. The absence of detailed historical investigations into the lives and careers of women scientists means that the explanations for these patterns frequently lack a detailed empirical basis.

In an attempt to assess the validity of these explanations, this paper draws on oral history interviews collected from 11 women bioscientists. Through reflection on their careers, the interviews explored internal and external motivations and decision making in their career choices. The experiences and stories shared by these women painted a very complex, and often surprising picture. Whilst the limited sample size prevents causal explanation, the insight gained is significant. When compared to the existing literature, the observations offer a novel historical narratives of women's involvement in science, insight into the disciplinary nature of the biological sciences in the 20th century, as well as suggesting fruitful areas of for further research.

Race, racism and science: Contemporary perspectives

Leyla Mariane Joaquim (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), leylamariane@gmail.com)

Our eyes tell us people look different. Human diversity fascinates some people and causes sense of otherness to others. For centuries scientists and anthropologists have classified humans into races, based on point of views as diverse as human diversity itself. This paper presents a set of historical episodes in which Science have either supported or disclaimed racist views. This study is part of a broader project in Science Education, which investigates pedagogical interventions and approaches related to race and ethnic relations. The research promotes educational approaches concerned with a formation for citizenship engaged with the fight against racism, discrimination and with an appreciation of ethnic and racial diversity. Here we focus on contemporary science, namely, late twentieth and twentieth-first centuries. The central question underlying the selected historical episodes is: What does Science have to say about race in our species? Throughout the centuries a great deal of scientific evidences had accumulated to support that race is not a biological reality. Today the vast majority of those involved in research on human genetics and variation would agree that biological races do not exist among human. However, racism still abounds in modern scientific discourse. We approach both studies that have rejected the biological concept of race - such as Richard Lewontin study from 1972 – and neo-racist studies – such as contemporary researchers funded by the Pioneer Fund. By comparing non-racist and neo-racist studies, we highlight biological determinism and reductionist fallacies that led to scientific racism and to old and new attempts to marginalize human groups and treat them as inferior. We conclude that neo-racists views are rooted in the scientific traditions of the nineteenth century, and in even earlier philosophical traditions and, accordingly, ignore scientific development. We claim that scientists should try to keep the results of their research from being used in a biased way that would serve discriminatory ends.

INDIVIDUAL PAPERS SESSION – AG-BOT
Biological Education II

Chair of the session: Agustín Adúriz-Bravo (Faculty of Exact and Natural Sciences, University of Buenos Aires, Argentina, aadurizbravo@cefiec.fcen.uba.ar)

Papers:

On the construction of "biology stories": The value of historical narratives for biology education

Agustín Adúriz-Bravo (Faculty of Exact and Natural Sciences, University of Buenos Aires, Argentina, aadurizbravo@cefiec.fcen.uba.ar) and Andrea Revel Chion (CeFIEC Institute, Faculty of Exact and Natural Sciences, University of Buenos Aires, Argentina,
andrearevelchion@yahoo.com.ar)

Bruner reminds us that science is not "out there in nature", but in the minds of people who seek to understand nature –scientists, but also teachers and students. "Understanding" can here be conceptualised as an articulated set of performances enabling full exercise of citizenship, i.e., facing problems in the world with social value and intervening on them with models. The question would then be which the appropriate "vehicles" are to facilitate students' solvent understanding of scientific concepts, in particular from biology.

Narratives can be one such vehicle in the case of biology teaching, since they: 1. exhibit sequentiality and historicity, which help building genetic, functional and evolutionary explanations; 2. relate the general plot with each constituent element, providing context to understand that discoveries do not occur "in void"; 3. include a plethora rhetorical figures, such as metaphor, metonymy and synecdoche, that make them more comprehensible and memorable in comparison with expository texts.

When narratives, understood as a genuine "way of thinking", as a logic to organise human knowledge on the natural world, are used within biology teaching, they provide ways of anchoring biological content in the minds of students. We can use historical narratives presenting biological problems that were resolved, to focus on the creative processes in science rather than on "science as conclusions". Narratives allow teachers to include historical, psychological, political and economic aspects, collaborating in conveying ideas on the nature of biology.

Our approach is contextual and multi-referential; it gives value to the interaction of contexts in science-in-the-making, humanising school science. This "humanisation" of biological content generates interest in the audiences (primary, secondary or University students), as scientific results appear as elements to solve the unexpected and tackle with the unbalance introduced by the problem. This motivation effect sustains students' attention founded on a structure of questions referred to temporality, causality and consequence, whose answers are "delayed" by the narrative until the dénouement.

Narratives constructed with didactical purposes unveil the aspirations, aims and urgencies that lead to failure and success in the history of biological thinking, broadening the scope of what should be taught beyond the "correct results" usually constituting the core of curricula, and adding information on the epistemological question of how biologists know what they know. Thus, "biological stories" (narratives constructed using the history of biology) are a means to integrate different references and perspectives, to recover what is put aside in logical-linguistic presentations, to present a more complete picture of the endeavours leading to postulation of key biological ideas – the cell, inheritance, natural selection, trophic relations, health, etc.

In this presentation, we discuss –with philosophy and history of science– the construction and implementation of "biological stories" (identification of Chagas-Mazza disease, the need to develop in the 19th century a "tropical medicine" in the imperial countries that had colonies, the health consequences of the War of the Triple Alliance against Paraguay, among others). Such stories are considered material that is worth to be narrated in biology classes.

Modeling socioscientific issues with laws for high school biology teaching

Ítalo Nascimento de Carvalho (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), italonc@hotmail.com) and Dália Melissa Conrado (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE). Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, dalia.ufba@gmail.com)

Socioscientific-based education intends to prepare students to analyze environmental and social impacts of scientific and technological innovations and developments, as well as impacts of society on science and technology. This could be the starting point for students to develop a critical perspective that allow them to judge these relations. Moreover, they could also learn to evaluate the ethical values of society, and ways to improve it towards a larger eco-social justice. The most suitable themes for this approach are controversial, and they require a certain level of moral reasoning and ethical assessing, such as abortion, transgenic organisms and climate change. Not surprisingly, socioscientific issues are of interest not only in classrooms: once they interfere with society, they inspire the creation and/or modification of laws and other legal devices. In fact, literature suggests that it is common students mentioning laws during discussions, and they can do it with different purposes as they engage in argumentation sequences. In this work, we explore the use of laws in socioscientific-based biology education. We briefly review how laws are used by students in discussions, mainly on how they are related to ethical aspects of decisions and actions. We also show some possibilities of using bills for modeling didactic interventions, as we consider them a valuable tool to help biology teaching to reach the four levels of a politicized science curriculum, as proposed by Hodson. Lastly, we present a didactic intervention to high school based on a Brazilian bill about the labeling of food products containing transgenic organisms.

Evolutionary explanation and religious beliefs: Where the conflict really lies

Frederik Moreira-dos-Santos (Center of Science and Technology in Energy and Sustainability, Federal Universiy of Recôncavo da Bahia, Brazil, fredsantos@gmail.com)

This presentation discusses how to deal with the relations between different cultural perspectives in classrooms. In order to deal with such relations of conflict or dialogue we show the importance of articulating both conceptions: understanding and evolutionary explanation, from a pragmatist perspective. It combines educational and philosophical interests. In educational terms, our concerns are related to how science teachers behave in multicultural classrooms. In philosophical terms, we are interested in reflecting on the relations between understanding, evolutionary explanation and knowledge. We focus on problems generated by possible conflicts between scientific and religious beliefs in the school environment. Science education literature has shown that literalist religious students have affective barriers to understand or accept evolutionary explanations. We argue that absolutist and totalitarian positions by teachers and/or students are the reason to the construction of such emotional barriers. We characterize an individual's position as absolutist if he or she takes some way of thinking as the only one capable of expressing the truth concerning the description and explanation about all state of affairs, without open-mindedness to understand different interpretative perspectives. When someone attempts to impose her or his interpretation about the facts to others, we call his or her position totalitarian. From this last stance, any other perspective is taken to be false a priori and, accordingly, as a putative target to be suppressed or adapted to certain way of thinking that seeks complete hegemony. We suggest, instead, that a pluralist and fallibilist evaluation of our own intellectual stances may help to construct a more respectful appraisal of the diversity of students' beliefs by both students and teachers. We believe that such evaluation may promote a richer openminded intellectual environment to understand scientific explanations despite the non-naturalist stances defended by students.

TUESDAY JULY 18
17:30-19:00 – Parallel sessions 7

ORGANIZED SESSION STANDARD TALKS – AG-ZOO
Dreamers, Visionaries, and Revolutionaries in the Life Sciences (cont.)
Org.: Michael Dietrich (Dartmouth College, USA, michael.dietrich@dartmouth.edu)
Chair of the session : Oren Harman (Bar-Ilan University, Israel, oren.harman@gmail.com)
Panel discussion:
Oren Harman
Mark Borrello
Luis Campos

ORGANIZED SESSION STANDARD TALKS – CD-A1
Toward a Theory of Organisms: Two Proposals and Three Aims: Using the Theory to Construct Objectivity, Provide Intelligibility and Frame Observations and Experiments
Orgs.: Ana M. Soto (Tufts University School of Medicine, Boston, MA, USA, ana.soto@tufts.edu) and Matteo Mossio (Institute of History and Philosophy of Sciences and Techniques (IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne), France, matteo.mossio@univ-paris1.fr)
Chair: Samuel M. Scheiner (U.S. National Science Foundation, sscheine@nsf.gov)

Papers:

Modeling mammary organogenesis from biological first principles
Maël Montévil (Laboratory Matter and Complex Systems, University of Paris 7 Diderot, and IHPST, University of Paris 1, France, mael.montevil@gmail.com)

The default state of cells and its physical constraints. The typical approach for mathematical modeling in biology is to apply mathematical tools and concepts which originated from theoretical principles in physics and computer sciences. Instead, the authors propose to construct a mathematical model based on proper biological principles. Specifically, they use principles identified as fundamental for the elaboration of a theory of organisms, namely i) the default state of cells and ii) the principle of organization. Cells display agency, move and proliferate unless constrained. They exert mechanical forces that i) act on collagen fibers and ii) on other cells. When fibers organize, they constrain the cells on their ability to move and to proliferate. The model exhibits a circularity that can be interpreted in terms of a closure of constraints. Implementing the mathematical model shows that constraints to the default state are sufficient to explain ductal and acinar formation, and points to a target of future research.

Carcinogenesis explained within the context of a theory of organisms
Carlos Sonnenschein (Tufts University, School of Medicine, Boston, MA, USA, and Centre Cavaillès, Ecole Normale Supérieure, Paris, France, carlos.sonnenschein@tufts.edu)

The tissue organization field theory (TOFT) posits that cancer is a tissue-based disease whereby carcinogens (directly) and mutations in the germ-line (indirectly) alter the normal interactions between the diverse components of an organ, such as the stroma and its adjacent epithelium. The TOFT explicitly acknowledges that the default state of all cells is proliferation with variation and motility. When taking into consideration the principle of organization, the authors posit that carcinogenesis can be explained as a relational problem whereby the release of constraints created by cell interactions and the physical forces generated by cellular agency lead cells within a tissue to regain their default state of proliferation with variation and motility.

A theory of ecoimmunology and its relationship to a general theory of organisms
Samuel M. Scheiner (U.S. National Science Foundation, sscheine@nsf.gov)

The theory of ecoimmunology consists of four propositions about organismal energy budgets and ecological interactions. These propositions can be used to build models which is demonstrated with a model of energetic and material trade-offs. This model integrates a variety of aspects of immune function and evolution that previously have been considered by separate models. The role of a general theory of organisms in revealing hidden assumptions is demonstrated, as well as how this model can be related to models of life history evolution that sits within a theory of evolution.

INDIVIDUAL PAPERS SESSION – CD-A2
Cultural Evolution

Chair of the session: Lorenzo Baravalle (Center of Natural and Human Sciences - Federal University of ABC (São Bernardo do Campo - Brazil), lorenzo_baravalle@yahoo.it)

Papers:

Invariance and unification in the theory of cultural evolution

Lorenzo Baravalle (Center of Natural and Human Sciences - Federal University of ABC (São Bernardo do Campo - Brazil), lorenzo_baravalle@yahoo.it)

Inspired by Woodward's account of causation and explanation and Sober's conception of the theory of natural selection as a theory of forces, Gustavo Caponi has recently defended that biology – and, especially, evolutionary biology – is grounded on a "mosaic of invariants", that is, a net of causal regularities which, although not stable and universal enough to constitute genuine causal laws, may guarantee the explanatory autonomy of this discipline by supporting a number of relevant counterfactuals. In spite of lacking proper causal laws, evolutionary biology is a unitary theory because invariants are, in some sense, unified by other kinds of laws – the zero force laws, like the Hardy-Weinberg equilibrium, and the consequence laws, like the equations of population genetics –, which connect them within a more general theoretical framework. Might the explanatory structure of a hypothetical unified theory of cultural evolution – like Boyd and Richerson's Dual Inheritance Theory – be conceived in a similar way? The goal of the present talk is to provide an answer to this question, by considering two related problems. Firstly, I shall attempt to identify the zero force law and the consequence laws of the theory of cultural evolution. Secondly, I shall assess one case study in order to determine if the causal regularities that are invoked in cultural evolutionary explanations may count as genuine invariants, in Woodward's and Caponi's sense.

Cultural evolution: Is language a special case?

Carlos Gray Santana (Department of Philosophy, University of Utah, USA, c.santana@utah.edu)

I argue that the leading general models of cultural evolution (cultural group selection, meme theory, cultural attractors, Evolutionary Psychology, etc.) capture only bits and pieces of what we know about language change, which is perhaps the most well-studied cultural-evolutionary phenomenon. This raises the question, is language a special case of cultural evolution, one that these theories don't have to fully account for? I examine three possible reasons for thinking so: linguistic differences aren't adaptive differences, language has discrete units, and language is more biologically determined than most cultural phenomena. I make the case that none of these is particularly unique to language, and so general models of cultural evolution need to better account for the empirical data on language change.

INDIVIDUAL PAPERS SESSION – CD-A3

General Epistemology and Biology I

Chair of the session: Octavio Valadez-Blanco (Department of Humanities, Metropolitan Autonomous University-Cuajimalpa; Science and Humanities Program, National Autonomous University of Mexico (UNAM), Mexico, hoktavius@yahoo.com.mx)

Papers:

The concept of semantic fitness inside a semiotic account of natural kind terms

Daniel C. Baiardi (Federal Institute of Bahia, IFBA, Campus Salvador, Brazil, baiardi.daniel@gmail.com)

The purpose of this paper is to present a new framework to an theory of meaning when applied to natural kind terms. The contemporary debate is mainly motivated by the failure and inadequacy of the dominant descriptions of how a community can create and make use of natural kind terms. Consensually, we consider that empirical sciences cluster the particular entities that are its objects of study in types (e.g., horse, water). This picture of our relations with natural kinds and ists terms is conduced under the methodology of inquiry developed by C. S. Peirce. It works with an gradualist and evolutionary approach to meaning and reference. Cognitive computing studies was introduced the concept of semantic fitness to model an optimum level of abstraction in order to produce more meaningful representations into a given ontological domain, classifying particular objects in a dynamic and progressive way. I will introduce here this concept for an evolutionary interpretation of Peirce's theory of meaning and try to expose the advantages of this framework. Instead descriptions of properties clusters (as a descriptivist) or a search for essences (as an essentialist), the pragmatist philosophy of language attempts to describe practical effects in constructing a class and to use a token to describe it. Thus, Classical Pragmatism assumes a strong continuity between animal life and cognition. This naturalistic maneuver allows the construction of a broader epistemology, with greater explanatory power, transcending the boundaries of what is human and searching for other levels of objectivity.

Cancer in the civilizing process: An epistemological and educational approach to historical and socio-environmental roots

Octavio Valadez-Blanco (Department of Humanities, Metropolitan Autonomous University-Cuajimalpa; Science and Humanities Program, National Autonomous University of Mexico (UNAM), Mexico, hoktavius@yahoo.com.mx)

In order to understand the different approaches and accounts in cancer research, I propose a perspective that distinguishes the complexity of cancer, upon three epistemological frames: ontogenetic frame, where we can understand the mechanisms that produce cellular and histological cancer processes; the epidemiological frame, where we analyze exposure of populations or individuals to certain types of environmental factors; and the evolutionary frame, where the disease develops in the history of multicellular organisms and, therefore, this is expressed in terms of inter- and intra-specific questions.

Under these approaches, human history is conflated as part of the evolutionary process, or as a narrative explanation of epidemiological data: human history and culture does not change cancer nature, but in any case only modifies its incidence.

In this paper I want to address the importance of the historical and social processes in cancer incidence, which I call "civilizing frame", in order to analyze the establishment and expansion of cancer in the Capitalist modernity.

My argument is based on empirical studies that propose that high incidence of cancer is a product of modern society (Zimmerman (2010), and not just a "natural" phenomenon related to aging populations; therefore, there is a relationship between the ecological and environmental transformation in modern civilization, and the modern burden of complex diseases as cancer.

What are the epistemic and ontological implication of considering cancer as an environmental and social disease? Here I analyze three civilization crisis related to high incidence of cancer: crisis of a Capitalist model of organizing nature (including human nature), where human populations are exposed to risk factors produced or enhanced by this model; ii) crises of global health as business strategy that undermine the social oppression of affected populations; and iii) crises of globalized ways of consumption and lifestyles that are limiting prevention strategies against the disease. Under this civilization frame, the global fight against cancer cannot be reduced to the biomedical production of a cure, but also to strategies towards transformation of structures and process that sustain these crises. Finally, I contrast these ideas with ecological and environmental studies that are assuming the ecological crises in relation with civilization process, and in categories such as anthropocene and capitalocene.

INDIVIDUAL PAPERS SESSION – MINAS1
Identity and Individuality

Chair of the session: Anne Sophie Meincke (Egenis, the Centre for the Study of Life Sciences, University of Exeter, UK, a.s.meincke@exeter.ac.uk)

Papers:

From personhood to neighborhood: Biotic communities and personal identity

Denise Regina Percequillo Hossom (Department of Philosophy, University of California, Davis, USA, drhossom@ucdavis.edu)

In the summary moral maxim of Aldo Leopold’s “The Land Ethic”, Leopold determines a focus of moral consideration to be the “biotic community”, stating “A thing is right when it tends to preserve the integrity, stability, and beauty of the biotic community. It is wrong when it tends otherwise" (1949, 139-140). While Leopold has been responsible for inspiring many environmentally conscious minds since his publication of "The Land Ethic" in A Sand County Almanac, within ecology and environmental ethics he has been met with concerted criticism. Various objections are directed at the concepts of "integrity", "stability", and "beauty". I see these objections as reflecting the lack of a coherent understanding of the biotic community concept. Leopold, however, would be unable to address the key conceptual issues facing the concept before his death in 1949. I argue that the issue of biotic community identity persistence over time is inseparable from the objections directed towards the concepts of stability, integrity, and beauty. Without addressing this issue, Leopold's Land Ethic is left on shaky ground. In this paper I provide a metaphysical framework for Leopold's biotic community concept. First, I draw a parallel between the biotic community concept and the concept of persons through an analysis of the issues and questions that concern both. This reveals that issues of personhood and personal identity – particularly persistence over time – contain various insights into the objections to the biotic community concept. Drawing from the discourse of personal identity, I chose to adapt Derek Parfit's theory of personal identity and personhood to the biotic community concept to address the concerns related to biotic community identity and persistence over time (Parfit 1971). I focus on how the relations of psychological continuity and psychological connectedness can be adapted to relations of biological continuity and biological connectedness.

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Processual animalism: Towards a scientifically informed account of biological identity through time

Anne Sophie Meincke (Egenis, the Centre for the Study of Life Sciences, University of Exeter, UK, a.s.meincke@exeter.ac.uk)

Animalism is the view that human persons are biological entities, i.e., organisms or animals, and that therefore their identity through time has to be understood in purely biological terms. Animalism is becoming increasingly popular among metaphysicians, about to supersede the hitherto predominant psychological stance on personal identity.

My paper will present a critical analysis of animalism which shows that in order to be a tenable position, animalism has to align itself with science. More specifically, I will defend three critical claims about animalism in its current form, namely 1), the Harmless Claim: animalism has not yet provided a sufficiently developed account of its key notion of biological identity, 2) the Not-so-harmless Claim: what animalists actually say about biological identity is to a great extent at odds with what biological science tells us, 3) the Radical Claim: animalism cannot provide a convincing account of biological identity which is in line with biological science, unless it radically changes its underlying metaphysical assumptions.

I shall start with a critical survey of existing animalist accounts of biological identity, confronting these with challenges from biology as reflected in the philosophy of biology. Phenomena such as twinning, asexual reproduction through binary fission and budding, chimerism, symbiosis, colonial life forms and the 'superorganism' clash with the naïve notion of biological identity employed by animalism. I shall argue that this naïve notion of biological identity ultimately rests upon the metaphysical assumption that an organism is some sort of big thing ('substance'), made from smaller things (ultimately 'atoms'). I shall demonstrate how this commitment leads animalism into the dilemma of either eliminating or mystifying biological identity, thus preventing a satisfying account.

On the basis of this diagnosis, I shall finally argue for replacing the thing ontological with a process ontological framework according to which organisms are not things but processes. I shall show how the resulting position, processual animalism, is able to accommodate the biological facts about organisms as revealed by biological science in a way that overcomes the traditional dilemma.

INDIVIDUAL PAPERS SESSION – MINAS2

Scientific Practices: Philosophical Perspectives II

Chair of the session: Maria Strecht Almeida (Institute of Biomedical Sciences Abel Salazar, University of Porto, Portugal, msalmeida@icbas.up.pt)

Papers:

Perspective and practice: A comparative view on Walther Vogt's and Alfred Sturtevant's approaches to development

Robert Meunier (University of Kassel, Germany, robert.meunier@uni-kassel.de)

In 1929, Walther Vogt published his long article "Gestaltungsanalyse am Amphibienkeim mit örtlicher Vitalfärbung II." (Arch. Entw.mechan. 120: 384-706.). In the same year Alfred Sturtevant published "The claret mutant type of Drosophila simulans: A study of chromosome elimination and of cell-lineage" (Z. wiss. Zool. 135: 323-356). Both authors addressed the problem of development, of how a seemingly undifferentiated egg develops into a multicellular organism. Vogt employed vital dyes to track embryonic processes (Griesemer

2007), to observe the movement of material from earlier to later developmental stages in Amphibia. Sturtevant, instead, drawing a remarkable analogy from his earlier work on mapping genes to chromosomes, utilized the genetic approach (Waters 2004) to infer the locus of gene action in the early embryo from phenotypic differences in gynandromorphic mosaic flies.

The case study, based on the comparison of these approaches, lends itself to an integrated history and philosophy of science account of developmental biology. From the perspective of philosophy of science, an important set of questions is the following: How is knowledge generated through scientific activity? How do the representations of knowledge (linguistic, diagrammatic and otherwise) become meaningful in the context of such activities? How do different research activities give rise to different forms of knowledge? To answer the latter question requires a comparative approach, but also regarding the former two questions it is helpful to look at several cases of research activities and the resulting knowledge to see what is common and what is specific in each situation. While the comparison thus serves an epistemological goal, the epistemological analysis at the same time allows me to address genuinely historical questions, in this case regarding the relation of embryological and genetic approaches in the early 20th century, their different genealogies and the constraints and conditions for integration.

The paper will show how the different perspectives of Vogt and Sturtevant on the common problem of development are materially embedded in different research practices, including the overall experimental strategy, the research material, the descriptive tools and the notation systems used to represent results. It will locate these practices in their respective traditions and analyze how they each support the identification of different entities and relations and, in particular, how they are associated with different conceptualizations of causation, namely production and difference-making notions of causation.

References:

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Coordinating measurement and world in Medicine: A model-based approach to the introduction of the metric system standardization in the XIXth and XXth centuries

Luciana Sarmento Garbayo (Department of Philosophy, University of Central Florida, USA, lusgarbayo@gmail.com)

In this paper I present a critical revision of the main arguments in the history of the standardization of the metric system in Medicine in the late XIX and early XX in Britain and United States. This revision is suggested in light of the new wave of scholarship on philosophy of measurement in the last 15 years (Chang, 2011; Tal, 2013). I shall provide a special focus on a model-based account of measurement in medicine in my philosophical analysis, while considering idealization strategies and empirical adequacy constraints in medical historical context. I will discuss the problem of coordination between the metric model and metrological realization of the metric prototype in medical practice, through the revision of the specialized journal debates present in the scientific community of the time and manuals provided at the time (Oldberg, 1881; The Lancet, 1905). I will complement my analysis with societal considerations on a key role for cost-effectiveness type of explanations in defense of in support of the metric standardization, which, I sustain, resemble an interventionist representation (Hacking, 1983), conventionalist (Cartwright, 1994) interpretation of medical metrics, in a practice-oriented platform.

Beyond multiplicity: Exploring narratives around the life span of the mammalian erythrocyte

Maria Strecht Almeida (Institute of Biomedical Sciences Abel Salazar, University of Porto, Portugal, msalmeida@icbas.up.pt)

Shifts in understanding are integral to science as process. Ultimately, this paper addresses the dynamics of knowledge production within the experimental sciences, exploring the emergence of new ways of looking at an old problem. The study is focused on the research conducted around the events leading to the removal of mammalian erythrocytes from the bloodstream. It examines, in particular, some changes in how the problem was depicted by the turn of the twentieth first century. My present analysis revisits previous work – specifically the integration of different narratives concerning the aging erythrocyte into a multiple biomedical object –, adding a few aspects towards a comprehensive account. The idea of the selective removal of these cells by age was proven in the mid-twentieth century by means of isotopic labeling. This fact guided the research regarding the aging process of the mammalian erythrocyte and a vast amount of data was obtained in the following decades. Yet, a complete elucidation of the problem was not achieved by the turn of the century. As the claim that the crucial question remained unanswered was acknowledged in the specialized literature, new understandings regarding the process were also emerging, involving either a marker of self or a partial apoptotic machinery. In this paper I will take a closer look at the changes in how the problem is articulated (and understood), examining both the accounts in the published literature, including textbooks, and bibliometric data. Building on this case study, I will discuss the issue of changes in understanding in the context of the dynamics of knowledge production, and how they might provide reinterpretations of old data and drive new lines of research.

INDIVIDUAL PAPERS SESSION – MINAS3
Philosophy of Evolution I

Chair of the session: Makmiller Pedroso (Towson University, MA, USA, mpedroso@towson.edu)

Papers:

Disentangling and integrating Mayr and Tinbergen

Brandon Allen Conley (Sage School of Philosophy, Cornell University, USA, bac248@cornell.edu)

Ernst Mayr (1961) and Niko Tinbergen (1963) each developed influential schemes for dividing the explanatory labor in the biology of behavior. Biologists typically conceive of the two schemes as a single unified framework, with Mayr’s distinction between proximate and ultimate explanations forming one of two axes dividing Tinbergen’s four questions (mechanism, development, evolution, and function) (Alcock 2001, Nesse 2013). However, the two schemes were developed to accomplish distinct ends: Tinbergen sought unification of distinct areas of research and emphasizes the continuity of his four questions, while Mayr sought to preserve the autonomy of evolutionary biology in the face of reductionist tendencies after the rise of molecular biology, and emphasizes the discontinuity of proximate and ultimate causes. This opposing goals of integration and autonomy create tension in the theoretical foundations of the biological study of behavior. The tension manifests in ongoing controversies over the methods, soundness, and theoretical import of integrative projects (evolutionary developmental biology, evolutionary psychology, niche construction theory, etc.). Attempts to integrate Tinbergen's questions are subject to the criticism for conflating proximate with ultimate explanations.

I examine the philosophical motivations of both Mayr and Tinbergen and provide a philosophical interpretation of how each scheme achieves its philosophical aims: integration for Tinbergen and autonomy for Mayr. I then turn to showing how the two frameworks can be reconciled. I interpret Tinbergen's questions within the framework of Robert Cummins' (1975) account of functional analysis. Emphasizing Mayr's "informational" formulation of his distinction, I argue that Mayr's proximate/ultimate distinction should be understood as an extension of his philosophical work on teleology. I argue that Mayr's and Tinbergen's insights can be integrated into a unified framework but not in the usual way. Tinbergen's questions are not a simple refinement of Mayr's proximate-ultimate distinction. The scheme which emerges is more complex, but I will argue that it is independently motivated and relieves the tension between Tinbergen's goal of integration and Mayr's goal of preserving the autonomy of evolutionary questions.

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Is methodological adaptationism really so dangerous?

Mingjun Zhang (Department of Philosophy, University of Pennsylvania, USA, mingjunz@sas.upenn.edu)

In this paper, I respond to Lloyd's criticism of methodological adaptationism. I argue that if methodological adaptationism is properly conceived and carefully employed, it avoids Lloyd's worries and should not be abandoned as a whole.

Methodological adaptationism is a widely used research strategy in evolutionary biology, in which "adaptation" is often used as a good organizing concept for evolutionary research (Godfrey-Smith 2001). Although great research progress has been made with the help of this strategy, there is still much criticism of it as the “first choice” for evolutionary research (Gould and Lewontin 1979). Lloyd (2015) uses a perspective she calls “the logic of research questions” to identify some dangers of methodological adaptationism, and she proposes the “evolutionary factors framework” as an alternative approach. Though I’m sympathetic to some of her critiques of several adaptationists’ particular views, these critiques do not apply to the whole program of methodological adaptationism.

Lloyd identifies “What is the function of this trait?” as the research question of methodological adaptationism. She argues that this question assumes traits are adaptations and “leads to bad logic, bad reasoning about evidence, and inferior biology” (Lloyd 2015, 350). I argue that there is no such thing as the research question of methodological adaptationism and that some other legitimate research questions can also be asked by methodological adaptationists.

Methodological adaptationists are notoriously accused of accepting adaptive “just-so” stories without providing sufficient empirical evidence. Lloyd adds to this accusation that adaptationists are disposed to shirk their burden of proof. This psychological tendency argument assumes that researchers adopting methodological adaptationism are inherently more likely to shirk their burden of proof. I argue that no such inherent connection exists and that this psychological tendency, if it exists at all, can be overcome by improving evidentiary standards for identifying adaptations and their functions.

The “evolutionary factors framework” is Lloyd's alternative to methodological adaptationism. The fundamental research question of this framework is, “What evolutionary factors account for the form and distribution of this trait?” I argue that this question is not helpful for biologists because it doesn’t provide any direction for further research. In fact, it is a meta-question that is shared by all the relevant researchers, whether or not they are methodological adaptationists.

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Coping with stress: How microbes respond to bottleneck events

Makmiller Pedroso (Towson University, MA, USA, mpedroso@towson.edu)

Microbes often form dense multicellular clusters (e.g., biofilms) that are especially resilient to environmental stress caused by different factors, such as antimicrobial treatments and protozoan predators. Their resilience is partly due to their ability to produce public goods, such as enzymes and signalling molecules, which are costly to produce but enhance the fitness of neighboring cells. However, the production of public goods is vulnerable to exploitation by free-riders, i.e., cells that consume a public good but that do not pay for its production costs. Since microbes lack the cognitive skills required to engage in reciprocity (e.g., memory), genetic relatedness is commonly used to explain why free-riders do not always have the upper hand in a microbial group. This is because clonal microbial cells tend to stay together in viscous environments, causing a public good to remain in the hands of genetically related cells instead of uniformly diffusing in the population. This paper aims to distinguish an alternative type of explanation for suppressing free-riders in a microbial group that does appeal to the genetic relatedness between its cells. According to this explanation, population bottlenecks induced by environmental stress can keep free-riders in check by increasing the risk associated with free-riding. That is, defecting becomes less cost-effective when the size of a group is sufficiently small. This explanation remains true regardless of whether the production of a public good is encoded by the same gene. Microbial collectives thus provide a minimal model to understand how extrinsic ecological factors can limit free-riding in a group without invoking sophisticated cognitive abilities and genetic relatedness.

INDIVIDUAL PAPERS SESSION – AG-BOT

Race and Ethnicity: Historical Perspectives

Chair of the session: Michael Osborne (College of Liberal Arts, Oregon State University, USA, Mike.Osborne@oregonstate.edu)

Papers:

Joseph Banks, John Hunter, and the skull trade

Anita Guerrini (School of History, Philosophy, and Religion, Oregon State University, Corvallis, Oregon, USA, anita.guerrini@oregonstate.edu)

The naturalist Joseph Banks (1743-1820) brought back some seventy human skulls from Cook's first voyage (1768-1771). Over time, he distributed these and other skulls he acquired to collections across Europe, including those of John Hunter and Johann Friedrich Blumenbach, as part of a global network of exchange.

From the late eighteenth century onward, many anatomical collections shifted focus from medicine to what we would now call anthropology, coupled with comparative anatomy as a way to demarcate human from non-human. These collections privileged the skull over the skeleton as a whole. Long held to be the repository of identity, the skull now helped to redefine late-Enlightenment ideas about the nature of the human, including not only identity but also ethnicity. Discourses of language and nationalism contributed to this redefinition.

Upon the death of the anatomist and surgeon John Hunter in 1794, the disposition of his vast collection was contested for several years, until it became the museum of the new Royal College of Surgeons in 1800. The debates surrounding this collection and particularly its skulls (many of which can be traced to Banks), and subsequent decisions about new acquisitions of skulls in the early nineteenth century, offer a unique glimpse into the redefinition of human remains in this period and the critical role the skull came to play.

Martial Race Theory in Africa: Herbert Spencer's institutional influence on European colonial armies during the First World War

Joe Lunn (University of Michigan-Dearborn, USA, joelunn@umich.edu)

During the First World War nearly 2,500,000 African soldiers and paramilitary carriers were mobilized and likely more than 1,000,000 perished. This unprecedented levy of African soldiers and laborers for service between 1914 and 1918 was the consequence of an extractive imperial system commandeering the lives and labor of subject peoples globally. Though fought between European nation states seeking to maintain or augment their positions of global wealth and power, the war in Africa was conducted in accordance with a set of pseudo-scientific racial assumptions most clearly given intellectual validation by Herbert Spencer.

Spencer, in the estimation of one influential French military officer, General Charles Mangin, was “the philosopher, who had conducted the most profound study of the organization of human societies and their development in history.” In his authoritative feasibility study of 1910, La force noire, Mangin embraced Spencer’s theoretical construct of “progressive evolution,” citing Spencer’s Principles of Sociology and contended that a dichotomy existed between as yet “primitive” but “militant” societies and their more highly evolved “industrial” counterparts. Referring to the “warrior instincts that remain extremely powerful in primitive races,” Mangin concluded that Africans possessed exactly those attributes that made them ideal for use as “shock troops” by the French in the event of a European war.

These ideas were by no means unusual. Indeed, not only did Spencer’s theories serve as a primary rationale for global imperial domination in the first place, but nearly every major European colonial army in Africa incorporated aspects of Spencer’s tenets into their organizational principals. Irrespective of whether they served in the French Tirailleurs Sénégalais, the British King’s African Rifles, the Belgian Force Publique, or the German Schutztruppen, Africans were all recruited from “races” deemed by their colonial overlords to be especially “warlike.” Only the Portuguese were an exception. The incorporation of Spencer’s ideas into the military organization, language instruction, and tactical doctrine of the European colonial armies between 1914 and 1918 offers an explicit glimpse of the Englishman’s institutional influence on the conduct of the war in Africa.

Using the French as a case study, my paper will present: 1) a brief summary of Spencer’s philosophy, 2) the application of his ideas in European colonial armies, and 3) the practical consequences of their implementation for Africans. In so doing it provides an insight into the significance of Spencer’s ideas for European imperialists, as well as the tragic human consequences of linking race theory to military doctrine during the First World War.

WEDNESDAY JULY 19
09:00-10:30 – Parallel sessions 8

ORGANIZED SESSION STANDARD TALKS – AG-ZOO

Conceptual and Political Challenges in Postgenomics: Organisms, Niches, and Plasticity

Org. and chair of the session: Maurizio Meloni (Department of Sociological Studies, University of Sheffield, UK, m.meloni@sheffield.ac.uk)

Under what is known as postgenomics, over the last few years we have witnessed a (re)emergence of views based on a deep entanglement between organisms and their surroundings. Conceptions that were marginalized if not repressed, first by selectionism and later by genetics, have powerfully reemerged: as seen for example in notions of the body, development, and heredity that are open and plastic, profoundly embedded in their surroundings, and directly shaped by social pressures. Proposals to expand the theoretical corner pillars of the modern synthesis have argued for replacing the gene by the plastic and environmentally responsive developing organisms as a starting point in biological theorizing. This double session will explore some of the conceptual and political challenges connected to this new biological landscape. On the one hand, it has been suggested that rather than genes, the capacities of organisms to actively mold themselves and their offspring as well as their environment should be understood as the primum movens of evolutionary change. This new biology highlights the activity of the organism. On the other hand, this very special status of the organism and its causal agency is threatened by the fact that the organism is understood to be fully embedded in and reciprocally related with its environment. This leads not only to new conceptual challenges of distinguishing organisms from their environment, but also to problems in identifying suitable targets of biologically informed policy making. In terms of politics, a new strong linkage between people, and the material and social environments they have been exposed to, may be emerging in disciplines like environmental epigenetics, microbiomics, nutrigenomics, and social neuroscience. If the human body is increasingly seen as porous and "composed of transduced representations of environments" (Landecker, 2016), what shall we think of individuals or social/ethnic groups for too long exposed to pathogenic environments? The double session brings together contributions from philosophy, history, sociology and political theory to reflect critically on the potential and challenges of the current postgenomic scenario, its historical background, and the promises and hype surrounding its concept.

Papers:

The challenges of the Extended Evolution Synthesis (EES) research framework

Eva Jablonka (The Cohn Institute for the History and Philosophy of Science and Ideas Tel-Aviv University, Israel, jablonka@post.tau.ac.il)

I present the conceptual challenges posed by the EES (Extended Evolutionary Synthesis) to the current view of evolution. Whereas selective “pressure” on preexisting heritable variation is the starting point for evolutionary analysis in the Standard Evolutionary Theory (SET), the origin of phenotypic variation and the active construction of selection regimes are alternative starting points for evolutionary investigations in the EES. Hence, the developing phenotype, a focus on canalization and plasticity, the consideration of multiple channels of inheritance, and active and directional niche construction, are the foundations on which the EES framework is built. After analyzing the conceptual implications of this framework, I discuss the social, and therefore, inevitably, also the political, implications of this developmental-evolutionary perspective.

No return of the organism? Postgenomic trends in biological theory and society

Jan Baedke (Ruhr University Bochum, Germany, Jan.Baedke@ruhr-uni-bochum.de)

This paper deals with the reemerging concept of the organism in postgenomic biology and its socio-political implications. Recently, a number of new approaches, such as epigenetics and niche construction theory, have argued that the plastic and active organism, rather than the ‘fixed genome’ should again be considered as a central conceptual and explanatory unit in biology, including evolutionary biology. This organismic view, on the one hand, highlights the capacities of organisms to actively construct their development and niches in a plastic and robust manner (to a certain degree) independent from the environment. On the other hand, it places the organism in a complex supraindividual web of relationships that determine its ontogenetic and even transgenerational destiny. In humans these relationships include, for example, those between mothers and embryos, children and parents, as well as (possible stressful) labor relations, and other nutritional, economic, and demographic patterns. The paper discusses, first, this current paradoxical trend in postgenomic biology of highlighting the organism and, at the same time, dissolving it in its material and social environment. Second, it is shown how this situation leads to contradicting views of individual and societal responsibility as well as to highly different public health policies.

Uses of epigenetics

Tatjana Buklijas (Liggins Institute, University of Auckland, New Zealand, t.buklijas@auckland.ac.nz)

Epigenetics, a field studying mechanisms that regulate gene expression, has in the last decade and half attracted much public attention. While the molecular link between environmental exposures early in life and changes in gene expression underlying diseases such as cancer has attracted the most interest, the possibility that such altered patterns of gene expression may be inherited has provoked the most controversy. Transgenerational epigenetic inheritance has been invoked to explain racial health disparities (Kuzawa and Sweet 2008), to request a new model of evolution (Laland et al 2014) and to rehabilitate early C20 Neolamarckians, considered charlatans not long ago (Vargas 2016). And yet within the field of epigenetics the status of transgenerational epigenetic inheritance is far from stable (Heard and Martienssen 2014). How should we explain this discrepancy, and how do we account for this cross-field appeal of a new form of 'soft' inheritance? Who advocates it, who opposes it, why, and what are the possible implications of these differing standpoints?

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ORGANIZED SESSION STANDARD TALKS – CD-A1

Philosophy of Neuroscience: Broader Implications for Philosophy of Science

Org.: Marshall Abrams (University of Alabama at Birmingham, USA, mabrams@uab.edu)

This two-part session discusses a wide range of issues concerning neuroscience: its concepts, methods, models, and theories. The talks provide diverse perspectives a variety of dimensions of neuroscience, and all have implications for other areas of philosophy of science.

The first part of the session focuses on a widely discussed family of models of cognitive function that view the brain as realizing certain Bayesian statistical methods. This family of models is alternatively known as predictive processing, predictive coding, prediction error minimization (PEM), or free-energy minimization. There's a wide range of evidence in favor of PEM models for many systems of the brain; this evidence includes experimental results, simulations, functional anatomy, and PEM's apparent ability to explain well-known cognitive phenomena. Though the evidence for PEM is still inconclusive, advocates of PEM make a variety of claims for it, sometimes quite grand, as the talks by Colombo, Kaestner and Walter, and Abrams make clear. The first two of these talks provide critical discussions of claims that PEM provides a general, unifying theory for neuroscience and other cognitive sciences, with a role analogous to that of Darwinian theory in biology. Part of what's at issue in these two talks is the question of what is being claimed by PEM advocates--and about what is it being claimed? These talks by Colombo and by Kaestner and Walter raise general questions about reduction, realization, models, and theories. Abrams criticizes a narrower claim, that PEM would be selected for in perceptual systems because it allows accurate perceptions of the world. Abrams argues that in some cases of selection for r-strategies, natural selection would favor varieties of PEM that lead to widespread misperception by individuals, though producing accurate perceptions on average for lineages. In such cases PEM processes can be viewed as distributed across members of the lineage in an abstract sense.

The second part of the session is broadly focused on questions raised by technological innovations in neuroscience. Craver's talk uses the spread of neuroimaging to investigate discovery processes for technological innovation, and norms involved in interdisciplinary research driven by technological change. Atanasova's talk focuses on neuroimaging studies of humans using the virtual Morris water maze, a computer-based analogue of physical Morris water mazes used to study rodents. Atanasova argues that the use of Morris water mazes shows how experimental practices can be shaped by new technology rather than by theory, how variation in a single kind of experimental system can support integration between subfields, and how research on humans can inform animal research. Haueis looks at functional interactions between nervous system components that have been elucidated by electrophysiological and neuroimaging techniques. He focuses on two concepts, the canonical microcircuit and central pattern generator, both of which have application to mid-level relationships in the brain. Haueis argues that these concepts can refer to different functional properties depending on the part of the nervous system to which they are applied, illustrating Mark Wilson's patchwork approach to concepts.

Chair of the session: Carl Craver (Washington University in St. Louis, ccraver@wustl.edu)

Papers:

Evolutionarily distributed prediction error minimization: R-strategies and selection for misperception

Marshall Abrams (University of Alabama at Birmingham, USA, mabrams@uab.edu)

Friston and others developed Prediction Error Minimization (PEM, aka predictive coding, predictive processing, free-energy minimization) models of how nervous systems implement perceptual processes. There's substantial though inconclusive evidence that PEM is realized in some parts of the brain. Friston argues that PEM allows brains to infer causes of stimuli, and more generally to infer even complex causal relationships realized in the environment. Because of this, he argues that PEM could be favored by natural selection. I argue that there are evolutionary contexts in which natural selection would instead favor PEM-like processes resulting in individuals who routinely misperceive. In these cases, selection favors something like prediction error minimization that's distributed across individual organisms.

Natural selection sometimes favors evolutionary "r-strategies" over "K-strategies". A type of organism implements an r-strategy when it is evolutionarily successful by producing many offspring at relatively low cost even though many of them fail to reproduce. Some organisms, by contrast, implement K-strategies, investing a lot of energy in producing few offspring who succeed in reproducing with relatively high probability. Thus there may be cases in which accurate PEM-based perception is too costly, so natural selection favors cheaper neural processes--such as simpler implementations of PEM--that lead to many offspring having systematically inaccurate perceptions in common environmental conditions. I illustrate this possibility with an agent-based simulation in which animals with a simpler PEM system compete against those with a more sophisticated one.

Such a case is not merely an instance of an evolutionary tradeoff that most advocates of PEM would accept: PEM systems will result in misperception in some conditions because of tradeoffs in the costs of developing a system for each individual. By contrast, selection for an r-strategy with respect to PEM can favor perceptual processes so environmentally inappropriate, for many individuals, that they routinely fail to reproduce. Nevertheless, the PEM model may still be partly applicable to such perceptual r-strategies cases, but at a higher level. Where natural selection favors an r-strategy with respect to PEM, it favors perception that's accurate on average within a lineage though inaccurate in many individuals. In PEM r-strategy cases, natural selection favors a generalized PEM process that's distributed over members of a lineage, either because communication allows a multi-individual PEM process, or in a more abstract sense.

It might be thought these points are irrelevant to the species of greatest interest to PEM researchers: humans, who invest a great deal of energy in producing few offspring who often reproduce, and are thus K-strategists par excellence. However, being a K- or r-strategist is a matter of degree, and "perceptual" processes can be accurate about some aspects of the world but inaccurate about others. It's been argued that cultural complexity in human social life routinely leads to maladaptive assessments of social and environmental conditions, producing extinction of groups, migration, or adoption of new cultural variants from more successful individuals. I suggest that we may be r-strategists with respect to higher-level, culturally mediated "perceptual" processes, even though we K-strategists for basic perceptual and cognitive systems.

Predictive processing: A theory of everything?

Lena Kästner (Humboldt-Universität zu Berlin, Berlin School of Mind and Brain, Germany, mail@lenakaestner.de) and Henrik Walter (Charité Universitätsmedizin Berlin, Germany)

Predictions are currently all over the place in cognitive science and neuroscience. Whether we are investigating emotions, memory, vision, or delusions, the currently preferred theories and models tend to invoke some form of prediction, free energy minimization, and internal model generation. Given the wide variety of phenomena that can be studied and assessed within a predictive coding (PC) framework, the following question comes naturally: Is PC the universal theory science has been waiting for? Or, perhaps a bit more realistically, does it qualify as a universal theory of the brain en par with Darwin's theory of evolution in biology or the laws of thermodynamics and Einstein's relativity theory in physics? If so, PC is going to be a really important, powerful contribution to both the empirical sciences and philosophy of science. On the other hand, though, PC's popularity could be merely a hype, a Bayesian trend falling on fertile grounds of powerful computer simulations, and offering an umbrella that provides shelter for a wide range research--a collection so diverse perhaps that its members have nothing meaningful in common.

To assess whether PC provides a universal theory of the brain, we must first understand what PC really says. There are various versions of PC, advocating multiple different uses and payoffs. Still, there seems to be a common core. But what exactly is that and what are the tenets and promises disguised by complicated mathematical formulas? To shed light on these questions is the aim of this paper. In due course we will discuss a range of open questions with respect to the PC framework and suggest possible answers. We do not claim this is the final word, tough. In many ways, the jury is still out. However, if PC is a genuine theory rather than an antimacassar you can pull over various pieces of furniture, it should generate testable predictions. We will thus end with sketching a few predictions PC might be read to make and that future research might set out to test.

The free-energy principle as a first principle of neuroscience?

Matteo Colombo (Tilburg University, Netherlands, m.colombo@uvt.nl)

The free-energy principle says that "any self-organizing system that is at equilibrium with its environment must minimize its free energy" (Friston 2010). Originally proposed to explain human action, perception, and learning, this principle has been extended to account for the evolution, development, morphology, and function of the brain. The free-energy principle has been variously referred to as a 'postulate,' a 'tautology,' and an 'imperative.' While it might afford a foundation for understanding the complex relations between life and mind, its status as a first principle in the cognitive and brain sciences remains unclear. In this paper, we ask: What would it take for the free-energy principle to be a first principle in science, and particularly in the cognitive and brain sciences? To answer this question, we precisely formulate the free-energy principle, distinguish different senses in which a principle can justifiably be said to be a "first principle" in science, and evaluate whether the free-energy principle fits any of these senses. Specifically, we put into sharper focus the notions of a 'postulate,' a 'tautology,' an 'imperative,' and an 'explanatorily fundamental' principle by focusing on scientific examples from Euclidean geometry, Darwin's theory of natural selection, and thermodynamics. Euclidean geometry is built on postulates. These are statements taken to be self-evidently true, which serve as premises for deriving further results in geometry. Darwin's theory of natural selection provides a unifying, explanatorily fundamental explanation of the design, diversity, and change of biological systems. But this explanation's success turns on the meaning of its central concept, 'fitness,' which has been said to be a tautology. The second law of thermodynamics was historically an empirical finding that was accepted as an axiom or imperative of thermodynamic theory, as it explains irreversibility in nature. The discussion of these cases helps us evaluate whether the free-energy principle play any similar role in the cognitive and brain sciences. We argue that the free-energy principle is akin to a postulate, because it serves as a premise for deriving further conclusions about functional properties of brains, and biological systems more generally. Yet, the free-energy principle is not self-evidently true. On the one hand, its empirical content is hard to pin down. On the other hand, its fit with current empirical evidence is not obvious. We conclude by identifying perils and prospects of a first principle approach in the cognitive and brain sciences.

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ORGANIZED SESSION DIVERSE FORMAT – CD-A2

Type of session: Graduate student workshop

Decoding science papers (tools for non-scientists)

Org. and chair of the session: Jessica A. Bolker (University of New Hampshire, USA, jbolker@unh.edu)

Scholars in HPS need not produce scientific research papers, but they must be able to read and understand them. This poses several challenges: the language and structure of scientific papers assume an audience familiar with the genre; and in any field, authors reasonably expect readers to possess both background knowledge and technical vocabulary specific to their discipline. HPS scholars with strong training in non-science fields may struggle to read primary scientific literature -- yet their ability to think critically about science requires that they understand what they're reading, and talking, about. (Incomplete or inaccurate understanding not only weakens HPS scholarship, but also bolsters the perception on the part of some scientists that HPS has nothing to contribute to their own work.) Fortunately, familiarity with key genre conventions in scientific papers and practical strategies for reading primary research literature can make the task of decoding science papers much easier for non-scientists. This workshop will provide basic knowledge and tools to help graduate students develop their skills in this area. (Participants are encouraged to bring a scientific paper related to their own research to work on during the session.)

Discussants:
Ana M. Soto (Tufts University School of Medicine, USA, ana.soto@tufts.edu)
Laura Perini (Pomona College, USA, Laura.Perini@pomona.edu)
Dan Burnston (Philosophy Department and Tulane Brain Institute, Tulane University, USA, dburnsto@tulane.edu)

ORGANIZED SESSION STANDARD TALKS – CD-A3

Multidisciplinary Perspectives on Evolutionary Biology, Religion and Society

Org.: James Riley (Centre for Science, Knowledge and Belief in Society, Newman University, United Kingdom, rile402@newman.ac.uk)

Surprisingly, although the relationship between 'science' and 'religion' is often talked about in the media, by public intellectuals, and in public spaces, very little research has been done that explores what people think about their own or others' views on the relationship between science and religion. In this panel, researchers from the multidisciplinary Science and Religion: Exploring the Spectrum (SRES) project present their findings about the relationship between evolutionary science and religious belief. The research seeks to build an understanding of the social and cultural contexts of public perceptions of the relationship between ‘science’ and ‘religion’, both historically and today, across all faiths and none. This panel will present results from the disciplines of history, sociology, social psychology, and media analysis. Topics covered will include: Issues with some high-profile public perceptions research into the relationship between religious belief and evolutionary biology; The social psychological projection of conflict perceptions; British Muslim perceptions of biological evolution; The popularisation of an evolutionary ether theology by Oliver Lodge in the early 20th century; Doubt, uncertainty and salience in the study of public perceptions of biological evolution; And a media content analysis exploring the UK print media’s coverage and framing of instances of public commentary by Pope’s on the topic of biological evolution since 1950.

Chair of the session: Fern Elsdon-Baker (Centre for Science, Knowledge and Belief in Society, Newman University, UK, F.Elsdon-Baker@staff.newman.ac.uk)

Papers:

Creating creationists: Conceptual and methodological issues in social studies of the perceived relationship between evolutionary science and religious belief

Fern Elsdon-Baker (Centre for Science, Knowledge and Belief in Society, Newman University, UK, F.Elsdon-Baker@staff.newman.ac.uk)

Scholarly and public discourse about the relationship between evolutionary science and religion is an area that receives considerable media attention. In recent decades in the United Kingdom, prominent communicators of evolutionary science, for example, Richard Dawkins, have linked evolutionary theory to actively anti-religious stances. This further contributes to public representations of a necessary clash between evolutionary science or ‘Darwinism’ and individuals’ personal beliefs. This paper will detail the conceptual issues inherent in some of the more highly publicised academic work which seeks to explore the relationship between evolutionary science and religious belief, and detail how the overdependence on blunt quantitative methodologies warps our understanding of public attitudes. I discuss the issue framing of polling of public opinion regarding levels of anti-evolutionism outside of the United States. By examining existing polls as exemplars, this paper will expand on wider philosophical concern over the lack of reflexivity and resultant problems with 'issue framing' in public opinion polls, and by extension the framing within media and scholarly representation of a clash narrative between 'religion' and 'evolution'. Finally, I propose a solution to some of shortcomings of previous attitudinal work, by outlining a theoretical exploration of several more nuanced conceptual categories of human exclusionism. Employing these categories in future social scientific work extends our ability to understand individuals' perceptions of the relationship between evolution and religious faith beyond the binary choice of either being an 'atheistic evolutionist' or a 'theistic creationist'. Therefore, this paper highlights the need to develop research protocols that more effectively capture the heterogeneity in various publics' lived experiences of the relationship between evolutionary science and personal religious beliefs.

The projection of belief in the conflict between science and religion

Carissa Sharp (Centre for Science, Knowledge and Belief in Society, Newman University, UK, C.Sharp@staff.newman.ac.uk), Carola Leicht (Kent Business School, University of Kent, UK, A.C.Leicht-23@kent.ac.uk), Karisha George (Centre for Science, Knowledge and Belief in Society, Newman University, UK, Karisha.George@staff.newman) and Fern Elsdon-Baker (Centre for Science, Knowledge and Belief in Society, Newman University, UK, F.Elsdon-Baker@staff.newman.ac.uk)

Social psychological research indicates that we tend to "project" our own beliefs onto others – that is, we expect other people to be similar to ourselves. However, the ways in which we engage in social projection changes based on our group identification. The Ingroup Projection Model (Wenzel, Mummendey, & Waldzus, 2007) argues that we tend to think that our ingroup is a good representative of the overarching social group while our outgroup is not, which leads to negative outgroup evaluation. Our aim was to investigate the extent to which people project their ideas about the "conflict narrative" between science and religion onto religious and non-religious ingroup and outgroup members. Across three studies we investigated whether people engage in social projection with targets of various group identifications (including "religious", "atheist", "evolutionary biologist", "evolutionary biologist who is religious", and "evolutionary biologist who is an atheist"). In Studies 1 (n = 253) and 2 (n = 342) we found that people perceived their beliefs about the conflict or compatibility between science and religion to be associated with others' beliefs. In Study 3 (n = 474) we utilized the Ingroup Projection Model in order to show that patterns of projection differ based on people's identification as agnostic, atheist, or religious. Our findings have implications for our understanding of the intergroup relations that are related to people's religious and scientific identities, and we discuss the potential of this research to inform interventions reducing prejudice against individuals belonging to and identifying with either or both belief systems.

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Wenzel, M., Mummendey, A., and Waldzus, S. 2007. Superordinate identities and intergroup conflict: The ingroup projection model. *European Review of Social Psychology* 18: 331-372.

Doubt, uncertainty and salience in public perceptions of biological evolution: Results from a qualitative study of the UK and Canada

Stephen Jones (Research Fellow, Centre for Science, Knowledge and Belief in Society, Newman University, UK, stephen.Jones@staff.newman.ac.uk), Rebecca Catto (Assistant Professor, Sociology, Kent State University, Ohio, USA, rcatto@kent.edu) and Tom Kaden (Research Associate, York University, Toronto, Canada , tomkaden@yorku.ca)

Until recently, social scientific research into perceptions of biological evolution tended to overstate the extent to which publics hold coherent and well-formed views about the subject. This emerged largely due to over-reliance on quantitative polls that ask participants to select between a limited number of fixed categories of evolution belief (for example, 'creationist', 'theistic evolutionist', 'atheistic evolutionist', and so on). In the last decade, more sophisticated quantitative studies have been developed that challenge this tendency by, inter alia, differentiating between belief in and belief about evolution (McCain and Kampourakis, 2016) and interrogating the extent to which publics consider correct belief in evolution to be important (Hill, 2014). This paper builds on this more recent research by presenting the results of a qualitative study consisting of 123 interviews and 16 focus groups with mixed religious and non-religious publics and scientists in the UK and Canada. The paper demonstrates 1) that publics are frequently uncertain about their beliefs about evolution, with some even being reluctant to participate in the study because they consider themselves not ‘expert’ enough to hold a position on the subject. It shows 2) that publics are often doubtful about their position, with those who question evolutionary science doing so tentatively and sometimes with the proviso that they would be open to revising their view. And it highlights 3) the varying salience of evolution between different identity groups, with this variation often being dependent on external social ‘prompts’. By drawing attention to the way in which the salience of evolution belief varies according to external factors, the paper seeks to illustrate how public perceptions of evolutionary science are in part determined by social changes and, in particular, by conflicts over morality, politics and identity.

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INDIVIDUAL PAPERS SESSION – MINAS1

Social Studies of Genetics

Chair of the session: Antonello La Vergata (Department of Language and Cultural Studies, University of Modena and Reggio Emilia, Italy, alavergata@unimore.it)

Papers:

From biology to utopia: Charles Richet’s mankind in the future

Antonello La Vergata (Department of Language and Cultural Studies, University of Modena and Reggio Emilia, Italy, alavergata@unimore.it)

The French physiologist Charles Richet (1850-1935), Nobel Prize winner for medicine in 1913 for his studies on anaphylaxis, was also the author of literary works, philosophical and psychological essays, including forecasts for the future of mankind (*Dans cent ans*, 1892), pacifist writings (*La guerre et la paix*, 1905; *Le passé de la guerre et l’avenir de la paix*, 1907; *Pour la paix*, 1919), and a *Traité de métapsychique* (1922). He was also an out–and–out eugenicist, convinced that an “intentional, conscious, scientific, and methodical” selection could achieve “any result, provided we had enough patience”. He founded the *Alliance nationale pour l’accroissement de la population française* (1896) and the *Société française d’eugénique* (1913), as he believed that the quantitative and qualitative increase of population was a vital matter for France. In *La sélection humaine* (1913) and other writings, he strongly reproved the “reverse selection” acting in his country. He dreamed of a society where a conscious selection would create, and preserve, “intellectual élites”, “homogeneous and closed”, each of them specialised in a particular field. The process would be crowned by the production of a “higher human nature, a real surhumanité”.

Richet occupies a special place in French eugenics for many reasons. First of all, for all his emphasis on the omnipotence of selection, he believed throughout his live in the inheritance of acquired characters, which put him half–way between neo–Darwinian supporters of so–called ‘strong inheritance’ and neo–Lamarckian supporters of ‘soft inheritance’ (that near all his fellow countrymen). Second, his eugenics was, like his forecasts, all of a piece with a general programme of scientific revision of society and its progress. Third, he does not seem to have made much of social–Darwinist uses of the notion of ‘struggle for life’. A radical of sorts and a pacifist, he was far from an apostle of laissez–faire competition. Like many French biologists, he seems to have shared the ideology of solidarité, to which, however, he gave a technocratic twist.

One can wonder if Richet could be seen as a representative of a persisting tendency, among many biologists, to draw far–fetched conclusions from their discipline and apply them rashly and crudely to society. Eugenics is only the most striking, and ill–famed, aspect of this tendency: many examples of it can be given, including recent Nobel Prize winners.

Our mutational load and the politics of the human breeding population
Evan Arnet (Department of History and Philosophy of Science, Indiana University Bloomington, USA, earnet@indiana.edu)

In 2016 a famous debate in the history of population genetics, specifically the idea of the human mutational load, returned to the fore in the pages of the journal Genetics. 66 years earlier the Nobel Prize winning geneticist Herman Muller published “Our Load of Mutations”. The paper summed up decades of genetic research into a single argument about humans. Through general relaxation of selection humans had begun to accumulate deleterious mutations and would continue to do so until a change in breeding patters or until our mutational load became too much for us to bear. In its contemporary iteration, the reoccurrence of "mutational load" was panned as eugenics with all that the term now entails. However, earlier opposition to the claim, despite coming from the notoriously anti-eugenics Theodosius Dobzhansky, directly concerned its empirical adequacy and only indirectly its political effects. This I contend is an interesting case study of how boundaries of what are the political and what are the scientific are contextually situated and contestable. I then discuss more broadly the idea of "intrusion" into the political. Specifically, the claim that a scientific description of the world is such that it necessitates a political response or incorporation into our political thought. The narrative of intrusion then is one that attempts to depoliticize the asking of certain questions. It is the facts which intrude – don't shoot the messenger. In this case, the question was, what are the implications of humans as a breeding population? I conclude by arguing that, despite the fact the prevailing narrative tends to designate the incorporation of biology into politics as being conservative, opposition to intrusion cannot be other than a defense of existing notions of the political.

Modeling nature, modeling society: Drosophila *Genetics in post World War Two Brazil*

Tito Brige Carvalho (Department of Sociology and Science Studies Program, University of California, San Diego; Program on Science, Technology, and Society, Harvard University, tbmcarvalho@gmail.com)

As the field of Science and Technology Studies focused on biological knowledge, animal modeling became a key site of analysis. Scholars have paid particular attention to the methodologies and types of reasoning used to develop and refine animal models, as well as the ways in which these models ground cohesive scientific communities through shared understandings of fundamental concepts and techniques and moral economies. Modern biology's first animal model, the *Drosophila* fruit-fly, has received particular attention in the literature, with Robert Kohler's 1994 book, *Lords of the Fly: Drosophila Genetics and the Experimental Life*, being a seminal reference. Divided into two parts, Kohler's book examines the construction and expansion of the *Drosophila* model in, respectively, Mendelian genetics (*D. melanogaster*) and Darwinian evolution (*D. pseudoobscura*). He adopts a pragmatic conception of credibility and truth that, according to him, locates the causes of scientists' behaviors and beliefs "in the production process rather than in professional and political ideologies." In this sense, Kohler's book has not only been informative for but also representative of the broader STS literature on model organisms. But while Kohler's work has been an invaluable resource for our understanding of model organisms as technological artifacts that are constructed and embedded in complex social and material systems, his exclusion of politics limits the scope and command of his account. For example, questions about eugenics—which is to say, questions about the proper constitution of the polity of modern societies—are ephemeral in Kohler's work, something that is surprising given the immediacy of these questions for evolutionary genetics in particular and science in general. As my research reinterprets the history of population genetics through a coproductionist lens that brings politics back into focus (Jasanoff 2004), I argue in this particular paper that *Drosophila* evolutionary genetics was also a site of the articulation of democratic values in the aftermath of World War Two. To do so, I pay special attention to the tropical species *D. willistoni* that Theodosius Dobzhansky studied in Brazil from 1943 to 1956 with regard to the adaptive role of genetic variation vis-à-vis variation in the environment. Based on Dobzhansky's unpublished correspondence, articles with Brazilian co-authors, and an original chapter on "Adaptive Polymorphisms" in the third edition of Genetics and the Origin of Species, I maintain that Drosophila at once modeled the genetic basis of evolutionary change as well as the ideal demos of liberal, cosmopolitan democracies.

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INDIVIDUAL PAPERS SESSION – MINAS2

Philosophy of Ecology II

Chair of the session: Victor Lefèvre (Institute of History and Philosophy of Sciences and Techniques, IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne, France, victor.lefevre@univ-paris1.fr)

Papers:

Explaining the dynamics of ecosystems: A plea for organicism

Victor Lefèvre (Institute of History and Philosophy of Sciences and Techniques, IHPST, CNRS/University of Paris 1 Panthéon-Sorbonne, France, victor.lefevre@univ-paris1.fr)

Explaining the dynamics of ecosystems is the fundamental problem of ecosystem ecology. There are two kinds of ecosystem dynamics: persistence or change. Both are problematic. The persistence of ecosystems is puzzling when it comes to thermodynamics and population dynamics. The thermodynamic issue is simple: how do ecosystems maintain themselves so far from the equilibrium? The population dynamics one is more complex: how can trophic networks be stable despite the fact that theoretical results from May (1972, 1973) predict the opposite because of their high connectivities? In order to solve the first problem, Jørgensen and Svirežev (2004) propose to characterize the order of ecosystems as the spontaneous order of dissipative systems theory (Nicolis and Prigogine, 1977). I argues that this reductionist solution misses an important feature of ecosystems: they are self-determined systems. More precisely, they produce a part of the constraints which channel the thermodynamic flows that go through them. In words of Montévil and Mossio (2015), they realize a "closure of constraints". This self-constraint enables ecosystems to persist in spite of population fluctuations and thermodynamic non-equilibrium. This hypothesis is a particular instance of the more general idea that ecosystems are "organized beings" in the sense that Kant (1791/2000) gave to this expression. This idea can also be used to explain the changes of ecosystems. These changes are not random: they generally follow ordered sequences of ecological successions or adaptive cycles. With examples of savannas and forests, I argue that ecological successions and adaptive cycles are developmental processes which means that they can't receive a purely physical explanation. This organicist idea has already been defended by fathers of ecology Clements (1916) and Odum (1969), and, more recently, by Ulanowicz (2012). In using the previously described theoretical framework of Mossio and al, I try to provide a more precise content to this idea.

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Hierarchy Theory as epistemological framework in conservation biology research

Leila C. Cruz (Multidisciplinar Institute of Health-Vitória da Conquista, Federal University of Bahia and National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), Brazil, leilacruz@gmail.com) and John Collier (University of KwaZulu-Natal - Durban, South Africa, collierj@ukzn.ac.za)

To meet the challenge of halting environmental crisis and biodiversity loss, conservation biologists deal with complex social-ecological systems. Doing so requires not only practical applicable methods but also epistemological frameworks to guide research and practice through modeling and organization both of study and intervention objects. Among possible frameworks, Hierarchy Theory (HT) offers a relevant contribution for understanding structuring principles of complex systems, an ontological and epistemological category frequently associated to systems found in situations involving natural resource management or biodiversity loss. HT was formally explored and systematized with the rise of system sciences which intended, among other purposes, to devise alternative scientific approaches that could surpass limitations of traditional science, which relies mainly in linear causal relations, reductionism and predictability. Due to its systemic character, HT could support both research and application strategies capable of meeting the inter- and transdisciplinary nature of environmental problems. But how do conservation scientists have employed HT in their work (if they did)? How do authors from this field have used its concepts and epistemological framework as a whole? We reviewed literature published in conservation biology in search of answers for those questions. Our approach begun with a review of HT's main theses and concepts, identifying elements that could be potentially of most interest to conservation researchers and practitioners. Next, we surveyed Scopus® and Web of Science™ databases for indexed publications after conservation biology and hierarchy theory. The concepts and theoretical elements identified earlier in our study were sought in the analysis of the publications retrieved in the bibliographic survey. Usage of HT concepts and theses was evaluated according to: (i) theoretical coherence with original constructions in HT proponents' publications; and (ii) the extent of integration with the argument of the analyzed publication. Results revealed few publications with explicit use of HT. "Levels" and "Scale" were the most used concepts, which seems consistent with the rise of spatially explicit approaches in this knowledge field. Employment of HT in most publications was only superficial. Overall, HT usage by conservation biology authors was limited, probably indicating that most researchers do not find it a useful epistemological framework or due to the lack of clear heuristics to operationalize it.

Go big AND go home? The Biome problem and its metaphysical and epistemological roots

Guilherme Sanches de Oliveira (Department of Philosophy, University of Cincinnati, United States of America, sanchege@mail.uc.edu)

The notion of "biome" is controversial. The exact number of biomes and their boundary conditions vary according to which specific climatic and vegetation variables are considered (Higgins et al 2016). For this reason, the "biome problem" has been compared to the problem of defining species (Donoghue and Edwards 2014). This paper offers a philosophical analysis of the controversy surrounding competing categorization schemes, including the recently proposed categories of "anthropogenic biomes" such as populated woodlands and croplands, and "indoor biomes" such as homes (Martin et al 2014, 2015). As I propose, historical developments in the biome problem can be traced to a deeper conceptual tension between incompatible metaphysical and epistemological commitments.

I draw from Kugler, Kelso and Turvey's (1980) pioneering application of dynamical systems theory in motor coordination and control. Kugler et al. contrast the "machine conception" and the "dynamic conception" of order in biological processes and phenomena. In the machine conception, phenomena are understood to occur due to clockwork-type mechanisms, and scientists accordingly seek to formulate sui generis explanations for each object of investigation. By contrast, in the "dynamical conception," biological systems are characterized by parallel and coordinated complex dynamics, and the goal of science is not to describe unique component-level mechanisms, but rather to identify laws, regularities, or patterns that apply over a range of distinct but analogous phenomena.

I argue that a similar tension is at the root of the biome problem. Earlier accounts posited fewer biomes, using categories that are more distinct from one another, but which, for that reason, overlook boundary areas. More recent accounts describe multiple unique biomes, creating categories that barely differ from neighboring ones—a gain in specificity at the cost of generality and global-scale applicability. Competing categorization schemes have different pragmatic implications. Still, I propose that the decision to identify a larger number of unique biomes ("go big") and even include indoor built environments like homes in the categorization scheme ("go home") ultimately rests on conceptual grounds. The controversy surrounding biomes and the choice between uniqueness and generality is guided by metaphysical and epistemological commitments that mirror the tension between the "machine conception" and the "dynamic conception."

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INDIVIDUAL PAPERS SESSION – MINAS3

Modeling and Mechanisms: Historical and Philosophical Perspectives

Chair of the session: Jens Harbecke (Department of Economics & Department of Psychology, Witten/Herdecke University, Germany, jens.harbecke@uni-wh.de)

Papers:

Two challenges for a Boolean approach to constitutive inference

Jens Harbecke (Department of Economics & Department of Psychology, Witten/Herdecke University, Germany, jens.harbecke@uni-wh.de)

According to the ``mechanistic approach” to theory construction, explanation in neurobiology requires the identification, location, and analysis of the mechanisms underlying a to-be-explained phenomenon on several levels. The definition of a mechanism given by Machamer, Darden, and Craver (2000, Phil of Science) describes it as consisting of “...entities and activities organized such that they are productive of regular changes from start or set-up to finish or termination conditions.” Bechtel and Abrahamsen (2005, Stud Hist Phil Bio Sci pt. C) extend this definition by describing a mechanism as “...a structure performing a function in virtue of its component parts, component operations, and their organization. The orchestrated functioning of the mechanism is responsible for one or more phenomena.”

My talk sides with the mechanists in their general approach to explanation. My main aim is to refine the methodological theory about the establishment and discovery of particular mechanistic explanations offered in Harbecke (2015, “A Methodology for Constitutive Inference”, Stud Hist Phil Bio Sci pt. C). Baumgartner and Casini (forthcoming, “An Abductive Theory of Constitution”, Phil of Science) have challenged this theory by claiming that it suffers from the “problem of a full variation of test factors” and from the “problem of fat-handed interventions”. According to the first charge, mechanisms underlying a given phenomenon are causal structures. Hence, when one lists all the elements of a mechanism in order to qualify them as relevant or irrelevant for the phenomenon, it usually turns out impossible to systematically vary the elements' occurrence. This failure of full variation of elements or factors makes the methodology of difference tests used in Harbecke (2015) inapplicable as the latter essentially requires a full variation of factors. The second charge argues that, since phenomena and their mechanisms are believed to occur in the same space and time, it is impossible to distinguish direct interventions on the phenomenon from interventions that change the phenomenon through an intervention on the mechanism.

In my talk, I agree that the first problem is a real one for the original formulation of the methodology presented in Harbecke (2015). However, I show that some minor adjustments to the original theory solve the full variation problem. Moreover, I show that the fathandedness problem is actually based on a confusion that poses no threat to the theory.

In an introductory section, I present an example of a currently accepted explanation in neurobiology that is used as a test case for the subsequent discussion. The regularity theory of mechanistic constitution is presented in the second section. The third section introduces the methodology of constitutive inference. Section 4 discusses the problem of full variation for the proposed methodology of constitutive inference. And it offers the solution mentioned above. Section 5 presents the problem of fat-handed interventions. It is shown why the problem is uninteresting for constitutive inference.

Explaining ecological phenomena by means of mechanistic models: Is it possible?

Luana Poliseli (History, Philosophy and Biology Teaching Lab, Federal University of Bahia, Brazil/ National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, luapoliseliramos@gmail.com) and Jeferson Gabriel da Encarnação

Coutinho (Biology and Ecology of Bees Lab; Federal University of Bahia/ National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE)/ Graduate Studies Program in Ecology and Biomonitoring, Federal University of Bahia, Brazil, jeferson.gabriel@gmail.com)

Unraveling what a scientific explanation consists of has been one of the most central topics in philosophy of science throughout the twentieth century. Although explanations in biology by means of mechanisms have long been debated, most recently it has appeared a new philosophical debate toward mechanistic explanation. Unlikely the reductionist viewpoint of the classical causal-mechanical relation, this approach embody new perspective such as hierarchical levels and complex systems. Such debates were initiated and stimulated by Machamer, Darden & Craver (2000) and Bechtel & Richardson (2010) studies. Roughly, mechanistic explanation requires providing an account of a mechanism to explain a particular phenomenon. Most scientists who adopt this view assume that, behind every phenomenon in nature, there exists a mechanism that unravels it. Thus, to describe such mechanism is to explain the phenomenon. While the literature of mechanistic explanations has mostly addressed historical cases, in this work we deal with science in the making. We are investigating which contributions we can derive from the philosophical literature on mechanistic explanation in biology for the scientific activity of building explanatory models in ecology. Thus, we ask whether this sort of explanation can be as successfully applied to ecology as it is to other sciences. There are few records so far of mechanistic explanations applied to ecological studies, suggesting that the dialogue between philosophy of biology and ecology can be fruitful. In the present work this dialogue is being constructed within a project aiming at developing a model to account for a specific ecological phenomenon, the functional community organization of autochthonous bees and pollination service maintenance in agricultural systems. To derive from the literature on mechanistic models contributions to the modeling effort we developed a set of heuristics. These heuristics served as a guideline toward the construction of the ecological model. Ecological phenomena are open systems, unpredictable in some of their dynamics and regulated in several hierarchical levels. This indicates that the identification of operational components and their network of cause and effect relationships may be insufficient to explain and predict ecological phenomena. The integration with the complex systems science can be more promising in the proposition of explanatory models in ecology, since it adds properties like openness, memory, uncertainty, non-linearity and thresholds that are crucial in the explanation of many patterns in Ecology. Thus, at this point it is already possible to realize that this approach can generate hybrid models, that is, they are based on more than one view on scientific explanation and proposition of models. Therefore, we are leaning to assert, agreeing with Braillard & Malaterre (2016), that mechanistic explanation itself does not provide a sufficient account to explain ecological phenomena in their complex totality.

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Processual orders of organized living systems: The agent models of Cuvier, Hufeland and Cabanis

Tobias Cheung (Institute of Cultural History and Theory, Humboldt-University of Berlin, Germany, t.cheung@gmx.net)

In the last third of the eighteenth century, models of living beings as self-active agents played a central role in French and German comparative anatomy, physiology and medicine. In this talk, I will examine three variations of these models in the works of Georges Cuvier, Christoph Hufeland and Pierre-Jean-Georges Cabanis. Cuvier, Hufeland and Cabanis did not develop a milieu theory, but they wanted to know why and how their agents interacted with the world that surrounded them. They thus asked for the conditions and for the mode of existence of living beings. Cuvier's, Hufeland's and Cabanis's organisms were self-active, self-organizing and self-stimulating agents. Their systemic orders of cyclic processes between inner and outer worlds depended on various regulating entities with proper energies or sensibilities. As organized bodies, they existed and reproduced themselves through an ongoing series of acts according to the circumstances of their surrounding worlds. Within this discursive framework, Cuvier focused on systemic orders of correlated and subordinated parts, Hufeland, on reproductive processes and cycles of destruction and production, and Cabanis, on complex networks of organic units with specific stimuli-reaction-schemes. While such agent models of inside-outside relations played also a central role in the philosophies of Kant, Schelling and Hegel, they became, within the French context of the first half of the nineteenth century, part of Destutt de Tracy's, Saint-Simon's and Comte's anthropologies and sociologies.

WEDNESDAY JULY 19
11:00-12:30 – Parallel sessions 9

ORGANIZED SESSION DIVERSE FORMAT – AG-ZOO
Panel with four speakers
Reflections on the Past 50 Years of the History of Biology
Org. and chair of the session: Michael Dietrich (Dartmouth College, USA, michael.dietrich@dartmouth.edu)

This panel takes the publication of the 50th volume of the Journal of the History of Biology as a moment to reflect on the development of the field of history of biology over the past 50 years. Panelists will each offer their perspective on major historiographic trends and themes that they believe have shaped the history of biology. These will include themes such as the rise of global perspectives on the history of biology, the growth of historical narratives that consider women and gender, and the general diversification of approaches away from history of biology as the history of ideas.

Discussants:

Garland Allen (Washington University St. Louis, USA, gallen@wustl.edu)

Since I entered the field of history of science in the early 1960s, historiographical approaches have undergone considerable changes in focus. In the early 1960s the field was still dominated by the history of the physical sciences, approached almost completely from the history of ideas (called "internalist" at the time). The 1970s saw the riise of the Edinburgh School and the "Hard Programme" that took the opposite approach: everything was contextual ("externalist") and in its extreme form ideas and concepts didn't seem to matter. Along the waythere was institutional history, "laboratory life" and the notion of "epistemic things" — in each of their ways introducing new perspectives and viewpoints. These developments highlighted the importance of forging a historiography shaped by the the concepts of Kuhn's paradigm shifts and Marx's socio-economic analysis of science, technology and historical materialism.

Ana Barahona (School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, ana.barahona@ciencias.unam.mx)

In the last decades of the 20th Century, the dichotomy center-periphery influenced historians of science working in non-European science to produce studies that brought to the fore local histories of science, although in tension with the global dimension. In the last two decades, however, numerous studies have rethought the question of the globalization of knowledge from a different perspective, seeking to overcome the bipolar center-periphery distinction. This new perspective has resulted in works that deal with actors and regions not considered before and that have played an important role in the internationalization of knowledge. This perspective has enabled the production of narratives that go beyond the national framework through analysis of transnational participants and processes, and has permitted new ways of thinking about the history of biology in national and regional contexts. Historians of science in regions such as Latin America, for example, can contribute if they situate themselves within the discussion of the transnational dimension of knowledge production.

Karen Rader (Virginia Commonwealth University, USA, karader@vcu.edu)

I will discuss "History of Biology as a Boundary Object." Using the STS as an interdisciplinary lens, I will comment on the ways in which history of biology has intersected over the last fifty years with other emerging scholarly fields, including SSK, Animal Studies, and Environmental Studies. In turn, I will also reflect on how "biology" remains a relevant historiographical focus, despite the increasing diversification and specialization of contemporary life sciences.

Marsha Richmond (Wayne State University, USA, marsha.richmond@wayne.edu)

I will address "Women in the Historiography of Biology." I will comment on how adding women into histories of biology (1) provides a more accurate reflection of the mixed-gender nature of biological research in the 20th century, (2) better depicts the make-up of research groups in both private institutions as well as many university laboratories, and (3) reveals critical social aspects of knowledge production in biology in the 20th century.

ORGANIZED SESSION STANDARD TALKS – CD-A1

Conceptual and Political Challenges in Postgenomics: Organisms, Niches, and Plasticity

Org.: Maurizio Meloni (Department of Sociological Studies, University of Sheffield, UK, m.meloni@sheffield.ac.uk)

Chair of the session: Tatjana Buklijas (Liggins Institute, University of Auckland, New Zealand, t.buklijas@auckland.ac.nz)

Papers:

The politics of nature-nurture: What it was, how it is changing in postgenomic times

Maurizio Meloni (Department of Sociological Studies, University of Sheffield, UK, m.meloni@sheffield.ac.uk)

For complex political, scientific and historical reasons, the twentieth century produced a rather stable association of values between environmentalism and liberal social attitudes (Pastore, 1949). Nurture and plasticity on the left and nature and innateness on the right of the political spectrum became a sort of commonsensical opinion, in debates on education, social justice, human development.

However, this connection of values may be less stable than what we tend to believe (Meloni, 2016). In this paper, I firstly highlight a sort of archaeology of the moral idiom of environmentalism (and plasticity) showing the profound ambiguity of its message (particularly in debates on race) and the oversimplified version with which it was made a natural companion of liberal values. Then, I highlight a few recent quandaries emerging in postgenomics from the circulation of epigenetics in debates on race, gender and social class, to illustrate that a reversal of values may be occurring. Far from being naturally linked to ideas of fixedness of traits, eugenics and racism can be certainly at ease with ideas of plasticity and direct causal power of the environment.

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Meloni, M. 2016. *Political Biology: Science and Social Values in Human Heredity from Eugenics to Epigenetics*. New York: Palgrave.

From the evolution of cooperation to the political physiology laboratory: The adventures of biopolitical science

Stephen Engelmann (Department of Political Science, University of Illinois at Chicago, USA, sengelma@uic.edu)

In the postwar twentieth century neo-Darwinism was always a marginal project in American political science, with one important exception. W.H. Hamilton—probably more important than any other biologist to the history of sociobiology—collaborated with Robert Axelrod, future president of the American Political Science Association, on the latter's Evolution of Cooperation (which Richard Dawkins has said "deserves to replace the Gideon Bible"). This paper explores the twenty-first century political physiology of the University of Nebraska's John Hibbing and his colleagues to understand how and why it largely ignores this prominent legacy and instead shifts fitfully among evolutionary-psychological, behavior-genetic, and neurobiological borrowings. The new science hit the mainstream with The American Political Science Review's publication of "Are Political Orientations Genetically Transmitted?" in 2005. It follows on the psychological turn in the subfield of American Politics, and so unlike Axelrod's game-theoretical work it consistently probes for similarities and differences in what the nineteenth century called character, to find there the (natural-cultural) grounds of politics. An examination of the sources, context, and trajectory of the new biopolitical science reveals why it is at one and the same time theoretically adrift and (at least in terms of funding and publishing) relatively successful, and why it is unlikely fully to escape the legacies of race science, eugenics, and nature/nurture opposition that it repeatedly and explicitly disavows.

This paper is part of a larger project that explores the utilitarian foundations of biosocial science. The dominant thread in this tradition finds the secret of good government in character. My investigation shows that within political science and beyond this thread has been unbroken by postgenomic developments, which are easily assimilated to a medicalizing policy orientation that builds in continuity between biological and political-economic constraints. Whether character outs as given and fixed or developmental and fluid proves to be less important than the reproduction of a framework that renders it as political patient rather than agent, to be better governed in accordance with its scientifically assessed tendencies.

Epigenetics as a political theory of genetically influenced social inequalities

Benjamin Gregg (Government Department, University of Texas at Austin, USA, bgregg@aya.yale.edu)

I first develop a perspective from the standpoint of epigenetics to argue for a strong form of egalitarianism that would regard an individual's epigenetically related disadvantages, in the sense of foiling the goal of equal opportunity. I then pursue this conception of justice in the context of human genetic enhancement, considering the phenomenon of intelligence in particular. On this basis I advance three proposals. First, I consider epigenetic consequences that might favor individual members of a population and, in the aggregate, members of a sub-population. I claim that giving, through genetic engineering, a sizable minority or a majority of a population a competitive advantage in life over others, would render the now disadvantaged population vulnerable to abuses of inequality. Second, in a political community that distinguishes between raising, to average, the IQ of a future baby with an IQ significantly below average, on the one hand —— and, on the other hand, raising a normal IQ to a level much above average, I would argue that therapy for the congenitally weak is just and a social responsibility whereas enhancement for "normal" or "average" persons is not. Third, I argue that parents and newborn babies can be bearers of rights but not embryos and fetuses. From this perspective I answer the question of what parents should be allowed by way of genetically engineering their offspring.

ORGANIZED SESSION STANDARD TALKS – CD-A2

Philosophy of Neuroscience: Broader Implications for Philosophy of Science

Org. and Chair of the session: Marshall Abrams (University of Alabama at Birmingham, USA, mabrams@uab.edu)

Papers:

The invention of functional neuroimaging: A window on technique-drive scientific change

The History of Neuroimaging Laboratory (WUSTL): **Carl F. Craver** (PI, Washington University in St. Louis, PNP, USA, ccraver@wustl.edu), Rick Shang (lab manager; WUSTL PNP), Dave Gruskin (assistant lab manager; Yale Neuroscience), Ronny Bass (WUSTL PNP), Alex DeChristofino (WUSTL Computer Science), Louis Goicouria (WUSTL PNP), Douglas Knox (WUSTL Digital Humanities); Stephen Pentecost (WUSTL Digital Humanities), Joseph McCaffrey (WUSTL PNP).

The invention of functional neuroimaging came to define the field of cognitive neuroscience and quickly diffused from a few central hubs into a more dispersed set of centers, researchers, and fields. The technique quickly transformed psychology departments and then broke beyond those boundaries into the social sciences, humanities, and even business schools. This episode in the recent history of neuroscience provides a window on forms of scientific change driven fundamentally by technological, engineering advances over deep theoretical advances, a form of scientific change that has received too little attention by philosophers of science. I am interested in the norms governing the invention, improvement, extension and adaptation of technologies to solve experimental problem. And I am interested in the discovery process by which such technological innovations are constructed. In this talk, I emphasize the interactions among radiologists, neurologists, electrophysiologists, experts in cerebral metabolism, and cognitive scientists required to combine distinct technologies into a reliable mechanism for detecting changes in blood activation during task performance.

Virtual Morris water maze: The independent life of an experimental system

Nina Atanasova (University of Toledo, USA, Nina.Atanasova@UToledo.Edu)

This paper presents a case study of the Morris Water Maze, an experimental arrangement initially developed as a behavioral test of rat learning and memory. The apparatus was later adapted for mice and most recently for humans. In the case of humans, it is used as a virtual navigation task in neuroimaging studies.

This use of the Virtual Morris Water Maze with humans is interesting for at least two reasons. First, it shows how animal modeling of human behavior and neurocognitive phenomena is a process of extrapolating back and forth between humans and nonhuman animals, contrary to a very common assumption that it only goes from animals to humans based on a priori suppositions of relevant similarities between the two. Second, it shows that what is commonly referred to as "experimental paradigm" in neuroscience is much more similar to Rheinbergerian experimental systems than it is to Kuhnian paradigms.

I argue that it is the opportunism afforded by the developments of new technology that often guides the experimental process in science. In the Morris Water Maze case, the availability of neuroimaging technologies enables neuroscientists to perform experiments on human subjects modeled after previously successful experiments with rodents. In this case, technology rather than some overarching theory shapes the experimental practices in the field. The Morris Water Maze is a clear example of an experimental system with a life of its own, independent from the theory under which it was originally designed.

Furthermore, the variations of the design and the diverse applications of the same basic apparatus allow for integration of experimental and theoretical results produced in different subfields of neuroscience. This goes against the worries that arise under a Kuhnian interpretation of the experimental and explanatory practices of neuroscience according to which integration across fields is not possible because they do not share comparable ontological assumptions.

Mesoscale concepts and cortical function

Philipp Haueis (Humboldt-Universität zu Berlin, Berlin School of Mind and Brain, Germany, haueis@cbs.mpg.de)

High-resolution neuroimaging made it possible to map the mesoscale between cortical areas and single cells, but it remains debated which concepts are suitable to describe functions of neural circuits at this scale. While philosophers of neuroscience have analyzed central concepts at the micro- and macroscopic scale (Chirimuuta and Gold 2009, Mundale 2003), an analysis of mesoscale concepts is largely missing. In this paper, I analyze two mesoscale concepts: the canonical microcircuit (CMC) and the central pattern generator (CPG). Researchers have recently proposed to project the CPG concept from the spinal cord to cortex to understand mesoscale functions (Yuste et al. 2005). Using the patchwork approach to concepts (Wilson 2006), I show that the CPG concept can be projected to different cortical functions. The patchwork approach holds that concepts are evaluated by their local applications and that extending concepts to novel cases can change which property they refer to. CPG and CMC concepts have different local applications, and projecting the CPG concept to the cortex can change to which functional properties it refers to. In the spinal cord, the CPG concept describes how circuits produce oscillatory rhythms that contribute to the survival of the organism (e.g. respiration). In the cortex, the CMC concept can be used to describe two different kinds of function. First, it can be used to describe cognitive processing functions such as direction-selective neural responses. By adding non-simultaneous thalamic input, direction-selective cortical output can be explained by the temporal difference in excitation-inhibition in two CMC modules (Douglas and Martin 1991). Second, it can also be used to describe infrastructural support functions such as gain control. By adding a negative feedback loop with gamma oscillations and chandelier cells, prevention of over-excitation and seizure activity can be explained by the inhibition of axon hillocks in excitatory CMC cells (Merker 2013). Consequently, projecting the CPG concept to cortex can refer to cognitive functions that process behaviorally relevant information, or to infrastructural functions that prevent system damage during increased functional demand. Using the patchwork approach, I show that each projection refers to different circuit elements and distinguishes survival, cognitive and infrastructural functions according to the organization of mechanisms that implement them. Making the patchwork structure of neuroscientific concepts explicit can help to better understand what these concepts refer to, and therefore help to integrate knowledge from various neural systems.

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ORGANIZED SESSION STANDARD TALKS – CD-A3

Biodiversity Patterns and their Ecological and Evolutionary Origin

Org. and chair of the session: Davide Vecchi (Centre for Philosophy of Sciences, Department of History and Philosophy of Science, Faculty of Sciences, University of Lisbon, Portugal, davide.s.vecchi@gmail.com)

The Modern Evolutionary Synthesis was undoubtedly a fundamental achievement in the history of biology. However, it is arguably insufficient to account for all evolutionary explananda, and particularly for biodiversity. Recent theoretical work in evolutionary biology has frequently highlighted the limitations of the Modern Synthesis in this sense (Lynch 2007, Koonin 2009, Laland at el. 2015). Even its most strenuous defenders conceded that it had limited explanatory resources to fully account for the generation of diversity. For instance, making reference to species diversity, Mayr (2004, p. 47) argued that pluralism concerning modes of speciation is surely legitimate because speciation occurs through a plethora of processes (e.g., hybridization, polyploidy, lateral gene transfer, symbiogenesis), with strong ecological bases, which have probably received insufficient attention in the speciation literature. Moreover, acknowledging the existence and importance of those other modes of speciation could improve biodiversity conservation efforts. In this session we shall aim to show that a satisfactory account of biodiversity generation would ideally require a consideration of a much more varied set of evolutionary processes as well as a deeper integration between evolutionary theory and ecology. We would like to provide an interdisciplinary context in which to discuss, from a philosophical and biological perspective, the putative limits of the Modern Synthesis approach to the phenomenon of generation of biodiversity and the prospects of a deeper integration with ecology. The session's contributions will either highlight the role of putatively neglected ecological and evolutionary processes in producing biodiversity patterns or the theoretical rationale for the development of an evolutionary conservation biology with strong ecological roots.

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Mayr, E. 2004. Happy birthday: 80 years of watching the evolutionary scenery. *Science*, 305(5680).

Papers:

Eco-evolutionary feedback theory: Bridging the gap between ecological and evolutionary processes

Silvia Di Marco (Centre for Philosophy of Sciences, University of Lisbon, Portugal + BIODECON R&D Project. Ref. PTDC/IVC-HFC/1817/2014, msilvia.dimarco@gmail.com)

The importance of biodiversity for ecosystem services is recognized both in biodiversity and ecosystem science. However, while conservation biologists struggle to develop an evidence base that supports the protection of biodiversity as a good endowed with direct value, community ecologists focus on the contribution provided by biodiversity to the ecosystem processes. For conservationists, such a utilitarian view of biodiversity is a cause of concern (Mace et al. 2012). This preoccupation, however, might be misplaced. Although ecologists have traditionally considered biodiversity a mere epiphenomenon of extant ecological conditions, they are gradually changing their approach. In fact, since the introduction of the concept of ecological service in conservation policies, community and ecosystem ecologists have paid more and more attention to biodiversity as a driver, not a product, of ecosystem functioning, and in order to study the reverse effect of biodiversity on ecosystem functioning, they are searching new ways to connect the dots that link the evolution of species traits at the individual level, the dynamics of species interactions and the overall functioning of ecosystems (Loreau 2010). The goal of this contribution is to spell out the interaction and reciprocal influence between evolutionary theory, community/ecosystem ecology and biodiversity conservation. To this aim we discuss the eco-evolutionary feedback theory by Post & Polkovacs (2009). This theory attempts to link community and ecosystem ecology with so-called contemporary evolution (heritable trait evolution observed over the human time-scale), thus making a strong case for the conservation of both ecological and evolutionary diversity. The presentation is divided in two moments: in the first part, we analyze the eco-evolutionary feedback theory as an example of evolutionary model characterized by a strong ecological component and directly informed by conservation concerns; in the second part, we discuss how this evolutionary model, by deepening the integration between evolutionary theory and ecology, is supportive of "evolutionary-sensitive" conservation policies even within the pragmatic and anthropocentric framework of the ecological services approach.

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Are species the main units of biodiversity? A lesson from multispecies biofilms

Elena Casetta (Train2Move Fellow - Marie Curie Actions, Department of Philosophy and Educational Sciences, University of Turin, Italy + Centre for Philosophy of Sciences, University of Lisbon, Portugal + BIODECON R&D Project. Ref. PTDC/IVC-HFC/1817/2014, elenattesac@gmail.com) and **Jorge Marques da Silva** (Department of Plant Biology / BioISI - Biosystems and Integrative Sciences Institute, Faculty of Sciences, University of Lisbon, Portugal + BIODECON R&D Project. Ref. PTDC/IVC-HFC/1817/2014, jmlsilva@fc.ul.pt)

Species are considered to be the most important units of biodiversity. However, as it is well known, species demarcation becomes fuzzy—if it makes sense at all—at the bacterial level. Some recent works (see, in particular, Bapteste et al. 2012) have shown that many other processes rather than vertical descent contribute to generate diversity, namely processes that use genetic material form multiple sources, such as recombination, lateral gene transfer, and symbiosis. These processes produce evolutionary outcomes at different hierarchical levels. Species, at least at the microbial level, might prove not to be the most relevant units of biodiversity, and speciation might not be the only process to be taken into account. In particular, Bapteste and colleagues suggest that a range of mosaic evolutionary units should be formally recognized. The two extremes of this range are "mergers" and “multilineages clubs”. Mergers are molecular, genomic, or organismal units that emerge when two or more entities are brought together in the same unit and subsequently are replicated through the replication of the unit of which they are components. Multilineages club are coalitions of entities that replicate separately and that exploit some common genetic material that cannot be traced back to a single last common ancestor of all the members of the club. Both mergers and multilineages clubs may result in evolutionary transitions (the mergers, if they loose the capability of autonomous reproduction; the clubs, if they have or acquire the capability of reproducing). In this contribution we will discuss a case of multilineages club, namely multispecies biofilms, making reference to a particular case study (the biofilm made of Acinetobacter and Pseudomonas putida; Hansen et al. 2007a; 2007b). We shall argue that multispecies biofilms play a crucial—and still underestimated—role in biodiversity production and conservation, both at the microbial and at higher levels (notice that, in spite of microbial diversity being at the basis of ecosystems functioning, its importance is usually neglected in conservation policies and actions). In particular, after having discussed how microbial diversity, and biofilms in particular, impact ecosystems diversity (and hopefully stability), we will argue that they increase phenotypic and genetic diversity. Then, we will ask whether multispecies biofilms might result in evolutionary transitions (at least in the case under scrutiny). Finally we will highlight two limits of the traditional species-based approach to biodiversity conservation that become especially evident in microbial diversity. The first is its limited capacity of taking into account evolutionary potential. The second is its limited capacity of taking into account multispecies communities.

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The instability of the homogeneous and the stability of the heterogeneous as causes of biodiversity

Davide Vecchi (Centre for Philosophy of Sciences, Department of History and Philosophy of Science, Faculty of Sciences, University of Lisbon, Portugal, BIODECON R&D Project. Ref. PTDC/IVC-HFC/1817/2014, davide.s.vecchi@gmail.com)

Darwinism proposes that biodiversity patterns are the result of the slow and gradual accumulation of heritable variations. An intriguing issue concerns the nature of the relation between genomic and phenotypic variation. In order to understand to what extent phenotypic diversity and complexity depend on genomic variation, we would need at least a categorization of genomic changes. However, a unified theory of genomic changes is lacking (Sarkar 2014), even though molecular biology has advanced tremendously in this direction and the use of the general term "mutation" to describe all instances of genomic change – even though still popular in the population genetics literature (Lynch 2007) – is certainly unjustified (e.g., point mutation, gene duplication, whole-genome changes and insertion of mobile DNA elements are, mechanistically-speaking, radically different processes). One very general way of grouping together all processes of genomic change might be reference to general evolutionary principles. In this talk I shall focus on two, proposed by past and recent evolutionary thinkers in order to complement the Darwinian explanation. The first - probably first noticed by Herbert Spencer (1862), but resurrected in a new form by McShea and Brandon (2010) – is the principle of the instability of the homogeneous, which is supposed to account for the tendency to diversify underlying life's evolution and for the path from one single life form to extant biodiversity. The second – again probably first noticed by Herbert Spencer (1862) and articulated in a scientifically respectable form by Maynard-Smith & Szathmary (1995) – is what could be called the principle of the stability of the heterogeneous, which is supposed to account for the tendency to complexify underlying life's evolution and for the major evolutionary transitions. The question I would like to pose in this context is: what biological form should these two principles adopt in order to complement the Darwinian explanation of biodiversity patterns?

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ORGANIZED SESSION STANDARD TALKS – MINAS1
Multidisciplinary Perspectives on Evolutionary Biology, Religion and Society

Org.: James Riley (Centre for Science, Knowledge and Belief in Society, Newman University, UK, rile402@newman.ac.uk)

Chair of the session: Bernard Lightman (Department of Humanities, York University, Canada, lightman@yorku.ca)

Papers:

Oliver Lodge, evolution, and religion

Bernard Lightman (Department of Humanities, York University, Canada, lightman@yorku.ca)

In this paper, I examine Oliver Lodge and how he incorporated evolution into his religiously inflected popularization of science from 1919 to 1933. Lodge's main concern after his retirement was to educate the public on the larger metaphysical and religious meaning of contemporary science. This meant explaining the new developments in physics, especially relativity theory and quantum theory, to the early twentieth century reading audience. But it also involved incorporating them into the metaphysical and religious framework he had previously developed, with its emphasis on the concept of the ether, psychical research, and on a broad-ranging natural philosophy. Lodge came to believe that unlike the past physicists that he most identified with, figures such as Kelvin and Maxwell, he needed to combine his natural philosophy with cosmic evolutionism. Lodge presented an evolutionary ether theology. Lodge is therefore an interesting case study in how an early twentieth century popularizer attempted to synthesize the physical and the organic sciences into a new unity. Rejecting the supposed materialism of previous evolutionary syntheses, like those of Herbert Spencer and Ernst Haeckel, Lodge created a new synthesis that contained teleological and religious overtones, which proved appealing to readers in the second decade of the twentieth century.

Popes and evolution in the press: A media content analysis of UK newspapers

James Riley (Centre for Science, Knowledge and Belief in Society, Newman University, UK, rile402@newman.ac.uk)

On 27th October 2014, Pope Francis addressed the Pontifical Academy of Sciences on the topic of evolution. His statements, which affirmed the truth of evolution and its compatibility with doctrines of creation, sparked media reaction around the world. Although some journalists commented that the Pope's position was not a new direction for the Church and criticised the general media reaction, stating how "site after site after site ramped up the Pope's words and took them out of context" (Dias, 2014). This media explosion suggests that many media outlets perceive the Catholic Church as being anti-science, anti-evolution or even pro-creationism. The first official Catholic encyclical which specifically addressed evolution had come 67 years earlier in 1950. In Humani Generis, Pope Pius XII explained that the Catholic Church does not forbid research and discussion to take place regarding the "doctrine of evolution", but warned against those who "rashly transgress this liberty of discussion, when they act as if the origin of the human body from pre-existing and living matter were already completely certain and proved by the facts" (Pius XII, 1950). The Catholic Church, then, was open to the idea of evolution in 1950, although at the time Pius deemed it an unproven hypothesis. In this paper, I present the results of a media content analysis which seeks to understand the UK print media coverage and framing of instances of public commentary on evolution by several Popes since 1950. Although much anecdotal evidence and public commentary suggests a media bias towards presenting the Catholic Church as anti-evolution, or anti-science, as of yet no empirical research has yet been conducted in this area.

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British Muslim perceptions of biological evolution

Glen Moran (Centre for Science, Knowledge and Belief in Society, Newman University, UK, Glen.Moran@staff.newman.ac.uk)

There is a common perception, both in academic literature as well as in the popular press, that Muslims in the UK reject evolution. However, this perception that the majority of Muslim individuals are 'Islamic creationists' is not rooted in substantial academic research. Drawing on 40 semi-structured interviews examining British Muslims' perceptions of evolution, this paper demonstrates that the situation is far more complex than has generally been assumed. It shows that participants from different ethnic and national backgrounds display different levels of understanding and acceptance of evolution. As a result, this paper argues that the participants' religion is not the only factor influencing Muslim individuals' perceptions of evolutionary theory, as is often assumed in academia and the media. The findings of this paper are significant given that some have used debates about 'Islamic creationism' to propose a 'clash of civilisations' narrative, where ingrained cultural differences are hypothesised to drive conflict and division in the modern world. Instead, by drawing on empirical evidence this paper argues that the influence of context is essential in shaping the way that participants view evolution and the position of evolution within their own religious beliefs. It also highlights several common misconceptions about evolution that were shared by the participants in this study, misconceptions which are not solely limited to those of Islamic faith.

ORGANIZED SESSION STANDARD TALKS – MINAS2

The Cell Theory Reconsidered: From Cell to Organism

Organizer and chair of the session: Sherrie L. Lyons (Center for Distance Learning, Empire State College (SUNY), USA, sherrie.lyons@esc.edu)

The cell theory emerged as one of the few unifying theories in biology. Yet certain aspects of it have always been problematic which reflected larger themes and philosophical debates over trying to understand hereditary and development. Would a structuralist or functional approach yield the greatest insights in understanding biological phenomena? The history of development shows that investigations in understanding the cell proceeded in two very different directions revealing a tension between reductionism and a more holistic approach to understanding life. Esposito's talk focuses on William

Ritter’s organismal conception of life. When it was discovered that the nucleus contained the hereditary material many biologists thought that it must also control development. But Ritter rejected nuclo-centric views, instead emphasizing the interaction between the nucleus and the cytoplasm. Ritter also thought one’s understanding of the cell had political implications and tied his systemic view of the cell to progressivist and democratic political ideals. Lyons’ talk examines Daniel Mazia's concept of the cell body, a structure smaller than the cell, but had all the basic attributes of a living entity. He believed something was missing in our understanding of the cell and emphasized the importance of microscopy in understanding cell structure. The implications of his ideas for current research will also be briefly discussed. Vallejos discusses three research programs in present day cell biology that focus on different levels of analysis: gene-centric, cytoplasmic structures within the cell, the whole cell and its interactions with other cells. While no one disputes the basic idea of the cell theory all of these talks suggest that it may need to be modified to fully understand how a cell becomes an organism surviving, reproducing and evolving in an ecosystem.

Papers:

Within and beyond the cell: William Emerson Ritter between cytology and politics

Maurizio Esposito (Department of Philosophy, University of Santiago, Chile, maurizio.esposito@usach.cl)

What a cell is and how it works were two of the main issues that William Emerson Ritter attempted to solve in his opus magnum, *The Unity of the Organism, or the Organimsal Conception of Life* (1919). Ritter considered cytology one of the most exciting disciplines in biology for two reasons: first, the cell represented the minimal highly integrated system showing how reductionist and mechanistic approaches in the life science were misguided. The systemic and irreducible interactions within nucleus and cytoplasm sustained Ritter’s dearest philosophical position: that the whole in the organic world was more than the parts. Second, knowledge in cell biology had political implications. In condemning nucleo-centric views, Ritter emphasized the importance of the internal and external environment in determining cell behavior. He believed that nucleo-centric standpoints supported a determinist and fatalist view of heredity, which in turn informed conservative and pernicious eugenic policies.

This talk aims to reconstruct Ritter's cytological thoughts within the social and political context of his time. It will be shown that during the first decades of the 20th century the cell was a contentious political entity. Whether the cytoplasm played a role in heredity or whether the nucleus carried all the sufficient elements for determining characters was not only an empirical issue; the inner nature of the cell addressed also important social concerns. In fact, Ritter believed that a systemic view of the cell would be in agreement with an anti-deterministic and holistic conception of heredity. What organisms are could not be exclusively ascribed to the nuclear matter, but also to the environment in which they dwell. In conclusion, the talk shows how Ritter linked a systemic view of the cell with progressivist and democratic political ideals.

"Something is missing": Daniel Mazia and the concept of the cell body
Sherrie L. Lyons (Center for Distance Learning, Empire State College (SUNY), USA, sherrie.lyons@esc.edu)

Daniel Mazia was best known for his work explicating the structure of the mitotic apparatus as he investigated the general problem of cell reproduction. For the last part of his career he focused on the importance of the centrosome as being critical to the "origin of twoness." He suggested that "something is truly missing in our image of the cell" and developed the concept of the cell body, a structure smaller than the cell and argued that it was the smallest autonomous self-reproducing unit of eukaryotic life. He suggested the centrosome might be the organ of interpretation through which the entire structure is managed. Today cell biology is in transition from a science that was preoccupied with assigning functions to individual proteins or genes, to one that is trying to cope with the complex sets of molecules that interact to form functional modules. Although much of Mazia's work involved identifying molecules that were critical to the various stages of cell division, he always had this larger vision, arguing that literally seeing the underlying structure of the cell as revealed by advances in microscopy would provide insight to development. Some current research that makes use of the concept of the cell body is discussed and emphasizes that the cell is not an autonomous unit. For most higher plants the cell theory has always been problematic since almost all the cells of a given plant are interconnected via cell to cell channels.

Furthermore cell to cell communication plays a critical role in the link between genotype and phenotype. Mazia recognized that neither a strictly biochemical approach nor a morphological one is adequate to understand how a cell becomes an organism.

Cell biology and the choice of a fundamental unit of analysis
Gabriel Vallejos (Faculty of Sciences, University of Chile, Chile, gabo.jet@gmail.com)

Cell biology can be considered as the study of cellular mechanisms. These can be defined as sets of entities and activities that produce regularities for their spatial and temporal organization. Such mechanisms can be decomposed, in turn, into sub-mechanisms. Decomposition might end in a "bottom out" or fundamental level of analysis. Currently, cellular biology has undergone a split into many sub-disciplines. Each one could be identified in agreement with the class of sub- mechanisms under study. According to the different "bottom-out" levels, three types of disciplines can be distinguished: gene-centric disciplines, disciplines centered in cytoplasmic structure (or whole cell inner structure), and disciplines that consider the whole cell as fundamental unit. In this talk I will briefly explore the development of these three research programs and give examples of the current research being done within each one. Gene-centric disciplines were consolidated in the 1970s after the discovery of the molecular basis of inheritance and deciphering of the genetic code. These disciplines fostered research programs whose aim is to explain all cellular processes in terms of the genes that control them. But this has been strongly criticized. A telling example is what happens in developmental biology, where many processes are not purely genetic, and to explain them it is important to consider the cytoplasmic structure and organization. In the aforementioned programs, the cell as a "locus of inquiry" is scrutinized. Recently the whole cell has been reconsidered as a fundamental unit of analysis in various disciplines. Here, cell movement, cell-cell interaction and physical properties of cellular aggregates play a central role. Cell surface has become a main protagonist, especially in immunology and developmental biology. Finally, despite the disagreements within the scientific community about the levels of analysis, it is agreed that it is necessary to foster permanent collaboration and coexistence among different approaches.

INDIVIDUAL PAPERS SESSION – MINAS3

Gender and Sexual Orientation: Philosophical Perspectives

Chair of the session: Ingo Brigandt (Department of Philosophy, University of Alberta, Canada, brigandt@ualberta.ca)

Papers:

Three concepts of gender for different social aims

Ingo Brigandt (Department of Philosophy, University of Alberta, Canada, brigandt@ualberta.ca) and Esther Rosario (Department of Philosophy, University of Alberta, Canada, erosario@ualberta.ca)

Examining previous discussions on how to construe the concepts of sex and gender, we argue that at least three different concepts of gender are needed. This is analogous to the idea that a plurality of species concepts is needed because different species concepts answer to different epistemic aims, but in our case social aims are at stake. In line with the emerging practice of 'conceptual engineering' in philosophy, which is not about analysing received concepts but developing improved or novel philosophical concepts, we dub our approach strategic conceptual engineering. This is the employment of a (possibly novel) concept for specific epistemic or social aims, concomitant with the openness to use a different concept for other purposes. We assume that also several concepts of race are needed, but in this presentation focus on gender, by sketching three distinct concepts of gender and arguing that all of them are needed, as they answer to different social aims. The first concept serves the aim of identifying and explaining gender-based discrimination. It is similar to Sally Haslanger's well-known account, except that rather than offering a definition of 'woman' we focus on 'gender' as one among several axes of discrimination. The second concept of gender is to assign legal rights and social recognition, and thus is to be trans-inclusive. Against Katharine Jenkins' recent proposal, we argue that this cannot be achieved by any concept that includes substantial gender-related psychological features, such as awareness of social expectations. Instead, our concept counts someone as being of a certain gender based on the person's mere self-identification with this gender. The third concept of gender serves the aim of personal empowerment by means of one's gender identity. In this context, substantial psychological features and awareness of one's social situation are indeed involved.

Queering explanations of human sexual diversity

Fabrizzio Mc Manus (Centre for Interdisciplinary Research in Sciences and Humanities, National Autonomous University of Mexico, Mexico, FabrizzioMc@gmail.com)

Many branches of biology, from genetics to epigenetics, from neuroscience to behavioral biology, have been recruited to explain human sexual diversity. This continues to be the case even if now the aim of explanations is not to serve as a basis for therapeutic interventions. Cultural Studies, specially after Foucault, have paid attention to the effects that biological knowledge has on pathologizing or normalizing, validating or invalidating, different and non hegemonic sexualities and gender configurations. Sadly, philosophy of biology has had little to said, at least until recently and with the mainstreaming of analytic feminism. My aim in this talk is to contribute to these new approaches in which philosophy of science joints efforts with gender studies and feminism and, hence, offers powerful resources to criticize gender biases and demands for explanations informed by cis-heterosexism. I specifically elaborate an analysis centered on the following points: (i) which are the common patterns of explanations given for sexual diversity in humans; here, I identify two basic recurring elements, one in which it is emphasized a causal structure that tends to neglect language and culture in favor of causal networks in which biological factors are privileged and, two, the construction of sexual diversity in terms of explananda that tend to homologize human sexual behavior with that present in other animals. I also pay attention to (ii) the effects and biases of those patterns, specifically, those leading to ignorance and discrimination; in this point I follow some of the developments in agnotology or the current epistemologies of ignorance. Finally, (iii) I discuss the pertinence of providing alternative explanations by giving an example of how the new post-dualistic biology might give us new insights in the study of human sexual behavior. Nonetheless, these insights might leave untouched the validating role of the biological and biomedical sciences. Thus, I argue that we not only need a new biology but, as well, a new relation between science and society if we aim to overcome the legacy of cis-heterosexism in science.

Adaptiveness of the sexual orientation spectrum: Resolving the seeming evolutionary puzzle of homosexuality

Jaroslava Varella Valentova (Department of Experimental Psychology, Institute of Psychology, University of São Paulo, São Paulo, Brazil, jaroslava@usp.br) and Marco Antonio Correa Varella (Department of Experimental Psychology, Institute of Psychology, University of São Paulo, São Paulo, Brazil, macvarella@gmail.com)

The majority of males and females predominantly prefer opposite-sex sexual and/or romantic partners. Such sexuality has been accepted as a standard default, possibly because it is easier to see its biological/evolutionary relevance. Indeed, in sexually reproducing species, preference for and sexual activities with opposite-sex partners evolved as a mechanism for combining genomes through complementary gametes, thus gaining genetic variability and direct fitness. In this line, scholars have argued that homosexuality is an evolutionary puzzle because it impedes reproductive success of their owners. Although direct reproduction is the ultimate evolutionary force behind most sexual activities, sexuality in general gained many other proximate functions during its evolution. These new functions can enhance direct reproduction, e.g., by means of survival and alliance formation and/or indirect reproduction by helping kin, also known as inclusive fitness. Therefore, many forms of sexuality, such as oral or anal sex, masturbation, sexual preferences for different species, preferences for same-sex individuals, or individuals outside of reproductive age, cannot per se offer direct reproductive success of the individual, but still these nonfertile forms of sexuality can offer other adaptive sociosexual functions (e.g., pair bonding, alliance formation, resource acquisition, well-being, etc.) that might indirectly foster future direct or indirect reproduction.

Further, sexual orientation is a psychological mechanism that generates a continuous array of individual variation and not a dichotomous psychological trait. Usually, (non)adaptiveness of the extreme point within the continuum (exclusive homosexuality) is discussed, while variation along the whole continuum of sexual orientation (e.g., predominantly heterosexual, bisexual, predominantly homosexual, etc.) is ignored. Even if exclusive homosexuality does not have any possible adaptive value, the majority of variation on the continuum of sexual orientation can offer adaptive advantages for their carriers.

In this paper, we will outline theories presenting adaptive reasons for the evolution of nonheterosexual orientations, either by stressing indirect reproduction via kin selection or direct reproduction via sneak copulations or same-sex alliance formation that can increase survival and future direct reproductive capacity. Also by-product theories offer plausible evolutionary reasoning for the origins and maintenance of nonheterosexual orientations. Following the latter theories, nonheterosexual orientations would have been passed on throughout generations together with the adaptive trait of sex-atypicality, advantages of an increased fertility in the other-sex kin, or in carriers who do not express the homosexual phenotype. These theories are not mutually exclusive, and together they can explain a bigger proportion of the sexual orientation continuum. We will stress the fact that sexuality does not equal reproduction, and that at least some homosexual and nonheterosexual individuals within the whole spectrum of sexual orientation do reproduce and raise their offspring. Non-heterosexual orientations thus do not need to present a puzzle for evolutionary thinking.

INDIVIDUAL PAPERS SESSION – AG-BOT

Philosophy of Evolution II

Chair of the session: Giorgio Airoldi (Department of History and Philosophy of Science, UNED, Madrid, Spain, airoldi@tin.it)

Papers:

A proposal of Design Space to classify and explain evolutionary changes

Giorgio Airoldi (Department of History and Philosophy of Science, UNED, Madrid, Spain, airoldi@tin.it)

Against neo-Darwinian accounts that argue that, through the optimization of fitness, Natural Selection has an unlimited power to create new phenotypic traits and architectures, alternative processes have been proposed to explain the tendency of organisms towards complex organizations. We can classify those in three main groups. First, the source of novel phenotype can be identified in genetic-based processes, as in Wright's shifting-balance theory or Eldredge & Gould's Punctuated Equilibria theory. Second, phenotype-centered mechanisms - like exaptations - are suggested as potential opportunities for design improvement. Finally, processes linked to self-organization laws working in complex systems or to developmental constraints are pointed out as the real path leading to new architectures.

We think that this abundance of candidate explanations for new phenotypic traits reflects the wide range of very different evolutionary facts that remain unexplained. For instance, change in wing colours in a population of B. betularia is a different phenomenon from the appearance of feathers: the former gives rise to a different version of the same trait, while the latter means a radical innovation. It seems clear that not every evolutionary phenomenon entails a change in architectural complexity, at least not in the same degree. Moreover, excluding the simplest cases (e.g., the B. betularia melanism), architectural complexity is not reducible to the value of a single scalar variable like fitness (as implicitly assumed in neo-Darwinian models). We claim that all these mechanisms (Darwinian and non-Darwinian) are relevant, but that, in order to define how and to which extent they contribute to shape phenotypic complexity, it is necessary to build a classification of evolutionary phenomena.

To do this, we propose to describe complex design also through the phenotypic robustness of the organism, and not only through its fitness. In this bi-dimensional design space, each point represents an organismic architecture, and movements between two points represent evolutionary facts. We explain how each of the above-mentioned processes acts in this space. Natural Selection, for example, mainly explains movements along the fitness axis, while other non-selective mechanisms explain movements along the robustness axis. Most evolutionary phenomena entail changes in fitness and robustness at the same time, and it is thus possible to track them by factorizing their movements along both axes. We propose the example of a possible explanation to the appearance of the function of flight as the sum of increased robustness due to drift (appearance of feathers for thermoregulation), fitness optimization by natural selection, and a further increase in robustness due to exaptation (use of drift for flight).

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The emerging structure of the Extended Evolutionary Synthesis: Epistemic turmoil and alternative interpretations

Alejandro Fábregas-Tejeda (Institute of Biology, National Autonomous University of Mexico (UNAM), Mexico, fabregas_alejandro@ciencias.unam.mx)

Contemporary evolutionary biology is often perceived as a plural landscape of multiple co-existent conceptual frameworks and strenuous voices that disagree on the nature and scope of evolutionary theory; within the discipline, a burgeoning discussion is gaining ground: whether we need a novel and comprehensive view to “extend” or “go beyond" the boundaries and explanatory power of the Standard Theory of Evolution. Accompanying the debate of this view that emphasizes notions such as “reciprocal causation” and “constructive development”, some historiographies and philosophical standpoints have emerged in an attempt to clarify what exactly the “Extended Evolutionary Synthesis” (EES) represents. For Massimo Pigliucci, the EES is merely the newest instantiation of a persisting Kuhnian paradigm: a single conceptual framework cemented by the ideas of Darwin and Wallace that has been refined, expanded and assembled in a step-wise manner during historically important instantiations (i.e. Neodarwinism, Modern Synthesis, EES). In contrast, the philosopher of biology Telmo Pievani has contended that the transition to an EES could be best represented as a progressive reformation of a prior Lakatosian “scientific research programme”, extending its Neo-Darwinian core and adding a brand-new protective belt of assumptions and auxiliary hypotheses with a pluralistic explanatory approach. A nuanced version of the latter view, expounded and discussed during the 2016 meeting “New trends in evolutionary biology” held at the Royal Society, is reaching for consensus among the international communities of scientists and philosophers that support the EES movement. In this paper, I argue that those philosophical vantage points are not the only way to think about theoretical change or the possible interpretations of what an “Extended Evolutionary Synthesis” stands for and what resignifications may entail. I propose the image of the emergent EES as a vast network of models and interweaved representations that, instantiated in diverse practices, are connected and related in multiple ways. Further, the EES could be articulated around a paraconsistent network of evolutionary theories, models, practices and representation systems, with edges and nodes that change their position and centrality as a consequence of the co-construction and stabilization of facts and historical discussions revolving around the epistemic goals of evolutionary biology. Such conceptual architecture of the EES would allow explanatory schemes of multilevel causation, pertinent to the ontological complexity of biological systems. I then proceed to critically analyze the purported structure of the EES published by Laland et al., in 2015 and, as a concrete example, I consider which epistemic units (sensu Ingo Brigandt's epistemology of explanatory integration) of Evo-Devo are present or still missing from the emerging architecture of the EES.

Conceptual networks analysis of the integration between internalist and externalist views in Evo-devo

Wellington Bittencourt-dos-Santos (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE). Graduate Studies Program in History, Philosophy and Science Teaching, Federal University of Bahia and State University of Feira de Santana, Brazil, biowell@hotmail.com)

The goal of the study reported here is to elaborate a cartography of evo-devo conceptual frameworks, as exposed in technical books of the field, in order to analyze the relation between internalist and externalist ideas. Computational analytical tools are used to generate and investigate the conceptual networks, as a way of exploring the conceptual framework underlying the discourse in the books. The conceptual networks were built from the connectivities established between key concepts, which were previously selected and validated by experts in evolutionary biology, evo-devo and philosophy of biology. These key concepts were used as indicators of internalist and externalist approaches in the analyzed books. We used several metrics from complex networks theory in order to understand the role of concepts in the network structure. These metrics allow us to evaluate the centrality of the concepts in relation to the connectivities established in the network. We also perform the partitioning of networks into conceptual communities, formed by concepts that are more strongly connected to each other. Subsequently, we seek to understand how these communities are related through the homophilia (establishment of ties with members of the same community) and heterophilia (establishment of ties with members of the others communities) between the concepts composing the networks. The cartography of evo-devo conceptual frameworks make it possible to: (i) investigate possible current integrations between externalist thinking, which prevailed in the modern evolutionary synthesis, with internalist thinking, which has been important in the history of evolutionary ideas and that has deserved more attention since the emergence of evolutionary developmental biology; (ii) provide a useful analytical framework of the current panorama of theoretical restructuring experienced by evolutionary biology.

WEDNESDAY JULY 19
15:30-17:00 – Parallel sessions 10

ORGANIZED SESSION DIVERSE FORMAT – CD-A1
Panel
Organisms, Membranes and Boundaries: A Process Perspective
Org. and chair of the session: John Dupré (University of Exeter, UK, j.a.dupre@exeter.ac.uk)

This symposium derives from John Dupré's ERC-funded project, A Process Ontology for Contemporary Biology. After a brief introduction to the project and the symposium by Dupré, in the first talk Dan Nicholson will explain the process perspective on the organism, specifically contrasting it with the more familiar mechanistic view, and stressing the pervasive fluidity of living systems. Organisms are processes that maintain a degree of stability only by constant exploitation of energy from their environment.

Although they are fluid, organisms and cells are anything but homogeneous. Their necessarily heterogeneous distribution of constituents is maintained by a vital class of entities that has been generally neglected by philosophers, membranes. Stephan Guttinger describes some of the crucial properties of these semi-permeable boundaries, properties that raise fascinating questions. To what extent do membranes provide boundaries to biological entities? But given that they are substantial material entities themselves, what are their own boundaries? These questions prove to have no straightforward answers, and the vagueness to which they point is best interpreted from a process perspective.

The final talk, by Anne Sophie Meincke, addresses the question of boundaries from a more general metaphysical perspective. The question has been largely ignored in traditional metaphysics, presumably because boundaries were assumed to be parasitic on the things of which they provided the limits. But processes, notably organisms, actively construct and maintain their boundaries. This provides the key to a richer conception of boundaries that can accommodate the vagueness delineated in the preceding talk.

After approximately a ten minutes introduction by the organiser, each speaker will talk for about 20 minutes, leaving 20 minutes for general discussion with the audience.

Papers:

Mechanisms and the fluidity of life

Daniel Nicholson (University of Exeter, UK, dan.j.nicholson@gmail.com)

Organisms are not fixed structures, like machines. Although they share with machines the property of being hierarchically organized, their respective modes of organization are fundamentally different. Machines exhibit a static organization, given that their physical architecture—as well as the degrees of freedom of their parts—is fixed upon manufacture. Organisms, in contrast, exhibit a dynamic organization, given that their form reflects a stabilized pattern of continuous material exchange with their environment. The reason for this difference has to do with the peculiar thermodynamic predicament organisms find themselves in. Organisms can only persist by maintaining themselves far from thermodynamic equilibrium, and this requires a constant expenditure of free energy, which organisms obtain from the matter they import from their environment. Importantly, it is not that matter flows through an unchanging organism; instead, the organism itself is continuously re-constituted from the matter it exchanges with its surroundings. Organisms are steady flows or streams; they are processes in a basic, ontological sense. Accordingly, the organizational hierarchy of an organism is a hierarchy of processes, not of things. The further down we go in the hierarchy, the faster the turnover of material exchange, and by the time we reach the level of the cell, we are confronted with a system that seems more reminiscent of a liquid than a solid. It has a highly plastic form that becomes modified in response to environmental cues, and its internal architecture is in a permanent state of flux. Linear structure-function relationships break down as its constituents transiently assemble and disassemble into different functional configurations to meet the changing demands of the system as a whole. Ultimately, the very concept of a 'part' loses its coherence, as it becomes apparent that there is no single, principled way of decomposing the system into discrete units. Although not immediately obvious, all of this is true for larger living systems as well. An organism is only rigid and static when it is abstracted from time. The longer we consider an organism (large or small), the more apparent its fluidity becomes, and the harder it is to recognize anything approaching the rigidity or even the stability that is characteristic of machines. In this talk I will argue that the fluidity of life challenges the supposed sufficiency of mechanistic explanations in biology, which typically involve identifying a set of parts in a system and showing how they causally interact to produce a phenomenon. Despite their unquestionable value in biological research, we should not lose sight of the fact that the mechanisms postulated by such explanations are always spatiotemporal abstractions from a broader and more fluid biological context, and that their explanatory power relies on the components of the mechanism, as well as its overall organization, being sufficiently stable during the time the phenomenon is manifested. Overall, while it is undeniable that describing mechanisms in organisms provides an effective means of explaining many different phenomena, we should not make the mistake of interpreting such successes as evidence that life itself is ontologically mechanistic.

Vagueness and the processual nature of membranes

Stephan Guttinger (University of Exeter, UK, S.Guttinger@exeter.ac.uk)

Biological membranes are highly dynamic molecular complexes formed out of lipids, proteins, and carbohydrates. Their key function is to serve as semi-permeable boundaries of cells and the organelles they contain.

A central feature of membranes is the interdependence that underlies their functioning: even though membranes depend on the metabolic activity of cells (as it provides the majority of the membrane's components), at the same time there could be no cellular metabolic activity without the presence of functioning membranes. This dynamic nature of membranes not only matters when we consider the more general relation between the membrane and the cell but also when we try to characterise the membrane itself at the molecular level: if we take a close look at the dynamics of membrane functioning and maintenance it becomes clear that there is no obvious way in which to delineate 'the' functional membrane; where to draw the boundary around the membrane itself is a question that seems to have no clear answer. The aim of this talk is to show that a processual view of biological membranes can help us deal with this issue of vagueness. To do so it will be crucial to re-think the nature of molecular complexes and their boundaries. Or so I will argue here.

Membranes form a powerful starting point for such a re-thinking not only because of their specific characteristics but also because of recent developments in membrane research. For most of the 20th century biologists treated membranes as mere aggregates of lipids and proteins. In recent years, however, this traditional view of membranes has come under pressure. Driven mainly by advances in the temporal and spatial resolution of imaging technologies, membrane biologists have replaced the molecular-aggregate model with a model that focuses on the importance of relations and change. The idea of 'lipid rafts', small and highly dynamic sub-regions within membranes, has been especially important in these developments. Here I will discuss some of the recent findings on lipid rafts and the implications they have for our understanding of the nature of biological membranes and their boundaries. This discussion will show that a switch to a processual view is not only in line with current scientific models but can also help to overcome the vagueness issue that the traditional view of membranes suffers from.

On the metaphysics of living boundaries

Anne Sophie Meincke (University of Exeter, UK, A.S. meincke@exeter.ac.uk)

Material objects are commonly taken to possess boundaries by virtue of which they are demarcated from the rest of the world. Boundaries, so it is assumed, individuate objects. Surprisingly, there is no generally accepted account of the metaphysics that would validate these natural assumptions. Apart from the fact that the nature of boundaries is not exactly a hot topic in today's analytic metaphysics, metaphysicians, when actually discussing the issue, tend to underestimate or even dismiss the ontological importance of boundaries.

One reason why scholars are suspicious about boundaries is given by traditional puzzles as to how boundaries relate to the entities they bound. Does the boundary separating two adjacent objects A and B belong to A or to B, to both A and B, or neither to A nor to B? The major driving force behind the increasing popularity of eliminativism, however, is considerations about vagueness. Given that physical objects are widely believed to be nothing but swarms of subatomic particles, how could the boundaries of such objects be any more than fictitious abstractions?

On the other hand, realist defences of boundaries typically attribute a lower ontological status to the latter: boundaries are taken to be less real than the objects they bound insofar as the former cannot exist in isolation from the latter. Boundaries are regarded as ontological parasites or so-called ‘dependent particulars’ (R. Chisholm); there would be no boundary of a thing if there was no thing in the first place.

In my paper, I shall argue that the dismissive tendencies in current metaphysics result from the underlying basic assumption that boundaries are the boundaries of things. I shall defend the claim that if we give up this assumption, assuming instead that the boundaries of most, or even all, ordinary material objects are the boundaries of processes, we can obtain a realist account of boundaries that does not diminish their ontological status.

I shall demonstrate how such a processual approach is in particular suitable for the boundaries of living beings. Organisms are processes that demarcate themselves from surrounding processes by interacting with these in different ways. Metabolism, the exchange of matter and energy with the environment through a semi-permeable membrane, is arguably the most basic form of such interaction. Without metabolic interaction there would be no membrane enclosing the organism. However, without a membrane there could be no metabolic interaction keeping the membrane, and thus the organism as a demarcated unit, in existence. Organisms possess their boundaries essentially exactly because these, rather than just being given together with the presumed existence of a thing, need to be actively maintained in order for the organism to continue to exist.

This disproves any speculations as to a lower, parasitic status of boundaries. Furthermore, acknowledging living boundaries as the boundaries of processes, I shall argue, easily accommodates vagueness and provides an innovative solution to the traditional puzzles of the metaphysics of boundaries that does justice to scientific facts.

General discussion

ORGANIZED SESSION DIVERSE FORMAT – AG-ZOO

Panel

Agriculture and the Biological Sciences: Heredity, Productivity, Organisms, and the Farmer

Orgs.: Gregory Radick (University of Leeds, UK, G.M.Radick@leeds.ac.uk), Berris Charnley (University of Oxford, UK, berris.charnley@ell.ox.ac.uk) and Dominic Berry (University of Edinburgh, UK, dominic.j.berry@ed.ac.uk)

This panel is focused on research into the relations between agriculture and the biological sciences. In the early 1980s as the history of science was making its first steps in studies of applied, biological and modern science, a number of historians in Europe and North America became interested in connections between biological sciences and agriculture. Their initial work in charting this ground and their concerns for social identity and value drew on, and were drawn on, by a broad community of sociologists, philosophers and science studies scholars. At the peak of this flourishing, scholars interested in agriculture and biology could read across a literature that brought together historians such as Allen, Kevles and Kimmelman in the US and Olby and Palladino in the UK; sociologists and philosophers from the SSK school; and Marxists Lewontin and Levins. Thirty years on, we aim to deliver the results of recent research in this area, alongside a sense of their significance for the history, sociology and philosophy of science, assessing the gains made thus far and signalling where research may need to go in the future.

As the papers across these two sessions make clear; agriculture and the biological sciences have come together in many ways. Some of the most important upshots of their relations can be traced in the disciplinary contours of genetics and that discipline's societal role, topics through which a number of our papers intersect. But we also draw on frames of gender, globalisation, sovereignty, technological development, ownership and materiality in explicating the rich connections between biological science, the field and society. Indeed genetics and geneticists mattered well beyond the domain of heredity, and accordingly a number of papers use genetics as a jumping off point into the wider issues of competing or novel expertises on the modern farm.

Chair of session: Gregory Radick (University of Leeds, UK, G.M.Radick@leeds.ac.uk)

Papers:

Making Mendelians: Agricultural breeding programs and the early careers of Edward Murray East and Rollins Adams Emerson

Barbara Kimmelman (Philadelphia University, USA, KimmelmanB@philau.edu)

One of the most important factors in the early disciplinary development of genetics in the United States was the success of agricultural breeders in establishing formal programs of genetic research and instruction. But before that could happen, they needed to accomplish a double transformation: themselves into Mendelians and their institutions into homes sympathetic to Mendelism. In location after agricultural location, ambitious botanists, zoologists, agronomists, breeders, horticulturalists, and chemists recognized the role that Mendel's work might play in the conduct of their own agricultural investigations. They wielded Mendelism broadly as a weapon in institutional battles to construct a rationalized scientific agriculture and a professional role for the scientific agricultural expert, and more narrowly deployed it as a means of building departments, attracting students, and gaining financial support for buildings and research. In an essentially symbiotic association, these pioneers' scientific fortunes rose with Mendelism, as Mendelian work found permanent institutional homes at the agricultural colleges and experiment stations.

Among these pioneers were Edward Murray East and Rollins Adams Emerson who in 1900 were studying and employed at, respectively, the Illinois and Nebraska agricultural college and experiment station. At Illinois, East worked as an agricultural chemist with a team of chemists and breeders under Cyril Hopkins in a series of selection experiments that combined attention to chemical content, statistical analysis and inheritance. East gradually assumed a leadership role in these studies, taking more and more responsibility for writing up their results in a series of agricultural bulletins. At Nebraska, Emerson served as a horticulturalist under Charles Bessey, Dean of the Agricultural College, who was as happy as not to leave the practical agricultural work to his underlings as he focused on fostering and leading an American school of botany. Emerson was left free to pursue what he felt was the best approach to horticultural improvement (as well as his own), and he built a program of study for undergraduate and graduate students at Nebraska that integrated Mendelian investigation into the study and practice of plant breeding. Under quite different circumstances, East and Emerson used the financial and rhetorical resources of early twentieth century agricultural education and research to successfully transform themselves first into Mendelians and then into geneticists who themselves trained generations of American geneticists.

Genetics and the penetration of capital into United States agriculture, 1890-1940: A Marxist analysis

Garland Allen (Washington University in St. Louis, USA, gallen@wustl.edu)

In the period of "classical genetics" (roughly 1915–1950), the common view of the gene was mechanistic—that is, genes were seen as individual, atomistic units, as material components of the chromosomes. Although it was recognized early on that genes could interact and influence each other's expression, they were still regarded as individually functioning units, much like the chemists' atoms or molecules. Although geneticists in particular knew the story was more complex, the atomistic gene remained the central view for a variety of reasons. It fit the growing philosophy of mechanistic materialism in the life sciences, Conceptually and pedagogically, it provided a simple way to depict genes as linearly-arranged units that was consistent with the construction of genetic and chromosomal maps. The atomistic gene also fit well with the increasing drive to move capital into agriculture, both for potential patenting purposes and for ease of experimental manipulation and prediction. It is the latter point on which the presentation will focus, using a neo-Marxist analysis. The rise of agriculture as an industrialized process provided a context and material support that fuelled much of the rapid growth of genetics in the first half of the 20th century.

California cloning: Oranges in circulation and the writing of transnational history

Tiago Saraiva (Drexel University, USA, tfs37@drexel.edu)

This paper explores modes of writing transnational history by following oranges in and out California. It focuses on cloning practices developed by A. D. Shamel in Southern California in the 1910s and their importance in maintaining and expanding a community of orange growers who embodied an alternative to the unbridled capitalism of the Gilded Age. The narrative travels with Shamel to Brazil and his quest for the origin of Californian navels, questioning the importance of knowing in detail the historical context of orange growing in Brazil to make sense of Californian history. It then tracks oranges out of California into South Africa revealing the importance of Shamel's cloning techniques in imagining new race relations in the British Empire through the transformation of the Sundays River Valley in the Eastern Cape into a citrusscape.

The paper counters the current tendency of historians of capitalism of writing global histories of commodities without engaging with the materiality of the things in circulation. It sustains that historians of science and technology through their familiarity with the processes involved in circulating knowledge, skills, and practices are uniquely positioned to question oversimplifying globalization narratives while unveiling new relevant scales of historical inquiry.

"Dedicated to all Miss Ormerod's correspondents in economic entomology": The Injurious Insects Movement and the social purpose of science, 1870-1901

Berris Charnley (University of Oxford, UK, berris.charnley@ell.ox.ac.uk)

In the last quarter of the 19th Century there was a global debate about the practices and purpose of science, its social value and funding. In Europe and America, gentlemen of science, scientific naturalists, natural historians, artisans and aristocracy, liberals and anarchists argued about how science should be done, by whom and to what ends. Could science improve humankind's lot? At home and in Empire? And if so, how? And who should pay? One important feature of these debates – a bulwark around which many rallied – were the applied or technical sciences. These were new disciplinary formations, often cleaved from Natural History, which claimed to apply the methods and results of science to the world's millenarian concerns, much as biotechnology is positioned today as the answer to climate change, medicine and food security.

As numerous historians have shown, in America a strong program of social support for such research, predicated on its promised social value, was created. Economic entomology was one key beneficiary, and in 1894 the Land Grant University-based experimental stations – deeply social institutions – employed at least 38 economic entomologists, who along with their retired colleagues and non-specialist collaborators had published over 200 articles since the 1860s. For the Official Economic Entomologists Association, the future looked bright. Studying insects would aid farmers, the Association's president argued, and aiding farmers would help the nation (not least because it reduced their likelihood of becoming unruly or rioting when faced with economic hardship), therefore the government should bankroll the enterprise. Unsurprisingly entomologists of an economic bent in the Britain looked to America (and Europe where similar official economic entomologists were increasingly being appointed in government-funded jobs) as a model. However, the British government was not forthcoming in providing state aid or funding and even when the first government-funded economic entomologist was eventually appointed in 1889, Charles Whitehead (a botanist by training) was a solitary figure with few resources. In many circles a kind of national envy set in, and under these circumstances novel arrangements and solutions were sought. Between 1870 and 1901 Eleanor Anne Ormerod co-ordinated a movement of thousands of correspondents, publishing their notes and observations of injurious insects as a yearly report which was sold for less than the cost of production, and mailed gratis to each of her correspondents. The network became the de facto source of authoritative knowledge on economic entomology for the British agricultural and horticultural sectors and for those in Britain's colonies. The movement was so successful, that Charles Whitehead (or his staff) allegedly plagiarised large sections of its work for official government reports and pamphlets. This paper tracks the injurious insects movement and the practices and social purposes it instantiated, arguing that in its participative and social endeavour it represented a quite different vision of science in society to either economic entomology as practiced in the American land grant university system, or its stable sisters in the official applied and technical sciences.

ORGANIZED SESSION STANDARD TALKS – CD-A2

Rethinking the Explanatory Role of Neuroscience in Psychopathology Research

Org.: Isabella Sarto-Jackson (Konrad Lorenz Institute for Evolution and Cognition Research, Klosterneuburg, Austria, isabella.sarto-jackson@kli.ac.at)

Psychopathologies constitute a main focus in neuroscientific, psychiatric, psychological, and neuropharmacological research. Yet for a long time, psychopathologies could neither be visualized or graded in medical examination nor (or just hardly) localized, biopsied, excised, or sectioned at autopsy. With the advent of increasingly sophisticated methods in neuroscience, new and standardized classification tools, large-scale epidemiological studies, the availability of a wide range of animal models for mental diseases, and, most recently, in silico models of the human brain, a new era is dawning. Improvement of empirical neuroscientific approaches promise a substantiation of the nosological validity with respect to nomenclature and classifications. There is, however, ongoing skepticism whether psychopathologies can be characterized on such empirical, biological grounds alone. Historical observations strongly indicate that classifications have usually reflected pragmatic aims of given disciplines rather than epistemic merits. Thus, psychopathological research may be dealing with significant conceptual problems, as socio-scientific presuppositions shape and channel research endeavors. For example, currently favored a priori concepts (such as disease categories or dimensions) may not be exclusive and exhaustive alternatives, may generate false dichotomies, or may even be contextual misdiagnoses. In addition, there might be an epistemological gap between what can be observed and the conclusions derived from those observations. Therefore, the currently advocated methodological pluralism for approaching psychopathological phenomena needs to be paralleled by an explanatory pluralism that draws from multiple mutually informative perspectives. In order to understand the full etiology of most psychopathologies, physiological as well as evolutionary and cultural perspectives must be taken into account to shed light on the interconnectedness of neurobiological and genetic risk factors with developmental, social, and cultural factors.

In this session, we aim to substantiate the claim for an integrative pluralism in psychopathology research, where scientists cross borders between different etiological frameworks or levels of explanation. Such endeavors will afford conceptual pluralism and allow overcoming disciplinary incommensurability. We will draw from different philosophical stances in this pluralistic debate.

Chair of the session: Nina Atanasova (The University of Toledo, Toledo, OH, USA
Nina.Atanasova@UToledo.Edu)

Papers:

Revisiting conceptual frameworks of psychopathologies: The 'drug-centered' versus the 'disease-centered' model

Isabella Sarto-Jackson (Konrad Lorenz Institute for Evolution and Cognition Research, Klosterneuburg, Austria, isabella.sarto-jackson@kli.ac.at)

Currently favored concepts of psychopathologies are largely based on a 'disease-centered' model that is derived from general medicine and assumes – in a neo-Kraepelinian fashion –that all described psychopathologies represent distinct physiopathologies. Along this line of arguments, the 'disease-centered' model suggests that the therapeutic use of psychiatric drugs can reverse, or partially reverse, a disease or abnormality that is manifested by symptoms of a particular psychiatric disorder. Over the last decades, this 'disease-centered' model has thoroughly replaced other models of psychopathologies, provided the rational grounds for most diagnoses and treatments in current psychiatry and psychology, and increasingly promoted the use of ataractics.

However, increasingly more scholars critically question the 'disease-centered' model and revert to a 'drug-centered' model of drug action. The latter assumes that psychiatric drugs are psychoactive substances that affect thinking, feeling, and behavior by generally altering brain states and thereby suppressing or replacing certain manifestations of mental and behavioral propensities. Following this line of arguments, psychopathologies will no longer be viewed as the mere derailment of brain homeostasis identifiable by physiological abnormalities and anatomical impairments, but require the examination of complete and concrete individuals, their ontogeny, and their relations with the whole of their physical, social, and cultural environment. This change seems to also mirror a reversion from a mechanistic to an organicist account.

I will discuss how the shift from the 'disease-centered' model towards a 'drug-centered' model of drug action concedes the influence of evolutionary, developmental, cultural, and social etiologies in addition to physiopathologies. Thus, the 'drug-centered' model requires a broad pluralistic conceptual framework and at the same time leads to the rejection of a strict demarcation or categorization of psychopathologies.

The logic of dysfunctions in Cognitive Neuroscience: Five methodological principles

Paola Hernández Chávez (Centro Lombardo Toledano, Mexico City, Mexico, hcpaola@gmail.com)

It is a common claim that behind any scientific discipline, there is a philosophical or ideological grounding. Since cognitive neuroscience is not an exception, I will refer to some of its permeating intuitions and background ideas guiding experimental designs. In particular, I will review five methodological principles influencing our notions of normality and abnormality in cognitive neuroscience. Among them: (1) Modularity of Cognition (according to which our cognition is composed of specialized mechanisms, characterized by being hardwired, domain specific, encapsulated, fast, automatic, etc.), (2) a Logic of Subtraction (once assumed that cognition is modular, counting back in search of compensation or partition of functions is recurring), (3) Reverse Engineering (takes place when you disassemble components in order to analyze how the parts work and contribute to the overall functioning), (4) Residual Normality (occurs when asserting that dysfunction arise from a disruption or deviation from the standard norms), and, (5) Double Dissociation (the method employed for distinguishing between related but separated cognitive processes, i.e., a useful tool when you want to assess functional independence of cognitive processes).

Altogether, analyzing these principles allows determining if the difficulties we are facing in our understanding of how brain and cognition work arise from a poor experimental design, a technology limitation, or an interfering background idea that is biasing our interpretation. Once we are clear about where and what the problems are, we will be able to design better protocols to understand human cognition.

ADHD across cultures: A case study in the biopsychosocial model of mental illness

Nina Atanasova (The University of Toledo, Toledo, OH, USA, Nina.Atanasova@UToledo.Edu)

Diagnosing and treatment of Attention Deficit Hyperactivity Disorder (ADHD) varies widely across countries around the world. Numerous studies have clearly shown a disproportionate prevalence of the diagnosis in the US in comparison with other countries. Some of the difference can be accounted for by the use of different diagnostic criteria. The Diagnostic and Statistical Manual of Mental Disorders (DSM), commonly used for diagnostic purposes of mental disorders in the US, recognizes lower thresholds of symptoms compared to the

International Classification of Diseases (ICD) which recommends diagnosing of hyperkinetic disorder at thresholds corresponding only to severe cases of ADHD as categorized by the DSM. Additionally, the evidence that the difference in diagnosing might be due to cultural idiosyncrasies in evaluating the symptoms and conceptualizing the disorder is abundant.

This complicated situation has led some to denial of ADHD as an objective biologically based phenomenon. However, the dismissal of the biological reality of ADHD on the basis of inconclusive evidence is not epistemologically justified. ADHD is currently diagnosed on the basis of behavioral symptoms. It is a real possibility that the symptomatic diagnosis of ADHD captures the behavioral manifestations of different physiological conditions. Research in the possible biomarkers of ADHD may reveal multiple alternative underlying conditions that lead to the same behavioral manifestations.

In this paper, I analyze differences in conceptualizing ADHD, and mental illness more generally, across cultures with the goal to articulate strategies for better theoretical and experimental approaches to the study of the disorder to the extent to which it is an objective biopsychosocial phenomenon. I maintain that a plurality of theoretical and experimental approaches in necessary for successful study of the condition.

INDIVIDUAL PAPERS SESSION – CD-A3

Experiments and Models: Philosophical Perspectives

Chair of the session: Lena Kästner (Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany, lena.kaestner@hu-berlin.de)

Papers:

Experiments in a 2 x 2 table

Lena Kästner (Berlin School of Mind and Brain, Humboldt-Universität zu Berlin, Germany, lena.kaestner@hu-berlin.de)

In contemporary philosophy of science, the received view is that scientific explanations describe the mechanisms responsible for the phenomena to be explained. Discovery of these mechanisms is typically based on experimental research. But what kinds of experiments feed into the discovery process at which stages? In this talk, I will characterize experiments along two independent dimensions. For one thing, we can distinguish experiments employing a difference-making logic (so-called intervention studies) from those using manipulations as tools (so-called mere interaction studies). For another, we can distinguish exploratory or data-driven research from experiments designed to test concrete hypotheses.

At first sight, it may seem intuitive to suppose interventions are especially suited for hypothesis testing while mere interactions are typically found in exploratory research. However, drawing on concrete examples from neuroscience and biology I demonstrate that this mapping is ill-conceived. Rather than mapping onto one another, the two distinctions I draw constitute independent dimensions along which experiments can be classified. Thus, we can systematically distinguish at least four different kinds of experiments: intervention-based hypothesis testing studies, mere interaction-based hypothesis testing studies, intervention-based exploratory studies, and mere interaction-based exploratory studies.

I will examine the distinct roles that each of these types of experiment plays in mechanism discovery and the subsequent construction of mechanistic explanations. This will highlight important features of each and lead us to a deeper understanding of the scientific discovery process as a whole.

Animal models in translational research: Rosetta Stone or stumbling block?

Jessica A. Bolker (Department of Biological Sciences, University of New Hampshire, USA, jbolker@unh.edu)

While key animal models have advanced scientific knowledge, they have often been less successful as a basis for advancing human health. Some of the reasons translation fails (such as weak study designs) are practical, and well-recognized; but others are epistemological, and harder to see.

First, dominant models can bias research directions. Models chosen based on a specific theory about disease mechanisms constrain research to testing the theory they embody, limiting exploration of alternatives. Alzheimer’s Disease (AD) offers an example. Most current research assumes that amyloid plaques in the brain are not only a hallmark, but a cause, of AD, and most models are designed to reproduce this phenotype. But plaque levels in the brain correlate poorly with the severity of patients’ symptoms. If plaques turn out to play little or no causal role in the disease, we will find ourselves at the end of a blind alley.

Second, popular models may not effectively represent the true object of study. Immunology offers two recent examples: the claim by Seok et al. (2013) that gene expression profiles associated with inflammation differ dramatically between mice and humans, and the discovery that the specific-pathogen-free mice that populate immunology labs more closely represent a neonatal human immune system, than an adult one (Beura et al. 2016, Reese et al. 2016).

Third, focusing on diseases as they appear in a model can shift research targets. The use of animal models to study neuropsychiatric disorders centers on behavioral assessments of animals with deficits that are taken to represent "depression-like" or other "disorder-like" phenotypes. But despite efforts to link standard behavioral tests to particular aspects of human dysfunction, it is extraordinarily difficult to establish the validity of these correlations.

Recognizing these challenges suggests some ways to address them. To compensate for bias resulting from overreliance on core models, we must identify species that shed light on aspects of disease not well represented in current models. To improve representation, we need more emphasis on studying humans alongside animal models. Another way to bridge the species gap is to identify a focal aspect of the human disease to guide the search for effective non-human models. To strengthen the focus on human disease, we must recognize that studying a better-understood, more tractable model may not yield clinical advances (or address what matters to patients): that approach is how we got so good at curing sick mice, while making slower progress in people.

References:

Seok, J. et al. 2013. Genomic responses in mouse models poorly mimic human inflammatory diseases. *PNAS* 110(9): 3507-3512.

Beura, L. et al. 2016. Normalizing the environment recapitulates adult human immune traits in laboratory mice. *Nature* 532(760): 512-516.

Reese, T. et al. 2016. Sequential infection with common pathogens promotes human-like immune gene expression and altered vaccine response. *Cell Host and Microbe* 19(5): 713-719.

Personalising RCTs: What is the right target?

Sophia Efstathiou (Department of Philosophy and Religious studies, Norwegian University of Science and Technology (NTNU), Norway, sophia.efstathiou@ntnu.no)

This paper explores one main question: what randomized controlled trial (RCT) designs would legitimate population-specific drug efficacy claims? “Personalised medicine” or “precision medicine” are visions driving work in bioscience in Europe as elsewhere. On its way to becoming “personalised”, biomedical work is targeting subgroups, including groups identified through race/ethnicity classifications. To examine some of the risks of population-specific pharmacogenetics or genomics I examine the case of a drug developed to target a particular ‘race/ethnicity’ group in the US. This is the case of the African American Heart Failure Trial or A-HeFT [I-III].

A-HeFT was a randomized, double-blinded placebo-controlled clinical trial that tested a heart disease drug called BiDil on 1,050 people self-identified as African American. A-HeFT was terminated early because the treatment was so efficacious it was deemed unethical to keep withholding it from people on the placebo arm. Passing the trial led the FDA to grant its approval to BiDil (in June 2005) for its target, which made it the first drug to come out with a race-specific label on. So what was controversial about BiDil? A-HeFT demonstrated its efficacy on its target and emphatically so. What seems to have troubled researchers here was the selection of this target population as a target population to begin with. There was a great controversy among the science studies researchers studying the case (e.g. Sankar and Kahn 2005, Kahn 2013). And the epistemological critique launched against BiDil can be (very roughly) summed up as follows: BiDil didn’t show that it didn’t work for non-African-Americans. It did not demonstrate its inefficiency in the complement of its target.

Whether or not this critique is correct the case brings up an interesting problem. What warrants the selection of a human subgroup as a clinical target? In the case of socially and historically identifiable race/ethnicity subgroups, biological and social scientific contributions to health compete for explanatory relevance but a social reality of other human subgroups may lay hidden in other cases.

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Kahn, J. 2013. *Race in a bottle: The story of BiDil and racialized medicine in a post-genomic age*. Columbia: Columbia University Press.

Sankar, P., and Kahn, J. D. 2005. BiDil: race medicine or race marketing? *Health Affairs* October, 11.

INDIVIDUAL PAPERS SESSION – MINAS1

Continental Philosophical Perspectives on Biology and Medicine

Chair of the session: Sandra Caponi (Department of Sociology, Federal University of Santa Catarina, Brazil, sandracaponi@gmail.com)

Papers:

Psychiatry and the construction of subjectivity in modern society

Sandra Caponi (Department of Sociology, Federal University of Santa Catarina, Brazil, sandracaponi@gmail.com)

In 1980, Michel Foucault gave two lectures at the University of Berkeley that were published in 2013 under the title of The Origin of Hermeneutics of Self. A year later, responding to an invitation from the School of Criminology of the Catholic University of Louvain, Foucault gave a course called Wrong-Doing, Truth-Telling. This course sought to analyze the role of confession in justice. Having as framework not only these lectures and classes, but also the courses given by Foucault at the Collège de France during the same period, I analyze an increasingly frequent phenomenon in contemporary society: the persistent tendency to declare, in psychiatric terms, a truth about ourselves; a practice that operates as the articulating axis of the construction of our subjectivities. More specifically, I analyze the contemporary construction of what I would like to call a psychiatric hermeneutics of self; which seems to have become the principle of intelligibility of our behaviors, sufferings and fears. In its daily repetition, this psychiatric hermeneutics of self operates as a practice of attribution of identities; and it shows that, in the processes of governance, there is not only an excess of power on one side and a complete absence of power on the other side. On the contrary, its way of functioning indicates that in the governed always exists a structure that makes them governable. For understanding that structure it is necessary to interrogate ourselves about the diverse historical configurations that allowed the confluence and articulation, in the field of psychiatry, of structures of domination, technologies of self, and regimes of truth.

Canguilhem: A philosophy of life and a philosophical history of life sciences

Olivier Perru (University of Lyon, France, olivier.perru@univ-lyon1.fr)

At first, Georges Canguilhem's philosophy is a philosophy of medicine recognizing the main contribution of the biological knowledge to medicine. But this philosophy also wonders about the nature of life.

Life involves biological processes, but, for an individual person, life is also normativity. Canguilhem's philosophy at once refers to the biological basis and to the human mind. His object is the vital activity with a "dimension axiologique" (moral aspect). It also supposes a critical work towards objects and scientific disciplines. According to Canguilhem, the epistemological history of life sciences concerns a scientific activity (biological research), an activity of constitution and of emergence of (biological) scientific disciplines. The relevance of Canguilhem is the fact that the historian of science has not only to restore a history of the scientific theories or a history of the development of the sciences in context, but he would have to explore the relationship and the limits between life science and its context in the process of genesis and of scientific elaboration. A scientific work is a vital activity of a human subject, history of science is the history of this activity, and this implies a philosophical approach. As other activities, scientific activity is a human activity. History of ecology gives a good example of a scientific elaboration from various elements and from diverse skills. History of the life sciences considers activities and processes. Ideologies that announce or extend a scientific construction also affect this discipline.

INDIVIDUAL PAPERS SESSION – MINAS2
Function and teleology
Chair of the session: Amanda Thorell (Department of Philosophy, Stockholm University, Sweden, amanda.thorell@philosophy.su.se)

Papers:

Physiological function, health and medical theory
Amanda Thorell (Department of Philosophy, Stockholm University, Sweden, amanda.thorell@philosophy.su.se)

In medicine, the concepts of normality, abnormality, health, and pathology are frequently used. Another frequently used concept is that of physiological function, which the previously mentioned concepts are usually taken to involve or apply to. A comprehensive naturalistic theory of biological normality/abnormality or health/pathology reasonably comprises some account of physiological function. The most well known theory of health/pathology, which includes an account of normality/abnormality, is perhaps Christopher Boorse's biostatistical theory. In this theory, physiological function ascriptions are made in accordance with a goal-analysis: the function of a trait is determined by its contribution to the organism's physiological goals, which are specified as individual survival and reproduction. This paper aims to defend this analysis of physiological function. In doing this, I make two important distinctions: first, a distinction between two types of function ascriptions made in medical theory, and, second, a distinction between efficient functioning and health.

Daniel Hausman argues in "Health, Naturalism, and Functional Efficiency" that Boorse's analysis is too narrow. There are, he claims, functions within subsystems within organisms, which contribute to the goal of the subsystem, yet undercut the goal of the organism. These are excluded by Boorse's goal-analysis. One example Hausman uses to show this is about a malignant tumor. The blood vessels in a malignant tumor, Hausman says, have the function of providing the cells of the tumor with oxygen and nutrients. Boorse's analysis, however, does not ascribe the blood vessels in the tumor this function, since they do not contribute to the goal of the organism. Rather, by supplying the cells of the tumor with oxygen and nutrients they are detrimental to the organism. In order to solve this problem Hausman suggests to widen Boorse's analysis, so that the goals referred to need not be those of the organism, but any organic system.

I agree with Hausman that the blood vessels in a malignant tumor have the function of supplying the tumor with nutrients and oxygen, and that Boorse's analysis of physiological function cannot account for that. However, I disagree with Hausman's proposed solution. Considering medical theory, I argue that Hausman's amendment is unsound. I advise to instead solve the problem by distinguishing two types of functions that play different roles in medical theory, namely physiological functions and causal role functions. According to this suggestion, the blood vessels in the tumor have no physiological function. However, they have a causal role function.

Answering a second example that Hausman brings up, I make a further important distinction, namely between efficient functioning and health. Although all healthy functions are (relatively) efficient functions, not all efficient functions are healthy. This is because all physiological functions cannot be ascribed health or pathology. The concepts of health and pathology only apply to function tokens that are of a type that is typical within a reference class.

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Hausman, D. M. 2012. Health, Naturalism, and Functional Efficiency. *Philosophy of Science*, 79: 519-541.

The influence of Teleology on the comprehension of evolution and its consequences to education: An analysis from Aristotle to Mayr's teleological categories

Marcela D'Ambrosio (Multiunit Program in Science and Mathematics Teaching University of Campinas, Brazil, marceladambrosio@gmail.com), Nelio Bizzo (School of Education, University of São Paulo, Brazil, bizzo@usp.br), Marco Solinas (Philosophy Department, University of Florence, Italy, mrc.solinas@gmail.com) and Fernando Santiago dos Santos (Federal Institution of Education, Science and Technology of São Paulo and University of Campinas, Brazil, fernandosrq@gmail.com)

One of the most famous iconographies related to evolution is the "evolutionary march". It represents a linear progression from apes towards Homo sapiens, in a progressive view of evolution. The origins of this view can be found in Aristotle's Scala Naturae, in which human beings are at the highest hierarchical place. Aristotle's thinking was also based on three pillars: species' fixity, essentialism, and teleology, which is the assumption that everything in nature has a purpose. Even though Aristotle's framework has been overthrown by Darwin's Evolutionary Theory, its influence can still be seen in general thinking: when teleology is comprehended metaphysically, it generates the progressive view already mentioned and the idea that evolution has an intrinsic tendency to specific purposes. Another problem is that teleology can be currently understood in multiple ways. For instance, it can be used also to describe movements of inanimate objects in nature, to describe goal-directed behaviors, adaptations, or even the presence of a pre-determination aspect in some biological features, such as the genetic program. The concept of adaptation is commonly misunderstood and phrases with teleological meaning are often used in biological explanations. Students might create an erroneous idea that some characteristics could have been selected for a specific reason, or that there was something or someone behind the process. The term "Natural Selection" can itself also generate misconceptions, as it is an anthropomorphic name, analogous to the "Artificial Selection", with which farmers and cattle ranchers intentionally guide phenotypic changes. Furthermore, languages are finalistic and eliminating such problems is a hard task, so students must be aware of such difficulties to comprehend metaphors and not make conceptual confusions. Thus, it is important that students properly know the structure of evolutionary thinking from a philosophical perspective, regarding not only adaptation but also a view of evolution as a branched process in which contingency is essential. The present analysis aims at discussing the multiple meanings of the term teleology, based on the proposal established by Ernst Mayr (1904-2005), going backwards to its origins. Furthermore, it aims at analyzing the importance of this discussion to the teaching of evolution as a tool to dismiss some of the most common evolutionary misconceptions.

INDIVIDUAL PAPERS SESSION – MINAS3
Philosophy of Evolution III

Chair of the session: Gustavo Caponi (Department of Philosophy, Federal University of Santa Catarina, Brazil, gustavoandrescaponi@gmail.com)

Papers:

The physiological and ecological correlate of the phylogenetic exemplar

Gustavo Caponi (Department of Philosophy, Federal University of Santa Catarina, Brazil, gustavoandrescaponi@gmail.com)

The biological world involves two hierarchies: the economic hierarchy and the genealogical hierarchy. The first is a hierarchy of systems; and the second is basically a hierarchy of lineages whose simplest element, however, is not itself a lineage but an exemplar, or a specimen, of a lineage. Bucephalus, we say, was an exemplar of Equus caballus. This duality raises many conceptual problems. One of them is how to conceptualize the point where these two hierarchies mesh. A simple way to decide the issue would be saying that this point is the individual living being; and that would not mean anything wrong. But, and here is my question, it is not too easy to define what is the element, or level, of the systemic hierarchy that corresponds to the exemplar of the genealogical hierarchy. The usual is to say that, in the systemic hierarchy, the individual living being appears as an organism; but the current discussion on biological individuality shows that this is an oversimplification: what is commonly meant by 'organism' is a level of individuation that is far from being present in all biological lineages.

On the other hand, even if we only consider the point of contact between the physiological and ecological levels of the economic hierarchy, we shall also find problems: still in cases of species where we can properly speak of organisms, the fundamental ecological interactors could not be true organisms. Such is the case of eusocial insects; where genuine individual organisms are integrated into superorganisms. In these taxa, it is not easy to decide what exactly the economic correlate of the phylogenetic exemplar is. The problem remains still more intricate if we regard cases of high integrated symbioses. There we find ecological interactors that, due to their very integrated metabolism, seem to be single organisms composed by individuals of different species.

But it is precisely there that we can find a clue to better identify the meshing point of both biological hierarchies. The key is what, in cases of very tight symbiosis, still allows us to talk about two symbionts of different species, forbidding us to talk about a single individual of one new species resulted from symbiogenesis. Namely: it can be said that there are two or more symbionts, and not just the systemic correlate of the exemplar of a single lineage originated by symbiogenesis, if and only if, these symbionts can display characters states able to increase the reproductive success of one of them without necessarily increasing the reproductive success of both. There, we find vestiges of selective autonomy that does not exist in the case of subsystems that are organisms of species originated by symbiogenesis, nor in the case eusociability. Concisely: what characterizes the systemic counterpart of the phylogenetic exemplar is the possibility of having a minimum degree of independent reproductive success. There is the systemic correlate of the exemplar.

There in evolution and back again: Evolutionary dialectics of ontogeny and phylogeny through Developmental Psychology and Biology of Cognition

Matheus Henrique da Mota Ferreira (Institute of Biology, Federal University of Rio de Janeiro, Brazil, matheushmf01@gmail.com)

There are many different senses for the word evolution or its derivative, evolutionary. The early debates have led to a concept of evolution that would be considered misorienting or lacking refinement for many evolutionary biologists nowadays. This said, I would like to reconsider the perhaps not so clear division between development and evolution (or ontogeny and phylogeny). The way I plan to do this is by comparing the Theory of Autopoiesis and the Biology of Cognition from Humberto Maturana and Francisco Varela with the ideas from some of the main authors in Developmental Psychology, namely Jean Piaget, Lev Vygotsky and Henri Wallon. Through this process, I intend to show the convergences and divergences between these two approaches and, simultaneously, to endorse an old view of evolution which sees ontogeny and phylogeny as two processes in a gradually oriented contiguity instead of two completely independent and differentiated processes. This "old" view has been recently reclaimed as not so much of a rebuttal to current hegemonic evolutionary thought, but instead as a complexification and complementation of the current dominant view about evolution. Some of these ideas will only be marginally explored, given the limitations of time and scope of this particular work. It is also important to state that this work has been inspired by the common confusion and medley made around Developmental and Evolutionary Psychology, which in Portuguese as well as in Spanish, may both be called "Psicologia Evolutiva". In a first attempt to discern these two, it is possible to notice that the early so-called Developmental psychologists were indeed using the ideas of development (ontogenetic unfolding) and evolution (phylogenetic transformation) as somewhat of a syncretic mesh. Rescuing this particular view, I conclude by showing that the contributions of these five authors to biological, psychological and sociological thought are important for the project of complexifying evolutionary thinking today and for furthering transdisciplinary knowledge on this field of growing relevance, which is Evolution.

INDIVIDUAL PAPERS SESSION – AG-BOT

History of Evolution I

Chair of the session: Gonzalo Peñaloza (Interinstitutional Doctorate in Education, Distrital University Francisco José de Caldas, Colombia, gpjimenez101@hotmail.com)

Papers:

The reception of Darwinism in Colombia in the late 19th century

Jairo Robles-Piñeros (Institute of Biology, Federal University of Bahia, Brazil, jairohxcbogota@gmail.com) and Gonzalo Peñaloza

(Interinstitutional Doctorate in Education, Distrital University Francisco José de Caldas, Colombia, gpjimenez101@hotmail.com)

Because Darwin changed radically and irreversibly our view of ourselves and our world, Darwinism had become a revolutionary idea within the Western academic and social world by the end of the 19th century. After the release of The Origin of Species, there were countless works around the world expressing their viewpoints abo/ut Darwin's postulates on his theory of biological evolution by natural selection, either to support or to oppose it. In Latin America, Colombia was not an exception and, during its conservative political restructuration process at the turn of the 19th century, Darwinian thought became a focus of resistance to its philosophical and ideological agenda. As a result, a tireless attempt to refute Darwin's ideas surged. In the current study we present an interpretation of a document entitled "Study on the evolutionary system" (1891), written by Emilio Cuervo, analysing how the political arguments and the Catholic ideology pointed to the circulation of Darwinism in the country as a philosophical system that denied the monogenic theory of human origins and God’s creation. In this analysis, we will emphasize its philosophical and ethical consequences and try to show how they attempted to detract Darwinism from the scientific sphere in Colombia by the end of the 19th century. As a result, this study shows how his arguments exhibited the political conflict of his time against the liberal ideas and, above all, denoted the important influence that Catholic philosophy and natural theology had in the scientific and academic circles of the country.

References:

Cuervo Márquez, E. 1891. *Estudio sobre el Sistema evolucionista. Obra honrada con el primer premio en el concurso filosófico del Colegio Mayor de Nuestra Señora del Rosario*. Bogotá: Imprenta La luz.

Darwin, C. R. 1952 [1872]. *The origin of species by means of natural selection, or the preservation of favoured races in the struggle for life*. 6th edition. Chicago: Encyclopaedia Britannica. (Great Books of the Western World, 49)

Evolution theory and the German social democracy

Douglas Rogério Anfra (Department of Philosophy, University of São Paulo, Brazil, diaphonia@gmail.com)

In Freedom in Science and Teaching (*Freie Wissenschaft und Freie Lehre*, Eine Entgegung auf Rudolf Virchow 'Münecher Net, 1878), Ernst Haeckel argued that evolution theory should be taught in

German universities. However, in order to take this stand, he had to defend himself against the dangerous accusations made by Rudolf Virchow, who saw elements of evolution theory in German socialism shortly before the adoption of the anti-socialist laws by the German State, from 1878 to 1881. This paper aims to present and debate this context, as well as to seek why evolution theory becomes an important theoretical reference for the socialist movement of that period, in Germany and in several countries under its political influence. The impact of evolution theory among German social democracy is notorious, and evidence of its importance can be found in: the frequency workers borrowed books on the topic at libraries; training courses meant for worker at SPD schools; and in the iconography related to public rites, such as Labour Day flyers, in which Darwin is represented alongside Karl Marx and August Lassalle as the most important theoretical references to the German workers' movement. In the book Woman and Socialism (Die Frau und der Sozialismus, 1879), August Bebel, the political leader of the German Labor movement wrote a response to Haeckel's exposition. The reference to Darwin among the German socialists runs through important political moments, such as the debate at the Congress of German Social Democracy held in Hanover between October 9 and 14, 1899, in which Darwin is vindicated by all the different political lines of the movement of the German workers, including both Marxist sectors who advocated for revolution and progressive and moderate social reformers who campaigned over issues such as voting rights. The purpose of this oral presentation is to shed light on these passages, reflecting on how the incorporation of aspects of Darwin, Haeckel and Spencer's theories to socialist theory produced a kind of "popular philosophy" that believes in the possibility of using the same historical interpretative key to understand biological and social phenomena. This philosophy transforms the concept of evolution in interesting ways. The political moment addressed in this papper becomes even more noteworthy and complex to understand by the history of the reception of theory of the evolution and its popularization when we compare this episode with the Lysenko case and all the difficulties faced by genetics theorists and evolution theory in the USSR.

Haldane between scientific facts and a hard place: The Lysenko affair and his conviction to the public understanding of science

Luis Felipe Eguiarte Souza (The Program in the History of Science, Technology, and Medicine, University of Minnesota, United States, eguia003@umn.edu)

From 1937 to 1950, J.B.S. Haldane, the English biologist and founder of population genetics, published a weekly popular science column in the British communist newspaper The Daily Worker, while chairman of the editorial board from 1940 to 1950. In 1942 this was one of the main reasons the British government lifted a ban imposed on the newspaper during WWII. He published on a vast array of scientific subjects and his contributions displayed his characteristic wit and in-depth scientific knowledge, in addition to the authority of being the official scientist of the British Communist party. The Daily Worker was not a mere side project for Haldane; it was an important part of his life's work as a leading British scientist. But all of this came to an abrupt halt when he refused to convincingly and wholeheartedly defend the Soviet Union policies created by Trofim Lysenko. Due to the Lysenko affair, Haldane quit his position at the newspaper and was let go from the British Communist Party. The purpose of this talk will be to shed light on Haldane's commitment to the public understanding of science for England's undereducated working class. Through analyses of several of his articles in The Daily Worker, comparison with other scientific columns of the time and examining ideas surrounding the traditional view of Marxist materialism on science, I will show how Haldane communicated complex ideas and new scientific research to the proletariat, This will show how Haldane differed from other contemporary advocates of science; Haldane's philosophical commitment to Marxism, which led him to become a member of the party, was one of the primary motivations for his public advocacy of science. His public persona as a renowned scientist and his high position in the Communist Party puts him in the center of the Lysenko affair, which would inevitably lead to his fall from grace in the Communist Party. However, his intellectual commitment to the standards and practices of science were stronger than his commitment to the Party line.

WEDNESDAY JULY 19
18:00-19:30 – Plenary conference

What use is an extended evolutionary synthesis?

Kevin Laland (School of Biology, University of St Andrews, United Kingdom)

Alternative conceptual frameworks can be of value to scientific fields to the extent that they stimulate new hypotheses, lead to new insights, open up novel lines of enquiry, or prove generative in other ways. The extended evolutionary synthesis (EES) is new a way to think about and understand evolutionary phenomena that differs from the conception that has dominated evolutionary thinking since the 1930s (i.e., the modern synthesis). The EES retains the fundamentals of evolutionary theory, but stands out in its emphasis on the role of developmental processes, which share with natural selection responsibility for the direction and rate of evolution, the diversity of life, and the process of adaptation. The EES emphasizes that phenotypic variation is not random, that there is more to inheritance than genes, and that there are multiple routes to the adaptive fit between organisms and environments. I spell out the structure, core assumptions and novel predictions of the EES, contrasting these with more traditional expectations. The EES does not replace traditional thinking, but rather can be deployed alongside it to stimulate and advance research within evolutionary biology.

THURSDAY JULY 20
09:00-10:30 – Parallel sessions 11

ORGANIZED SESSION DIVERSE FORMAT – AG-ZOO

Multiple speakers session

Philosophical Issues in Astrobiology

Orgs. Kelly C. Smith (Clemson University, USA, kcs@clemson.edu) and Carlos Mariscal (University of Nevada, Reno, USA, carlos@unr.edu)

Astrobiology is the NASA- constructed scientific meta-discipline focused on the origins, distribution, and future of life in the Universe. In this session, we present a sampling of the growing philosophical work on astrobiology. We also encourage interested parties to join us in our biennial meeting, SoCIA, scheduled for Spring of 2018 in Reno, Nevada.

Chair of the session: Kelly C. Smith (Clemson University, USA, kcs@clemson.edu)

Papers:

Some philosophical thoughts about planetary protection

Erik Persson (University of Lund, Sweden, erik.persson@fil.lu.se)

In my presentation I will suggest how philosophy, in particular ethical theory but also philosophy of science, can be used to identify and possibly provide constructive advice regarding how to handle potential value conflicts in connection with planetary protection. Planetary Protection, the way the term is used today, is mainly a technical term for measures taken in order to avoid contamination either of extra-terrestrial bodies (i.e. planets/moons/asteroids/etc.) (forward contamination) or of our own earth (back or backward contamination). I will here concentrate on the former. The motivation behind present guidelines for planetary protection takes the form of a desire among astrobiologists to study a pristine environment. One want to make sure that any extra-terrestrial life will not be strongly influence, or even destroyed, by any invasive earth life before one manages to study it properly. This means the guidelines for planetary protection aim to keep the body in question free from contamination by earth organisms for the duration of the study. This aim can be questioned from different vantage points. If extra-terrestrial life has moral status in their own right or value other than as study objects, the guidelines might have to be stronger. If not just science but also commercial initiatives have an interest in the body in question, it might be argued that the need to protect the indigenous life needs to be balanced against the potential commercial value of the body. Taken together, the intersection of science goals, commercial interests and societal concerns regarding planetary protection provide some philosophically very interesting examples of ethical problems concerning the relation between science and other interests.

To serve Man: Eating meat, eating people, and eating aliens

Leonore Fleming (Utica College, USA, leflemin@utica.edu)

At the very end of The Twilight Zone episode “To Serve Man,” a woman yells, “It’s a cookbook!” staging a plot twist worthy of the show, because the audience finds out that the book left by the aliens was not, in fact, a list of ways to serve and aid humankind, but rather a list of recipes to serve and dish up humankind for them to consume. While the idea of aliens traveling to our planet to use us as food is universally shocking enough to make it one of the best Twilight Zone episodes, if the positions are reversed, and we imagine humans visiting another planet, and using their inhabitants as food, this hypothetical Twilight Zone episode no longer seems worthy of a "best of" list. Thus, we must consider how it is that we confront the human and non-human differently, if we are ever to have a chance of creating a moral theory for life-that-we have-yet-to-discover in the Universe. Confining our perspective to Earth, in fact, to a simple being such as a mouse, illustrates that there is such complexity in how we recognize and understand it as a life form. Depending on the context, a mouse can be a pet, a lab subject, a rodent, an intruder, a food source, or many other things. The life form of the mouse itself—its biology—is not what is different in these scenarios; but, the way we see the mouse as something else, the way we talk about and act with respect to the mouse, and the similarities and differences we choose to emphasize in each case, these are the things that differ. So, though I am sympathetic to ideas like 'speciesism' or 'a future like ours' that attempt to create ethical theories prescribing how we should value and understand life, unfortunately, I argue that they fall short, especially with respect to the consideration of extraterrestrial life. The reason being that we see humans as creatures that sit around the table, and everything else, given the right context, can be served on it.

When astrobiologists write humanities & when humanists write astrobiology

Carlos Mariscal (University of Nevada, Reno, USA, carlos@unr.edu)

Astrobiology is one of the most interdisciplinary fields around today: involving not just physics, chemistry, and biology, but also philosophy, social science, and public policy. When fields this disparate focus on similar topics, it is possible for very similar concepts to be independently invented and entire subfields of research ignored. In this talk, we use bibliometric analysis to compare references, engagement, and citations between astrobiologists engaged in humanistic inquiry on the one hand and humanists engaged in astrobiology on the other. Humanist inquiry is still nascent in these areas, so it is hard to draw general conclusions about its efficacy, but one tentative conclusion is that the two communities engage with each other in seemingly very different ways. There is an asymmetry in that while humanists reference the key scientific works in their areas of investigations, scientists seldom address the key works of relevant humanists. Moving beyond the bibliometric analysis, we argue drawing these communities together with more interpersonal interaction may help address this asymmetry.

Pinning down "Life"

Kelly C. Smith (Clemson University, USA, kcs@clemson.edu)

There is an increasing need to come to a consensus about what living systems are and are not. We are launching an intensive search for life beyond Earth and disagreement over the proper concept of life has already created sharp debate concerning the interpretation key experiments. And developments in synthetic biology and computer science are forcing researchers to ask whether the systems they create embody the minimal characteristics of living systems. In recent years, two ends of the continuum have dominated the debate. On one end are those who view definition as the specification of necessary and sufficient conditions, an approach ill suited to biological categories. On the other end are those who define life in terms of what can be easily tested or observed rather than what matters theoretically. As a result, thoughtful commentators tend to either call for a radical pluralism with respect to definitions of life or become pessimistic about the possibility of defining life at all. There will probably never be a single notion of life that serves all the purposes for which people use the term. And no realistic definition of life will be able to draw the kinds of clean boundaries we intuitively seek. However, at least for scientific contexts, I argue there is a core concept centered about the ability to create adaptive complexity.

ORGANIZED SESSION STANDARD TALKS – CD-A1

Generic and Genetic Perspectives on Evolvability

Org.: Alan C. Love (Department of Philosophy, University of Minnesota, USA, aclove@umn.edu)

The capacity to produce selectable phenotypic variation has been treated largely from the perspective of evolutionary genetics and molecular cell biology, both of which emphasize different types of genetic explanatory approaches (e.g., Wagner and Zhang 2011). However, a growing literature has emerged surrounding “generic” (i.e., applicable to living and non-living systems) explanations of evolvability that appeal to abstract network properties such as robustness. Integrating these approaches faces obstacles due to polarization across disciplinary boundaries, a tendency to concentrate on a small subset of properties as most important, and a lack of comparison between models to expose conflicting assumptions within and between approaches. This symposium explores generic and genetic perspectives on evolvability to discover underlying conflicts and facilitate the integration of these perspectives to better understand life's complexity. Stewart focuses on a new experimental tool for measuring genetic properties of biological systems: high throughput RNA sequencing (RNA-seq). Using comparative data from RNA-seq for mouse, alligator, and iguanid lizard digits, he argues that one can achieve a novel predictive understanding of the evolvability of the vertebrate limb. Rebolleda-Gómez explores the origin of multicellularity and how attendant changes in physical scale and resource availability affect evolvability. Through experimental evolution, she shows that a combination of ecology and physics is critical to characterizing a lineage's capacity to evolve. Love examines the bias towards investigating intrinsic properties in analyses of evolvability. The contribution of extrinsic, generic features to evolvability, such as physical scale or ecosystem engineering, depends on the temporal scale in view. Once made explicit, this offers a route for combining generic and genetic features, as well as intrinsic and extrinsic features, to yield more integrated models of evolvability.

Reference:

Wagner, G., and J. Zhang. 2011. The pleiotropic structure of the genotype-phenotype map: the evolvability of complex organisms. Nature Reviews Genetics 12:204-213.

Chair of the session: Thomas A. Stewart (Yale University, USA, tom.stewart@yale.edu)

Papers:

RNA sequencing as a predictive tool for analyzing evolvability

Thomas A. Stewart (Yale University, USA, tom.stewart@yale.edu)

A system's evolvability is determined, in part, by the potential of its components to vary independently from one another. When more components vary independently, this can increase the evolutionary degrees of freedom for a system. Here I argue that high-throughput RNA sequencing (RNA-Seq), a technique that measures the quantity of different species of RNA in a system (Wang et al. 2009), can yield information about the variability of an anatomical system and, thus, help to characterize its evolvability. I present a comparative transcriptomic study of digits from the developing forelimbs of American alligator (Alligator mississipiensis), green anole (Anolis carolinensis), and mouse (Mus musculus). RNA-Seq was performed on dissected digits and their associated, posterior inter-digital webbing, which is a known source of molecular signals for the patterning of digits. Species differ in the degree of differentiation of gene expression profiles of digits within a limb. This result is robust; it is recovered from differential expression analyses, hierarchical clustering, and principal components analyses. Patterns of correspondence of individual digits also differ between the species considered. For example, in mouse the transcriptomic (RNA expression) profile of the anterior-most digit ("thumb") is markedly distinct from those of the four more-posterior digits ("index", "middle", "ring", and "pinky"), which are highly similar to one another. By contrast, in alligator the forelimb is organized into two modules comprised of the anterior three digits ("thumb", "index", and "middle") and posterior two digits ("ring" and "pinky"). These results provide a predictive framework for analyzing the evolvability of amniote limbs. Limbs whose digits are relatively homogenous in gene expression profiles should be less able to evolve intra-autopodial (or "hand") digital disparity as compared to limbs with a high degree of differentiation. And patterns of correspondence among digits within a limb (e.g., differences between mouse and alligator) predict variational modules—units that exhibit relative integrity through evolution—within limbs. This approach to understanding variability differs from more traditional morphological approaches, which involve sampling a population and describing patterns of covariance (Larouche et al. 2015).

References:
Larouche, O., R. Cloutier, and M.L. Zelditch. 2015. Head, body and fins: patterns of morphological integration and modularity in fishes. *Evolutionary Biology* 42: 296-311.
Wang, Z., M. Gerstein, and M. Snyder. 2009. RNA-Seq: a revolutionary tool for transcriptomics. *Nature Reviews Genetics* 10: 57-63.

Temporal scale and extrinsic contributions to evolvability

Alan C. Love (University of Minnesota, USA, aclove@umn.edu)

For the past two decades, the concept of evolvability has been involved increasingly in empirical and theoretical developments in evolutionary biology. Some have even claimed that it should play a central and unifying role (Hendrikse et al. 2007). Although most of these studies center on genetic properties of populations, such as the consequences of epistatic mutations (Draghi et al. 2010), others focus on generic properties of dynamical systems to account for evolvability, such as criticality (Torres-Sosa et al. 2012). Whether they scrutinize genetic or generic features, studies of evolvability concentrate on different temporal scales, use models with varying degrees of abstraction, and tend toward analyzing intrinsic properties of organismal lineages. Some of these differences arise from distinct explanatory goals, which are manifested in how the concept of evolvability represents a space of research questions (Brigandt 2015). This suggests that it is problematic to strive for a unitary answer to the question of "what evolvability really is." Interestingly, the tendency toward intrinsic properties appears even in these analyses: "Evolvability is an abstract, robust, dispositional property of populations, which captures the joint causal influence of their internal features on the outcomes of evolution" (Brown 2014, emphasis added). In this paper I examine two generic contributions to evolvability—change in physical scale and environmental heterogeneity—that are extrinsic to populations and show that the evolutionary significance of these contributions depends on temporal scale. Using three different temporal scales (microevolution, mesoevolution, and macroevolution), I show that differences in how physical scale changes and heterogeneity of the environment vary in their contributions to the evolvability of a lineage. As a consequence, building integrated models that include both generic and genetic properties requires the commensurability of temporal scale. Additionally, the joint combination of intrinsic and extrinsic factors to evolvability becomes more salient when temporal scale is made explicit. Two cases help illustrate these points: multicellularity (for changes in physical scale), and ecosystem engineering (for questions of environmental heterogeneity). Not only does this analysis help to establish integrative modeling resources for inquiry into evolvability, it also sheds light on puzzling cases of morphological stasis, especially as exemplified in living fossils.

References:

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Draghi, J.A., Parsons, T.L., Wagner, G.P., and Plotkin, J.B. 2010. Mutational robustness can facilitate adaptation. *Nature* 463: 353-355.
Hendrikse, J.L., Parsons, T.E., and Hallgrímmson, B. 2007. Evolvability as the proper focus of evolutionary developmental biology. *Evolution & Development* 9: 393-401.
Torres-Sosa, C., Huang, S., and Aldana, M. 2012. Criticality is an emergent property of genetic networks that exhibit evolvability. *PLoS Computational Biology* 8:e1002669.

ORGANIZED SESSION DIVERSE FORMAT – CD-A2

Roundtable

How is the Human Possible? The Hybrid Hominin, the Hybrid Mind, and Unique Relation of Embodiment to Sociality

Orgs.: Lenny Moss (Dept. of Sociology, Philosophy, & Anthropology, University of Exeter, UK, Lenny.Moss@exeter.ac.uk) and Victor Ximenes Marques (Center for Natural and Human Sciences, Federal University of the ABC (UFABC), Brazil, marques.v@ufabc.edu.br)

It has become increasingly clear that central to any empirically adequate understanding of human mindedness, and thus human nature (whatever that is), is an appreciation of the particularities of human embodiment along with the depth and significance of human sociality. How to relate our embodiment to our sociality however has never been obvious. Very recent work amongst "4E" investigators of cognition have taken up this challenge under headings of "the extended mind" and "the extended body". The proposed session will draw upon the neotenous birth and development thesis that has been a mainstay of philosophical anthropology (and is now acquiring further confirmation even at the level of developmental neurochemistry) in setting forth a revised philosophical anthropology that will offer an evolutionary-developmental structure for theorizing about both the prevalence of binary characterizations of human mindedness as well as the relationship of human neotenous embodiment to human sociality and intersubjectivity. The session will be structured as follows. The session will begin with a 40-minute presentation of the main thesis by the first speaker (Moss) followed by comments and open debate and discussion by the three other participant discussants (Marques, Honenberger, and Hollingsworth).

Chair of the session: Victor Ximenes Marques (Center for Natural and Human Sciences, Federal University of the ABC (UFABC), Brazil, marques.v@ufabc.edu.br)

The hybrid Hominin and its evolved hybrid mind: Groundwork for a renewed Philosophical Anthropology?

Lenny Moss (Dept. of Sociology, Philosophy, & Anthropology, University of Exeter, UK, Lenny.Moss@exeter.ac.uk)

The distinction between the nature and function of the right cerebral hemisphere, now perceived as contextually sensitive, affective, embodied, and often unconscious versus the left hemisphere, now perceived as abstract, analytical, disembodied, decontextualized, formalistic and usually explicit, has recently been given new life in the masterly work of neuroscientist Iain McGilchrist. There are, and have, been many other sets of binaries, derived from philosophers, cognitive scientists, and others to describe divergences in the nature of the human mind, human experience, and or human orientation. These binaries includes Merlin Donald's distinction between mimetic and mythic consciousness, the "I-mode"/"we-mode" distinction of Tomasello, Tuomela and others, 'the absorbed coping' versus 'space of reasons' distinction that animates the Dreyfus/McDowell debate, Kahneman's fast versus slow distinction, Plessner's distinction between the animate, lived body, and the 'objectural' body we dispose over, Heidegger's distinction between the 'ready-to-hand' and the 'present-to-hand', and Nietzsche's distinction between the Apollonian and the Dionysian. Philosophical Anthropology has long since tasked itself with the job of providing a post-dualist framework that can unify disparate strands in the human sciences and bring phenomenological and empirical accounts into a common naturalistic register. This session will explore and debate an attempt on the part of a renewed philosophical anthropology to unite and align these disparate binaries through an evolutionary contextualization. More specifically, it will be argued that anthropogenesis proceeded by way of two principal transitions, or 'detachments', the first resulting in an ancestral hominin super-group, and the second associated with partial individuation. All of the aforementioned binaries will then be interpreted and accounted for as residues, continuations and implications of these anthropogenic processes. Finally, the implications of the hybrid mind for understanding the nature of human sociality will be considered.

Discussants:

Victor Ximenes Marques (Center for Natural and Human Sciences, Federal University of the ABC (UFABC), Brazil, marques.v@ufabc.edu.br)
Elliot Hollingsworth (Dept. of Sociology, Philosophy, & Anthropology, University of Exeter, UK, eh388@exeter.ac.uk)
Phillip Honenberger (Dept. of Biological Sciences, Dartmouth College, USA, Phillip.Honenberger@Dartmouth.edu)

ORGANIZED SESSION STANDARD TALKS – CD-A3
The History and Philosophy of Taxonomy as an Information Science
Orgs.: Joeri Witteveen (Utrecht University, Netherlands, j.witteveen@uu.nl) and Staffan Müller-Wille (University of Exeter, UK, sewm201@ex.ac.uk)

Biological taxonomy can be described as an information science, as the art and science of dealing with data about the natural world. Taxonomists since Linnaeus have developed complex philosophies and practices of extracting, retrieving, circulating and tracking information about organisms from a steadily expanding cornucopia of data.

The aim of this double session is to deepen our understanding of the foundations of taxonomy from an integrated historical, philosophical and social studies perspective. We consider how the challenges of organizing and communication taxonomic information have shaped taxonomic practice and philosophy in (post-)Linnaean times. A theme common to the papers in this session is the question of how taxonomy has succeeded in providing stable references to kinds of organisms, while information on these kinds accumulates and changes, and even more intriguingly, these kinds change (or vary) themselves.

The session commences with an analysis by Bettina Dietz of how the Linnaean practice of publishing preliminary taxonomic accounts, to be corrected and updated in a steady flow of new works, created a layering of linked pieces information that rested on a novel dynamic of collective authorship. Next, Joeri Witteveen examines how the related practices of refining and redrawing the boundaries of taxon concepts impacted the philosophy of taxonomic reference in the increasingly data-intensive, networked and globalized taxonomic enterprise of the mid-nineteenth century. Staying in the mid-nineteenth century, Staffan Müller-Wille uncovers the theoretical and practical motivations behind the continued use of the species/variety distinction amidst widespread skepticism that it picked out a real difference in nature. Gordon McOuat discusses from a similar perspective how the late-nineteenth-century introduction of the new category of subspecies upset the dominant philosophical view on the meaning of ranks and their taxa. Catherine Kendig examines how the implications of the activity of kind-making in taxonomy can be better understood by examining the roles of "sortal" concepts and the process of sortalizing. Finally, Thomas Reydon challenges the widespread idea that knowledge about the classification of an organism as a member of some ranked taxon enables one to predict and infer many unobservable traits about that organism.

Chair of the session: Staffan Müller-Wille (University of Exeter, UK, sewm201@ex.ac.uk)

Papers:

Co-authoring taxonomy in eighteenth-century botany

Bettina Dietz (Hong Kong Baptist University, Hong Kong, bdietz@hkbu.edu.hk)

This talk explores the culture of co-authorship and, as a consequence, the co-authoring of taxonomy in Linnaean botany, focusing on Pehr Osbeck's report of his journey to Canton (1750-1752). Osbeck, a Swedish naturalist and student of Linnaeus, released his material in a series of successive, increasingly extensive publications that were authored by him and a number of other scholars. This allowed him to make a first version of his new findings available to an interested public as quickly as possible, while leaving the inevitable process of correcting and updating them to be undertaken by stages at a later date. Given the amount of information required for an accurate plant description, let alone a taxonomic attribution, not only Linnaeus but eighteenth-century botanists in general were aware of the preliminary nature of their publications, acknowledged the necessity to continuously update and correct them, and developed strategies to do so efficiently.

Tracing the publication trajectory of Osbeck's report makes visible the process of multiple authors working on the same text, updating plant descriptions, resolving issues of nomenclature, and correcting taxonomic attributions. It began with most of Osbeck's newly discovered plants being published, by mutual agreement, in Linnaeus' *Species plantarum* (1753). After Osbeck's travel report had appeared in Swedish (1757), translations into German and English offered additional authors the possibility to correct and update it. This layering of information along with the documentation of the provenance of each individual addition shaped not only the appearance of the published text, but also a concept of collective botanical authorship.

Anchoring taxonomic names in a deluge of data

Joeri Witteveen (Utrecht University, Netherlands, j.witteveen@uu.nl)

Naming biological taxa is dealing in uncertainty. Linnaeus was already conscious of the fact that whenever he bestowed a name on a newly discovered taxonomic group, he did so with imperfect, theory-laden knowledge about where and how the taxon's boundaries should be drawn. Where Linnaeus discerned one taxon, a future taxonomist might well end up identifying two or three.

Changing ideas about taxon circumscriptions can raise questions about taxon identity. If an original concept of a taxon is later determined to have been a composite of, say, three taxa, then which of those three concepts refers to the original taxon with smaller boundaries? Linnaeus perspicaciously anticipated such issues and described a procedure to address them. His method for linking names to taxa that work well in his times, but it led to new problems in the context of the increasingly and data-intensive, networked and globalizing taxonomic enterprise of the nineteenth century.

In this talk, I will give a historically-informed philosophical analysis of a particular episode in the transition in taxonomic reference systems, from what I will call the Linnaean method of "wrapping" names to the (post-)nineteenth century method of "strapping" names. First, I will show that the latter method had palpable philosophical and practical advantages over the Linnaean method for the purpose of anchoring and tracking a deluge of new taxonomic names. But what about names that had already been coined by Linnaeus or by his predecessors? How to deal with those names under the new method? In the second part of my talk, I discuss how these questions became the topic of a brief but fierce debate that raged in the pages of Science at the dawn of the twentieth century. A close analysis of this debate reveals how the fundaments of the contemporary codes of taxonomic nomenclature were shaped through an intricate mix of philosophical argumentation and sociopolitical dispute.

"Good and bad species" – Anton Kerner von Marilaun, Charles Darwin, and Gregor Mendel on the ranking of species

Staffan Müller-Wille (University of Exeter, UK, sewm201@ex.ac.uk)

It is a well-known fact that Darwin doubted in his *On the Origin of Species* (1859) that species and varieties can be clearly distinguished. The same doubt was expressed by Gregor Mendel in his *Experiments on Plant-Hybrids* by paraphrasing the Heinrich Georg Bronn's translation of the *Origin* (1863). An interesting further "missing link" between Darwin and Mendel is provided by a book on "Good and Bad Species" (*Gute und Schlechte Arten*) that the Austrian botanist Anton Kerner von Marilaun published in 1866. In it, Kerner argued that what count as "good" species for botanists varies regionally; varieties he encountered on a trip through Hungary, for example, were considered "bad" species among Vienna botanists, whereas Viennese "good species" where simply not found there. I will analyse these sources, making two points. First, that the doubts expressed by these three naturalists about the possibility to distinguish species from varieties did not imply that they believed all variation was continuous, but rather that there was no single criterion that defined the taxonomic rank of species. And second, that ranking was nevertheless considered necessary, even if by arbitrary criteria, for taxonomic and nomenclatorial purposes, and hence ultimately to ensure that information relating to organisms could circulate.

ORGANIZED SESSION STANDARD TALKS – MINAS1

Ethnobiology: Historical, Philosophical, and Sociological Issues

Orgs.: David Ludwig (Wageningen University & Vrije Universiteit Amsterdam, Netherlands, davidundludwig@gmail.com) and Charbel El-Hani (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), charbel.elhani@gmail.com)

Ethnobiology is commonly defined as the study of "biological knowledge of particular ethnic groups — cultural knowledge about plants and animals and their interrelationships" (Anderson 2011). While ethnobiology is a comparably young area of research that became institutionalized in the second half of the 20th century, it has grown into a dynamic field with its own infrastructure of journals, societies, and conferences. Despite this growth, ethnobiological research is rarely discussed in the history, philosophy, and social studies of biology and there is also a need for more discussion of historical, philosophical, and sociological aspects in the community of ethnobiologists. The aim of this symposium is to introduce ethnobiological research to the ISHPSSB community and to advance the discussion of the historical, philosophical, and sociological issues of ethnobiology. On the one hand, biological knowledge of local communities raises general philosophical questions about the structure of "traditional knowledge" and about the cross-cultural comparison of epistemologies and ontologies. On the other hand, ethnobiology raises a range of pressing questions at the interface of science and society from issues of environmental justice to culturally responsive science education. The session will engage with this broad range of issues on the basis of five talks and a 30 minute panel discussion on the theoretical and practical significance of ethnobiology.

Reference:

Anderson, E. N. “Ethnobiology: Overview of a Growing Field.” In Ethnobiology, edited by E. N. Anderson and et al., 1–14. New York: Wiley, 2011.

Chair of the session: David Ludwig (Wageningen University & Vrije Universiteit Amsterdam, Netherlands, davidundludwig@gmail.com)

Papers:

Revamping the metaphysics of ethnobiological classification

David Ludwig (Wageningen University & Vrije Universiteit Amsterdam, Netherlands, davidundludwig@gmail.com)

Ethnobiologists of the 1960s and 1970s commonly used taxonomic research to defend metaphysical claims about the “naturalness,” “objectivity”, “reality”, and "universality" of indigenous knowledge. The work of Brent Berlin has been especially influential in developing a “convergence metaphysics” that explains cross-cultural similarities of taxonomies in terms of shared recognition of objective discontinuities in nature. More recently, convergence metaphysics has largely fallen out of favor as ethnobiologists tend to emphasize the local character and the diversity of traditional ecological knowledge. The aim of this talk is twofold: First, I provide a historical account of the rise and fall of convergence metaphysics in ethnobiology. I show how convergence metaphysics emerged as an innovative theoretical program in the wake of the “cognitive revolution” and the “modern evolutionary synthesis” but failed to incorporate both theoretical insights and political concerns that gained prominence through the 1980s and 1990s. On the basis of this historical reconstruction, I develop a positive proposal of how to engage with metaphysical issues in ethnobiology. By integrating traditional debates about convergence of taxonomies with more nuanced accounts of distinctly local classifications, metaphysical debates can play an important role for understanding ethnobiological knowledge. Furthermore, I argue that such a nuanced metaphysical account can contribute to a better understanding of the practical relevance of ethnobiological classification from applied ethnobiology to current debates about the “ontological turn” in anthropology.

Contributions and pitfalls of current Ethnobiology
Natalia Hanazaki (Federal University of Santa Catarina, Brazil, natalia@ccb.ufsc.br)

Ethnobiology, as other subareas of the scientific knowledge, is experiencing an interesting growth in the last few decades, especially in Brazil. Among the several reasons underlying this growth is the context of indigenous rights recognized and highlighted, especially since the late 1980s. More recently, we can observe the awareness about of the value of ethnobiological knowledge for practical reasons, such as to improve or to better understand conservation strategies. The advancement in this area also brought new challenges, and here I will discuss two of these several challenges. First, from an approach that emerged in the studies about indigenous societies, we gradually encompassed a diverse range of human groups in a globalized world. Are there any adjustments needed to deal with these changes? A second challenge is the establishment of a constructive dialogue with other areas of scientific knowledge with similar objectives. The identity of ethnobiologists can turn this area into another box of knowledge, especially when this dialogue is little explored. To discuss and illustrate these challenges I will use examples from a bibliometric analysis about the scientific production related to the field in Brazil and in the world, as well as examples from practical experiences while teaching ethnobiology for Biology students and for indigenous Guarani, Kaingang and Xokleng-Lã Klanõ students.

Integrating communities values of biodiversity and traditional knowledge with scientific knowledge to environmental management: Epistemological limits and challenges

Fabio Pedro S. F. Bandeira (State University of Feira de Santana, Brazil, fpbandeira@gmail.com)

In recent decades, ethnobiology and ethnoecology have provided evidence for understanding the different ways in which traditional communities represent and manage the environment in their territories. The indigenous management system also defines the spaces and use of natural resources, according to their knowledge of the flora, fauna and physical environment and according to the indigenous conception of nature and its cosmovision. Indigenous institutions related to access to and use of natural resources are also ruled by sophisticated mechanisms of social regulation, which are based on a symbolic mapping of the territory, where actors from both the social world and supernatural, or infra-natural, worlds have their place. Notwithstanding the role of Traditional Ecological Knowledge (TEK) and cultural values in biodiversity and ecosystems management, other factors such as public policies, immigration, changes in land tenure, the creation of protected areas, payment for ecosystem services, ecotourism etc., may influence decision-making processes in ecosystem and resource management and have socio-ecological consequences. These may or may not be reversible, are reflected in changes to land use and cover, and have an impact on biocultural conservation over time. Integrating traditional and scientific knowledge as a foundation for the management of natural resources and ecosystems has been a challenge for researchers, governments, indigenous peoples and traditional communities in various countries since the 1990s. The departure point for this idea, based on an analysis of several case studies, is that conservation and the sustainable management of biodiversity and ecosystems will be effective if local communities participate at all levels of research, as well as when dialogue between traditional and scientific knowledge is sought through co-investigation. Participatory research acts as a counterpoint to traditional models of investigation, in which scientific knowledge is considered hegemonic and the community merely functions as the research object or as informants, without influencing the research as active subjects. The potential for collaborative research suggests a form of knowledge production that critically connects the contributions of science and local knowledge, in order to reorient them towards a real transformative activity. There are no adequately tested models for integrating these two distinct forms of knowledge production, organization and transmission although some experiences have indicated certain principles and strategies of approach that could be adopted and should be adapted to different socio-cultural and political contexts. This paper will present and discuss the epistemological limits and challenges of an experience within the sphere of the COMBIOSERVE project, a collaborative research carried out by an academic team and a Pataxó community researchers of Bahia, Brazil, that had worked for three years to understand land-use/land change and the traditional ecological knowledge of natural resource management, through mapping techniques in a context of intercultural dialogue, offering support to identify the conditions and principles of successful community-based conservation.

ORGANIZED SESSION STANDARD TALKS – MINAS2

Global Perspectives on Human Genetics: Past and Present

Orgs.: Edna Suárez-Díaz (Science and Technology Studies, School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, ednasuarez@ciencias.unam.mx), Rosanna Dent (Department of History and Sociology of Science, University of Pennsylvania, USA, rdent@sas.upenn.edu) and Vivette García-Deister (Science and Technology Studies, School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, vivettegarcia@ciencias.unam.mx)

The practice of human genetics has been transformed in the last six decades by the global reach of scientific exchanges, collection practices, and the transnational character of leading projects. Public health campaigns, human evolution research, surveillance and national identity projects, and the rise of biomedicine stand as major forces behind research carried out by human geneticists in every continent in this period. Though recent scholarship has abandoned the idea of a sharp discontinuity between pre- and post-war human genetics, the sheer volume of global efforts invested in the study of human biological heredity and variation after WWII has transformed the content and reach of the many fields grouped under the umbrella of human genetics. The “DNA revolution”, which had an impact only after the 1980s, is more a crucial inflection in this transformation, than a major cause.

This double session aims to reflect on major trends and specific transformations in the study of human genetics after World War II and up to the present. More than an exclusive attention to populations, and a commitment to molecular genetics, the practice and understanding of human genetics in this period provide evidence of increased exchanges and transfers, the pervasiveness of collection enterprises, and the construction of meaningful connections between actors located in every continent in the world, which widened the interests of medical and evolutionary genetics to vast regions in Latin America and Asia.

This session tackles such questions from the disciplinary approach of history and social studies of science. Moreover, it brings together papers dealing with transnational projects in human and evolutionary genetics, which had an impact on biomedicine, anthropology, and forensic science, and took place in the United States, Latin America, and the Middle-East, explicitly engaging with the themes and topics of the conference. While four speakers will deal with historical developments in the two decades after the war, with an emphasis on how local efforts shaped the globalization of human genetics, two more speakers will reflect on the role of contemporary globalized research practices, standardized methods, and databases informing highly localized forensic genetics programs, that have relied on developments in biomedicine taking place after WWII.

Chair of the session: Vivette García-Deister (Science and Technology Studies, School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, vivettegarcia@ciencias.unam.mx)

Papers:

Human chromosomes in the atomic age

Soraya De Chadarevian (Department of History, University of California, Los Angeles, chadarevian@history.ucla.edu)

In the late 1960s the British human geneticist Lionel Penrose declared that what was, just a decade ago, an ‘almost completely unexplored territory’ had become ‘a happy hunting ground for thousands of investigators around the world’ (Penrose 1969). The field he was referring to was the study of human chromosomes. In this paper I will reflect on the reasons for the fast development of the field and what the history can tells us about the place and meaning of human heredity research in the decades following World War. In particular, the focus will be on the resources, international exchanges and practices on which researchers in the field built and its broader implications for science, medicine and politics.

"Men of exuberant health": Indigenous subjects and the gendered study of human microevolution in midcentury Brazil

Rosanna Dent (Department of History and Sociology of Science, University of Pennsylvania, USA, rdent@sas.upenn.edu)

In 1962, an interdisciplinary team of scientists arrived in Mato Grosso to conduct a pilot study for a new methodology of human genetics research. Predicating their study on the notion that the realities of Indigenous people in the present reflected the distant past, the geneticists, anthropologists, and physicians that visited the Xavante village were deeply interested in the interactions of culture and genetics. This paper examines how the scientists' perceptions of masculinity informed their study of human microevolution in the mid-twentieth century. In their view, Indigenous people were not only useful subjects of study due to their closeness to nature; their socio-cultural and political realities were of great interest in understanding human evolutionary history. Beginning with the famous chief, Apowẽ, the geneticists documented and quantified as many characteristics as possible for each individual living in the village from blood groups to kinship. In the aftermath of their fieldwork, as they untangled the demographic history of the people they studied, their attention settled on violent political disputes and the institution of polygamy as the two key factors shaping microevolution in the group. In particular, the geneticists would fixate on what they perceived as the political prowess, impressive physique, and masculine reproductive aptitude of the men they included in their research. This paper traces the enduring influence of these Xavante actors, "men of exuberant health," from the field into the resulting theories of human microevolution.

Not-so-distant neighbors: Blood diseases across the US-Mexico border in the 1960s

Edna Suárez-Díaz (Science and Technology Studies, School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, ednasuarez@ciencias.unam.mx)

New modes of circulation of practices and knowledge characterized the decades after World War II. International and national agencies fostered technical assistance programs and massive health campaigns as part of the internationalization of scientific practice in several fields, but also as political tools in the struggle against social unrest. Amidst technological advances in the study of genetic variants, biomedicine provided a rationale for an increasing interest in human populations around the world.

Blood diseases, in particular, attracted resources from the World Health Organization, the US Public Health Service, and several national and international campaigns. Researchers focused on the presence and distribution of structurally anomalous hemoglobins (the cause of sickle cell anemia), the different kinds of thalassemia, and other genetically transmitted diseases, including glucose-6-phosphate dehydrogenase (G6PD) deficiency. Without respect for national borders, those diseases affected the “backward” African-American populations in the segregationist US South, and the malaria-infested populations of Latin America, Africa, and Asia. My contribution will focus on the intersection of public health care campaigns, and the molecularization of population genetics in Mexico and the United States, which illustrates the connections between the rise of biomedicine, and Cold War era concerns.

INDIVIDUAL PAPERS SESSION – AG-BOT
Philosophy of Evolution IV

Chair of the session: Ciprian Jeler (Department of Interdisciplinary Research - Humanities and Social Sciences, "Al. I. Cuza" University of Iaşi, Romania, ciprianjeler@yahoo.com)

Papers:

Group selection and how not to define a group’s fitness

Ciprian Jeler (Department of Interdisciplinary Research - Humanities and Social Sciences, "Al. I. Cuza" University of Iaşi, Romania, ciprianjeler@yahoo.com)

In multi-level selection theory, it has recently become quite customary to consider that it is justified to call a group fitter than another one simply because the sum or the average fitness of the individuals within it is higher than those of other groups. For simplicity, I will denote here the number of offspring individuals (and not groups) that a group produces with the term “group productivity”. This paper critically assesses the legitimacy of the assumption that a group’s fitness can be defined as its productivity. I begin by checking whether such a definition of group fitness is compatible with the two most influential frameworks for understanding evolution by natural selection, namely the "variation in fitness of heritable traits" framework usually associated with Richard Lewontin and the "replicator-interactor" framework usually associated with Richard Dawkins and David Hull. When the definition of group fitness as group productivity turns out not to be compatible with these two frameworks for understanding evolution by natural selection – or, in any case, not with their most consistent formulations –, I go on to analyze the possibility of salvaging this definition of group fitness by appealing to a more inclusive notion of fitness – suggested by Ariew and Lewontin (2004) –, according to which fitness should be defined as "the proportion of the limiting resources for species reproduction that is pre-empted by a given type." Group productivity could thus be seen as defining a group's fitness after all, because producing a larger number of individuals would thus be one of the potential ways in which a group would pre-empt a larger fraction of the relevant limiting resources. However, I will show that modifying our general notion of fitness in order to accommodate the definition of a group's fitness as its productivity is not necessary – nor, indeed, advisable – given that there is a simpler, more classical manner of treating the kind of (putative) multi-level selection cases that seem to require such a definition of group fitness.

In conclusion, defining a group's fitness as its productivity seems unjustified. However, I will end by arguing that there is nothing wrong in conceiving group productivity as a trait on which, depending on the specific details of the focal case, group selection may act. Indeed, I will show that this is precisely how group selection was seen in Michael Wade's (1976) well-known experiments.

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Ariew, A., Lewontin, R. 2004. The confusions of fitness. *Br J Philos Sci* 55: 347-363.
Wade, M. J. 1976. Group selection among laboratory populations of Tribolium. *Proc Natl Acad Sci USA* 73: 4604-4607.

The distinction between populations and individuals in the context of Darwinian explanations: A matter of integration

François Papale (Department of Philosophy, University of Montreal, francois.papale@umontreal.ca)

In this paper, I defend the idea that the notions of population and individual refer, within Darwinian explanations, to different areas of a continuum of integration: populations have a nuanced degree of integration while individuals are paradigmatic cases. Moreover, I will argue that the degree of integration associated to biological entities is best understood by considering two properties: reproduction and persistence. The aim of this paper is not only to present the continuum of integration, but also to provide a conceptual framework supporting the distinction between the two concepts that are keystones of the theory of evolution by natural selection and lie at the heart of contemporary debates both in biology and philosophy of biology.

In order to achieve these objectives, I will first review the contemporary representations of natural selection in order to clearly highlight the epistemic function played by the two concepts under study (Godfrey-Smith 2009). Following this, I will explore the most common definitions of biological individuals and populations (Bouchard 2011; Godfrey-Smith 2013; Millstein 2010). This will serve to show that in both cases the capacities to reproduce and to persist are of great importance. At the same time, I will show that the distinction is not as obvious as it may seem: some biological entities may be taken both as individuals and populations (Bouchard 2011). In the presence of such problematic cases, the importance of fully understanding the specificity of individuals and populations becomes clear: where we cannot distinguish them, we cannot use Darwinian explanations. In order to resolve this tension, we propose an account of populations and individuals that is inspired by Millstein's recent work on the notion of population (Millstein 2010) and what she calls the Hull-Ghiselin conception of individuality. Building on her insights, I will argue that what allows populations and individuals to play their respective roles in Darwinian explanations is the fact that they are more or less integrated with regard to reproduction and persistence.

In other words, this paper aims at describing the fundamental concepts of the theory of evolution by natural selection in a precise and innovative manner. Understanding these two concepts through their degree of integration also helps understanding why borderline cases (e.g. the quaking aspen) are problematic for Darwinism and how to relieve the tension that they illustrate.

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______. 2013. Darwinian Individuals. Pp. 17-36, in: Bouchard, F., and Huneman, P. (ed.). *From Groups to Individuals: Evolution and Emerging Individuality*. Cambridge, MA: MIT Press.
Millstein, R. L. 2010. The Concepts of Population and Metapopulation in Evolutionary Biology and Ecology. Pp. 61-86, in: M. A. Bell, D. J. Futuyma, W. F. Earnes and J. S. Levinton (eds.). *Evolution Since Darwin: The First 150 Years*. Massachusetts: Sinauer.

Ecological Interactions within the Holobiont: On the Holobiont's interactions of its microorganisms

Tamar Schneider (Department of Philosophy, University of California, Davis, United States of America, tschneid@ucdavis.edu)

In the last three decades, studies in microbiology exposed a new world of diverse and dynamic interactions. Through metagenomics sequencing, complex bacterial communities became visible and proved important for many biological phenomena. As a result of discovering the connection between microorganisms and organisms' survival, the notion of the Holobiont has become prominent and has been used as an alternative unit of selection. This view, commonly called the Hologenome theory, focuses on the interactions and relations between the host and its symbionts and their relevance to the host's development and evolution (Zilber-Rosenberg & Rosenberg 2013; Bordenstein & Theis 2015). My own discussion of the Holobiont shifts the focus from the host-symbiont interactions to the symbiont's ecological interactions. I argue that an ecological view of these interactions could help us better understand the holobiont in its specific environment and could highlight their role in the evolutionary process.

When thinking of symbiotic, competitive, or predatory interactions between organisms, the environment is the context in which these interactions occur, and in many cases, it dictates through outside pressure the nature of these interactions. This way of thinking applies in particular when interactions are viewed as strategies for survival (leading eventually to resource-competition or collaboration). However, in microbial interactions, the environment itself is part of the interactions. Namely, the interactions occur through small environmental modifications. For example, quorum sensing is considered to be a type of bacterial communication through molecular signals. The environment, therefore, is an active part of the interactions.

The molecules released from the bacterial cells to a small-scale environment create modifications that accumulate to influence the mode of bacterial proliferation. Thus, the diverse bacterial communities coordinate to fine tune their growth rate to match the availability of resourses and space. These interactions are not only in response to environmental pressures; rather they are a modification of this environment. Reflecting back on the Holobiont, its behavior and well-being are composed of these small levels of environmental modification through bacterial communication.

Both humans and nonhuman organisms interact with each other, with other species in their environment, and with the environment itself in a regulated periodic way that creates a web of interdependency. While this web of interdependency is studied in ecology, its weight in studies concerned with evolution is limited. Instead, viewing bacterial ecological interactions with their host's environment as an interdependency web between microorganisms and macrorganisms could shed new light on the nature of the Holobiont in its environment and lead to a more complex conception of evolution and development.

References:

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THURSDAY JULY 20
11:00-12:30 – Parallel sessions 12

ORGANIZED SESSION DIVERSE FORMAT – AG-ZOO

Roundtable

Manipulation and Causation in Biology: Genetics, Evolution and Experimental Intervention

Orgs.: Maurizio Esposito (University of Santiago, Chile, maurizio.esposito@usach.cl), Davide Vecchi (University of Lisbon, Portugal, davide.s.vecchi@gmail.com), Gabriel Vallejos (Faculty of Sciences, University of Chile, gabo.jet@gmail.com) and Lorenzo

Baravalle (Federal University of ABC/São Bernardo do Campo, Brazil, lorenzo_baravalle@yahoo.it)

To what extent do manipulative analyses provide us with causal understanding of biological phenomena? Can successful manipulation justify scientific realism in the life sciences? The session explores these questions through the philosophical and historical examination of different cases in which the relation between manipulation and explanation is explicit. The roundtable aims to foster reflection over the epistemological and ontological implications of knowing by doing and intervening, from a practical and conceptual viewpoint. Indeed, from 18th century experimental biology, manipulation has been one of the important epistemic strategies for identifying causal relationships among and inside biological entities (i.e. organs, cells, genes etc.). However, while many philosophical analyses have focused on the connection between evidence and theory, the relation between manipulation and theoretical outcomes has been frequently overlooked (although increasingly less so). Specific cases taken from contemporary biology will be discussed. In particular, genetics (in what sense is DNA a casually specific difference maker?), evolution (how does an interventionist account of causation help to characterize genetic drift as a genuine evolutionary force?), synthetic biology (to what extent does successful manipulation provide genuine, and not only instrumental, knowledge of living systems?) and experimental biology (what are the epistemic differences and similarities between "in vitro/in vivo" experimental intervention?)

Chair of session: Maurizio Esposito (University of Santiago, Chile, maurizio.esposito@usach.cl)

Papers:

Handling life: Intervention and causation in Biology

Maurizio Esposito (University of Santiago, Chile, maurizio.esposito@usach.cl)

Manipulating organisms has been one of the most important epistemic strategies in the history of biology. From the experimental biology inaugurated by Abraham Trembley and Lazzaro Spallanzani in the 18th century to the physiology of Claude Bernard and Carl Ludwig in the 19th century, modern knowledge of life could not be easily severed from sophisticated technics of experimental intervention. In the

20th century, for instance, from the experimental physiology of Jacques Loeb until synthetic biology, direct intervention is deeply intertwined with the production of new entities (parthenogenetic egg, protocells, synthetic genome, chimeras etc.) and theoretical knowledge is often the consequence of complex technological interventions. The talk aims to foster philosophical and historical reflection on the relation between experimental intervention and theoretical knowledge in the biosciences. In particular, the paper explores the epistemic question whether or not successful manipulation provide genuine, and not only instrumental, knowledge of living systems. And, furthermore, it briefly examines the relationship between realism and pragmatism in biology.

Prokaryotic transcription as a test case for manipulationist accounts of developmental causation

Davide Vecchi (University of Lisbon, Portugal, davide.s.vecchi@gmail.com)

Crick (1958) famously proposed that the relationship between DNA sequence and gene products should be understood in terms of specificity and determination. Waters (2007) has argued along Crick's lines by borrowing Woodward's (2003) manipulative analysis of causality. Waters makes two important conceptual distinctions in order to defend his argument: between difference-making causes that "fully account" and those that only "partially account" for a phenotypic outcome; and that between "specific" and "non-specific" difference-making causes. In this talk I shall argue that, even though DNA is indeed a specific difference maker, it is difficult to make sense of the claim that it is a developmental determinant. On the one hand, DNA is not the only causally specific difference maker. Waters' analysis of specificity, like Woodward's (2010), might be flawed as they take into account only the possibility of manipulating the level of molecular factors instead of their chemical structure. Furthermore, specificity comes, as Weber (2006) has convincingly argued, in degrees. I shall propose a theoretical rationale for defending this thesis that draws inspiration from the model of developmental equivalence of environmental and mutational inputs (Zuckerkandl & Villet 1988). On the other hand, DNA sequence is not a necessary and sufficient condition for the determination of the structure of mRNA. I shall propose a theoretical rationale for defending this thesis that draws inspiration from the switch model of development (West-Eberhard 2003). For argumentative purposes, I shall only consider the simpler process of prokaryotic transcription: if it turns out that even the formation of prokaryotic mRNA is not fully accounted for by DNA then, by extrapolation, DNA is not a developmental determinant.

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Extrapolating reliable knowledge through different experimental systems

Gabriel Vallejos (Faculty of Sciences, University of Chile, gabo.jet@gmail.com)

One of the main philosophical problems of experimental biology consists in the comparison and extrapolation of knowledge among different experimental systems and between the latter and theories in biology. In the laboratory different kinds of biological entities are scrutinized (Proteins, DNA, enzymes, macromolecular assembly etc.) and isolated from their natural environment (in vitro). Indeed, in the study of the living complex systems (in vivo) the access to the properties of the parts is severely limited. So, how is it possible to extrapolate knowledge from these different experimental systems? What kind of relation do exist between experimental systems and biological theories? The talk aims to answer to these questions. It will be suggested that the epistemic access to an object depends from the articulation of different experimental systems and the same properties of the epistemic object (detection and auxiliary properties).

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Is genetic drift a force of evolution?

Lorenzo Baravalle (Federal University of ABC São Bernardo do Campo, Brazil, lorenzo_baravalle@yahoo.it)

One of the traditional problems of the so-called "dynamical" interpretation of the theory of natural selection – which considers this theory as a theory of forces, to some extent analogous to Newtonian mechanics – concerns the causal nature of genetic drift. Although it is, in fact, virtually possible to decompose this statistical effect in a sum of individual causal interactions, it is not yet clear whether the overall process may be considered a force of evolution, since it apparently lacks the vectorial features of Newtonian forces. As Luque (2016) has observed, the debate on the dynamical interpretation in the last decade has improved our understanding of Newtonian mechanics, but only a little our understanding of evolutionary theory. This is possibly because, instead of highlighting the specificity of evolutionary forces, most of philosophers have insisted on the analogy with Newtonian mechanics. In this talk, my aim is to show (following, for instance, Reisman & Forber 2005, Shapiro & Sober 2007, and Gildenhuys 2009, 2014) how an interventionist account of causation (Woodward 2003) could help to characterise genetic drift as a genuine evolutionary force, by determining a set of ecological constraints whose manipulation involve population-level random dynamics.

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ORGANIZED SESSION STANDARD TALKS – CD-A1

Doing and Undoing Race

Org.: Ageliki Lefkaditou (Norwegian Museum of Science and Technology, Norway, ageliki.lefkaditou@tekniskmuseum.no)

Even when not explicitly connected to racial science, research on human biological diversity has been a topic of fascination and debate through its associations with notions of identity, belonging and origins. In recent years, the quantity of human genome-wide data has grown exponentially thanks to rapid advances in DNA sequencing and bioinformatics and new expectations have surfaced among researchers and the public for reconstructing human migrations, improving forensic identification, and minimizing health disparities. At the same time, scientists, social scientists and humanities scholars engage critically with these topics and examine how old racial categories re-emerge - or have become embedded - in population and medical genetics, and instruments of governance and promote new forms of bio-colonialism and exploitation. Yet, the discussions on the implications of these developments on our understandings of collective and individual identities rarely reach the public. While in some contexts such as many of the European countries, race is a tabooed topic excluded from official discourses and thought of as merely a relic of the past, whereas the resonant notions of “population”, “ethnicity”, or “geographic ancestry”, are presented as unproblematic alternatives, in others such as the US, racial discourses are prevalent and overwhelming. This session brings together scholars from diverse contexts and backgrounds to discuss historical and contemporary attempts to address the contested issues around race and human biological variation in their travels between scientific laboratories, scholarly circles, and the public. Our aim is to demonstrate the complex negotiations that go into regulating, legitimizing, or challenging race and its proxies and reflect on the tensions and synergies manifested at the interface of science and society.

Chair of the session: Dominic Berry (University of Edinburgh, UK, dominic.j.berry@ed.ac.uk)

Papers:

Two takes on race: Exhibitions in mid-20th century United States museums

Tracy Teslow (University of Cincinnati, USA, tracy.teslow@uc.edu)

Racial science was always a contested enterprise. By the 1930s, despite nearly a century of scientific effort in Europe and the United States to pin race down, it remained elusive. Virtually every aspect of racial science was subject to disagreement; method, classification, implications—all were debated. Moreover, while most anthropologists understood race in essentialist terms, many also approached race in more nuanced cultural and historical terms. My paper examines how these tensions in the anthropology of race were evident in two prominent museum exhibitions meant to educate American audiences about the “Races of Mankind,” one mounted at the Field Museum of Natural History in Chicago in 1933 and another mounted at the Cranbrook Institute of Science, located outside Detroit, Michigan, in 1944.

The Field Museum’s Races of Mankind was the largest and most renowned exhibition of race and racial science ever mounted in the United States. Opened in 1933 to coincide with Chicago’s Century of Progress World’s Fair held across the street, the exhibition drew more than three million visitors in its first year. Entering the first floor exhibition hall, visitors confronted 101 life-size bronze sculptures intended to depict the "principal" human racial types. Meant as one of two marquee halls displaying the fruits of physical anthropology, the Races of Mankind combined the aesthetic appeal and the detailed, ethnographic naturalism of sculptor Malvina Hoffman's figures with the purported empirical rigor of physical anthropology and the scientific authority of the natural history museum, to create a powerful vehicle for delivering to the American public a vision of race that promoted both division and unity. Exhibit documentation, extensive correspondence, and contemporary publications reveal the tangled mix of racial and cultural theorizing, philosophical and methodological disagreement, compromise and convenience that lay behind the supposedly straightforward science of race presented by the Field Museum.

Unlike the identically titled exhibition mounted at the Field Museum a decade earlier, the 1944 Cranbrook "Races of Mankind" exhibition was designed to intervene in a dominant racial ideology at home and abroad that was increasingly viewed with alarm. Based on a widely distributed pamphlet authored by anthropologists Ruth Benedict and Gene Weltfish, Cranbrook's "Races of Mankind" presented displays meant to undermine notions of racial superiority and hierarchy. Mounted in a moment of racial crisis—amid devastation wrought by Nazi racial policies in Europe and racial turmoil at home—"The Races of Mankind" marked an attempt by scientists to reframe racial science by renouncing particular hierarchical and essentialist concepts, and by adopting a more humanist stance. Yet both the booklet and the exhibition clung to racialized types as a fundamental organizing principle. Benedict and Weltfish combated racism not by rejecting race, but by attempting to sharply distinguish race from culture, framing race as a viable but limited descriptive exercise and racism as a cultural matter of individual and group prejudice. The solution to the problem of racism was not abandoning the "race" concept, but disabusing the public of their erroneous notions.

Ways of seeing faces: Race as visible difference in facial reconstruction

Abigail Nieves Delgado (Ruhr University Bochum, Germany, abigail.nievesdelgado@rub.de)

Facial reconstructions are complex techno-scientific objects produced to represent absent faces. In recent years, numerous facial reconstructions have been made by physical anthropologists and experts in craniofacial reconstruction for museum exhibitions or as tools for identification of human remains in forensic sciences. In both contexts, the main goal is to offer an approximation of a particular unknown countenance for potential identification by an observer. Even if the face is a highly individual object, its reconstruction depends on the use of a number of general categories. One of these is race. In fact, racial categories are central to facial reconstruction. There are two moments when experts reproduce race during reconstruction. First, in the professional evaluation of the skull and its determination as Caucasoid, Mongoloid or Negroid. For example, the skull of Richard III would be classified as Caucasoid, while a skull found in Mexico would be taken as Mongoloid as first choice. Second, in the use and production of averages and indexes of soft tissue depth. There is a continuous production of population indexes in many laboratories around the world. Nowadays there are indexes for Brazilians, Chinese, Mexicans, white British children, Afro-American males, white Caucasians, etc. However, the relevance of racial categories is not restricted to the process of reconstruction. These are also central for public communication or the 'translation' between science and the lay public. This means that racial categories are also important to the public reception of these objects. Hence, race is continually produced and validated through the creation and reception of these objects, as communication between expert and public happens by means of these outdated categories.

In this paper, I propose that a notion of race as 'visible difference' is informing contemporary facial reconstruction and, at the same time, is reinforced by this technique. Through the voices of experts in facial reconstruction, I present an analysis on how practitioners continually recreate race even if they do not always hold ontological commitments to it. In addition, the analysis of facial reconstructions as objects where race is enacted, but also consumed allow us to see how deeply entrenched racial divisions are into our ways of seeing. It shows that even if racial categories have been theoretically removed from scientific discourse and practice, they are still central to some areas of the biosciences. In fact, to stop reproducing race depends on stop seeing race, and this is a far more difficult task. Thus, through the analysis of facial reconstruction it is possible to better understand the complexity of racial perspectives in contemporary biosciences, public and social spheres.

Ageliki Lefkaditou (Norwegian Museum of Science and Technology, Norway, ageliki.lefkaditou@tekniskmuseum.no)

During the last couple of decades, museums of natural history, anthropology and ethnography, history, art, and science and technology have turned their attention to telling difficult (hi)-stories. This movement towards revisiting, or in many cases deconstructing their institutional pasts, and exploring their political potency, has resulted in several national and local museums producing exhibits related to race and racism. Especially for curators and scholars working in science and technology museums, these topics provide an opportunity to develop more nuanced interpretations of historical racial science, explore contemporary research on human genetic diversity, and empower their audiences to engage critically with science. This paper focuses on one such exhibition, provisionally entitled "Blood, Bone and DNA," and under development at the Norwegian Museum of Science and Technology. As a member of the working team, I will discuss our research strategy and findings, as well as our curatorial challenges and choices.

This specific exhibit endeavours to show the multiple entanglements between science, technology, culture, politics, and economy in the production of biological understandings of individual and group identities. While avoiding didactic illustrations of "how things are" and normative considerations of "how things should be," the exhibition looks at the practices of measuring, classifying, visualizing, mapping, standardising, and (e)valuating to reveal how race is done. In the centre of these practices have always been objects with profound cultural significance; human remains, especially skulls, blood, and more recently DNA, are invested with meaning and associated with the most fundamental aspects of the human condition. As these objects oscillate between the readily available and tangible to the invisible or even mysticized, the products of such research have equally varied from visually compelling artistic ethnographic representations to disturbing racial type photos, and from world maps to obscure statistical data sets and diagrams. Instruments as simple and trivial as measuring tapes to high-tech DNA sequencers substantiate difference and attest to the varying demands in expertise, tacit knowledge, skill, or detached technical reproduction. The coexistence and juxtaposition of these objects and practices as well as the emphasis on their circulation across space and time will open up questions on the relationships between historical and contemporary attempts to study human biological variation. Echoing important theoretical, methodological, and ethical criticisms raised by humanities and social sciences scholars, as well as anthropologists and geneticists, the exhibition will provide an open, safe, and democratic arena to discuss the racializing processes of today.

My final aim is to demonstrate how through this exhibition making process, the museum space becomes an important site for exploring the possibilities and limitations of history and philosophy of science in practice, and for building bridges between diverse scientific communities, scholarly critiques and artistic interpretations of science, and large numbers of users and audiences.

ORGANIZED SESSION STANDARD TALKS – CD-A2

The History and Philosophy of Taxonomy as an Information Science

Orgs.: Joeri Witteveen (Utrecht University, Netherlands, j.witteveen@uu.nl) and Staffan Müller-Wille (University of Exeter, UK, sewm201@ex.ac.uk)

Chair of the session: Joeri Witteveen (Utrecht University, Netherlands, j.witteveen@uu.nl)

Papers:

The threat of sub-species: The intrusion of a taxonomic category and what it might say about meanings in taxonomic practice

Gordon McOuat (University of King's College/Dalhousie University, Canada, gmcouat@dal.ca)

After witnessing a period of acute turmoil, the second half of the 19th Century had settled down nicely regarding identifying, naming and referring to taxonomic categories, especially (but not exclusively) the "species" category. Identifying "natural kinds" and their proper rankings could be given over to the tacit authority of "competent naturalists" and their associated institutions, barring threats of permanent revolution in naming and classifying things. Endless disputes over "essentialisms" would be held at bay. At the core lay a certain philosophy of language and meaning hammered out in the disputes of the earlier part of the century.

However, as the 19th Century turned into the next, along came a new category and rank, subspecies, intimately tied to worlds outside the received circle of "competence": namely, field practices, periphery naturalists, and colonial museums. The new outsider category rank, subspecies, threatened established authority and the fine balance of language. Markedly, the intrusion of "subspecies" brought with it the recrudescence of spectres of "essentialism". This paper will examine the intrusion of subspecies into taxonomic rank and the consequences both to the disputes over the meaning and practices of taxonomy and to associated philosophies of language. From this debate over subspecies we may learn a lesson or two regarding the notion of "getting taxonomies right."

Individuation, identity, and sortals in biological taxonomy

Catherine Kendig (Michigan State University, USA, kendig@msu.edu)

Information science relies on a system of signs or symbols that effectively fix that product or process to which they refer by naming or coding. The prerequisite of something qualifying as information is that it is named or coded. For instance, referring to some entity (e.g. a product or process) as "part x", is in some sense informative only if it is labelled as such. The part, in virtue of its label, is trackable and comparable to other parts. The tracking of named biological parts can be traced back at least as far as the early anatomist, Vesalius (1543) in his Structure of the Human Body. Vesalius used letters as signifiers of parthood by representing the serial repetition of the form and structures of bones (e.g. vertebrae) and the symmetrical muscles (e.g. within right and left arms and legs) by labelling them with the same Greek letters.

Naming and tracking is pervasive in all fields of biology but seems to play a particular role in the history and philosophy of taxonomy, comparative anatomy, physiology, genomics, and synthetic biology where discovering something is the same part is crucial to resolving phylogeny. But how are entities discovered to be the same, how are they tracked, and why does it matter? In talking about species, organisms, genes, and microbiomes, one thing that taxonomists as well as environmental scientists, cell biologists, geneticists, and ecologists want to do is count species, organisms, genes and microbiomes. Counting relies on knowing what something is and where one thing ends and another begins or whether a process is continuous or discontinuous. I explore this simple suggestion by considering whether taxonomy can be loosely understood as sortal-tracking using a particular notion of sortals (e.g. Locke, Frege, Reippel, Wilkins, and Lowe all mention sortals in terms of species where species are taken as exemplars of sortals). A sortal concept is a concept of individuation of a particular kind that affords counting of it. A sortal provides a way of counting parts of a particular kind. That is, a sortal specifies whether two or more parts are identical or non-identical and it provides a way to signify what it is that is being referred to in terms of its kind.

So, how might we use a sortal concept within discussions of taxonomy as information science? Sortalizing processes are one type of kind-making activity that partition wholes into parts which are then named. But what does thinking about sortals and the assigning of signatures to indicate parts really do? For instance, must the use of a sortal concept be underpinned by an assumption of identity of things being signified with letters to indicate the same part or is the naming event enough? And, is the signification as a part prerequisite for the determination of their relationship of sameness (homology) or similarity (analogy) to one another and for assigning them to taxa?

Taxa and systems as holders of information about organisms

Thomas Reydon (Leibniz Universität Hannover, Germany, thomas@reydon.info)

Erecting biological taxa and placing them within a system of classification is an information-intensive process in which large quantities of data are used to individuate taxa and to position them with respect to each other in tree-like structures. Recent decades have seen an enormous increase in the amount of information that is processed to erect taxa and place them into a classification, fuelled by advances in computational methods and capacities. The rise of Numerical Taxonomy in the 1960s-1970s (Sokal & Sneath, 1963) is a case in point (but see Vernon, 1988), and in contemporary Phylogenetic Systematics using advanced computational methods to create sets of phylogenetic trees from large data matrices has become standard (e.g., Felsenstein, 2004).

On this basis one would expect that taxa and classifications embody large amounts of information about their member entities, that is, organisms. Ernst Mayr, for example, once remarked about species: "(…) If I have identified a fruit fly as an individual of Drosophila melanogaster on the basis of bristle pattern and the proportions of face and eye, I can 'predict' numerous structural and behavioral characteristics which I will find if I study other aspects of this individual." (Mayr, 1961). That is, once an organism is identified as a member of a species, we can infer a considerable amount of information about that organism, in the same way as the various natural kinds of entities featuring in the sciences allow inferences over their member entities. Similarly, inferences are often made about shared organismal traits of the members of higher taxa on the basis of their being members of the same clade. Accordingly, in recent discussions this view of species and higher taxa has been promoted in the literature on natural kinds in biology, in which many authors treat taxa as the bases of reliable generalizations at various levels of the Linnaean hierarchy.

In this talk I want to argue that matters are not as straightforward as they are often thought to be. I will argue against claims such as Mayr's that identifying an organism as a member of a particular taxon allows us to predict many of its unobserved traits, or that in general we can predict the traits of unobserved members of taxa on the basis of their taxon membership. Still, phylogenetic systems allow for some generalizations about the members of taxa. I will explore the question what kind of inferences are possible about the members of species and higher taxa, and argue that taxa and classificatory systems are poor holders of information about organisms.

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ORGANIZED SESSION STANDARD TALKS – CD-A3

Ethnobiology: Historical, Philosophical, and Sociological Issues

Orgs.: David Ludwig (Wageningen University & Vrije Universiteit Amsterdam, Netherlands, davidundludwig@gmail.com) and Charbel El-Hani (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), charbel.elhani@gmail.com)

Chair of the session: David Ludwig (Wageningen University & Vrije Universiteit Amsterdam, Netherlands, davidundludwig@gmail.com)

Papers:

Ethnobiological and ethnoecological research as key contributors to culturally responsive science education: Epistemological grounds and educational studies

Charbel El-Hani (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), charbel.elhani@gmail.com)

Science classrooms contain, at all educational levels, a diversity of students, coming from varied cultural backgrounds. Thus, we can say that every science classroom is multicultural. If we then assume that science education should both create conditions for the understanding of scientific ideas and be developed in a culturally responsive manner, to know the culturally-grounded knowledge students bring to the classroom becomes of key importance. Those culturally-grounded ideas are often mixed up in the educational literature in an assortment of "misconceptions", "alternative conceptions", "prior conceptions", etc. However, it is clear that this is a misinterpretation of the nature of culturally-grounded knowledge, entailing a problematic appraisal from an epistemological and sociocultural point of view. I will argue, thus, that ethnobiological and ethnoecological research has a key role to play in culturally responsive science education, which has not been deployed yet to the extent that is needed. To illustrate how ethnobiological and ethnoecological research can be put into play in educational research leading to classroom innovations fostering dialogue between school science knowledge and traditional knowledge I will discuss the work we are currently developing in the fishermen village of Siribinha, in the shore of the state of Bahia, Brazil, paying particular attention to the epistemological issue of the value of traditional knowledge vis-à-vis scientific knowledge.

Integrating different accounts for interpreting traditional communities' knowledge in the science classroom: Contributions for dialogue, increase of students' self-esteem and sense of community belonging

Diego F. Valderrama-Pérez (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), diego.valderrama.bio@gmail.com)

Among ethnobiologists and ethnoecologists debates on the demarcation between scientific and traditional knowledge are common. These debates have led to the emergence of competing accounts for interpreting the knowledge of ethnic and traditional communities. These different accounts are based on varied criteria and situations of the ecological and sociocutural context of the communities which influence the ways of understanding nature and the learning processes of their members. The immediate knowledge of the children and young people of these communities is based largely on these criteria and situations. I will argue the need to take into account different accounts for interpreting the knowledge of traditional communities for the promotion of dialogues between school science knowledge and traditional knowledge and the increase of students' self-esteem and sense of belonging to the community in the school environment. I will specifically address the context of the science classroom as it is the place where members of these communities commonly come into contact with the scientific ideas and discourse, more precisely, with what is called in the literature "school science knowledge". Traditional knowledge and (school) scientific knowledge have been constructed and legitimized in different sociocultural contexts and thus we should discuss whether each form of knowledge should be studied and valued in the classroom from its own criteria, particularly when they differ from the criteria underlying school scientific knowledge. To illustrate these ideas I will discuss the work we are currently developing in the marine fishermen village of Taganga, in the state of Magdalena, Colombia, in which we use different accounts for interpreting local knowledge and elaborate didactic materials to foster dialogues between ways of knowing in the natural sciences classroom.

Panel discussion on the relevance of ethnobiology for ISHPSSB

ORGANIZED SESSION STANDARD TALKS – MINAS1

Nuclear Environments: Geography and Locality in Atomic Age Ecology and Environmental Research

Org. and chair of the session: Judy Johns Schloegel (Independent Scholar, USA, jjschloegel@comcast.net)

These sessions build upon the growing body of scholarship addressing Cold War ecological science, technology, patronage, politics, and environmental history by examining the centrality of geography and locality in ecological and environmental research carried out in Atomic Era nuclear environments. As is considered here, within the context of the US Atomic Energy Commission (AEC) alone, nuclear environments have been highly diverse geographically, spanning the American West desert, the central Pacific Ocean and its coral reefs, Japan, Latin America and Columbia, Montana, Minnesota, and the US Great Lakes. Nuclear environments were likewise diverse in their understood scope, including: rice farms and wheat fields; atolls; nuclear power reactor sites and their adjoining bodies of water; atomic weapon test sites; plutonium production facilities; forest and marine tropical ecosystems; regional "nuclear sacrifice zones"; and perhaps most ambitiously, the whole globe itself.

Collectively, these papers consider the relevance of geography and locality in Atomic Age ecology and environmental research by exploring the notion of nuclear environments in a variety of cases between the late 1940s and the early 1970s. We explore in the first session: cooperation between the UCLA Atomic Energy Project and the University of Washington Applied Fisheries Laboratory in radiobiology and ecology research at multiple vast and remote spaces in the American West and Pacific Ocean; the symbiosis between studies of nuclear weapons and studies of coral reefs in the Pacific by the US, France, and the United Kingdom; and the global ambition and geopolitical imperative of the US AEC's Project Sunshine, a radioactive tracer program launched to evaluate the dispersion and accumulation of strontium-90. In the second session, we consider: the idea of the American West as an environmental "nuclear sacrifice zone" through the lens of the anti-nuclear scientific group, the Western Montana Scientists Committee for Radiation Information; the heated debates among biologists and engineers about the likely environmental impacts of a new Central American "Panatomic Canal" created through nuclear excavation, as well as its non-nuclear alternative; and the multiple tensions arising from concerns about locality that threatened Argonne National Laboratory's successful Great Lakes Research Program, dedicated to the radioecology and study of thermal effects associated with the siting of nuclear power plants.

Papers:

Hidden atomic loci: Cooperation in radioecology at the UCLA Atomic Energy Project and the University of Washington Applied Fisheries Laboratory in the 1940s and 1950s

Joshua McGuffie (University of California at Los Angeles (UCLA), USA, jmcguffi@ucla.edu)

In the 1940s and '50s, the radiobiologists, fisheries biologists, and doctors working at the UCLA Atomic Energy Project and the University of Washington Applied Fisheries Laboratory enjoyed a strong working relationship as they developed programs for long-term radiation monitoring. In charge of radioecology and radiation monitoring at Alamogordo, the Nevada Test Site (NTS), and the Pacific Proving Grounds, and with great influence at Hanford, these two small laboratories shared responsibility for a great swath of the US West and its Pacific domains. I highlight three hallmarks of their cooperation in this paper. First, they carried on the highly decentralized model of radiological research instantiated by the Manhattan Engineer District. Second, they fit the western model of distant, urban loci maintaining control over vast areas of what was considered un- or underpopulated land. Third, as they worked together, the laboratory staffs disregarded disciplinary boundaries, seeking radiation where it could be found.

These characteristics of the labs' work help to make the picture of the US atomic program more robust by improving the geography of US atomic knowledge and scientific authority and by helping to understand the nascent fields of radiobiology and ecology. I focus particularly on the late 1940s and early 1950s, when the labs were conducting long-term biological surveys at Bikini and Alamogordo but were also involved with bomb testing at the NTS and plutonium production at Hanford. It is my hope to contribute to the already rich historiography of the atomic US west by tying these two knowledge repositories together and showing how they built wartime experience into their science and then applied the authority of the laboratory over great, irradiated landscapes.

The symbiosis between studies of nuclear weapons and studies of coral reefs, 1946-1977

Alistair Sponsel (Vanderbilt University, USA, alistair.sponsel@vanderbilt.edu)

The United States, France, and the United Kingdom tested hundreds of nuclear weapons on coral reefs in the Pacific between 1946 and 1996. I have shown in my earlier work some of the myriad ways in which weapons-testing infrastructure and methods reshaped the field of coral reef science. This paper illustrates that the decision to conduct the test on (not just at) coral atolls also expanded the scope of what was knowable about nuclear weapons. I argue that the distinctive features of coral reefs (namely that they are physical structures propagated through organic growth) and the distinctive features of nuclear weapons (that they produced both an immediate physical concussion and, as it turned out, long-term biological effects) were suited to one another in ways that allowed knowledge simultaneously to be generated about atoll geology and ecosystems and the physical and radiological effects of the bombs themselves. This (perhaps unfortunate) synergy between coral reefs and nuclear weapons gave the Pacific proving grounds a broad scientific significance that set them apart from the desert proving grounds in Nevada, Algeria, and Australia.

Cold War, hot spots: Global fallout, regional variations, and the question of scale in the U.S. Worldwide Radiostrontium Sampling Program

Toshihiro Higuchi (Georgetown University, USA, th233@georgetown.edu)

What is an appropriate scale of analysis for environmental science in the Anthropocene? The Anthropocene is a term proposed to describe the latest geological epoch in which human activities have a significant impact on Earth's physical and biological systems as a whole. Yet, their impact has proven highly uneven from place to place. If so, how do scientists choose a specific scale out of many possibilities? What are the consequences of that choice? To explore these questions historically, I will examine Project Sunshine, a radioactive tracer program initiated by the U.S. Atomic Energy Commission (AEC) in 1953 to ascertain the global dispersion and accumulation of strontium-90 produced during nuclear weapon tests. I argue that the Project's ambitious geographical coverage reflected not only the material process of radioactive contamination, but also the geopolitical implications of U.S. national security strategy during the early Cold War period that made a global radiostrontium assay politically imperative. I will first trace the origins of Project Sunshine, showing how the AEC conceived the study as part of its political effort to combat the growing skepticism in the United States and abroad about the wisdom of actually using or even testing nuclear weapons on a massive scale. I will then take a close look at a Sunshine expedition to Latin America in search for the "maximum man," the most contaminated group of people predicted by the Sunshine model, to back up the AEC's categorical denial of any undue hazard to public health anywhere in the world. Finally, I will briefly discuss the discovery of heavy contamination of rice in Japan and that of wheat in Minnesota, showing how independent data underlining the heterogeneity of regions increasingly cast doubt on the AEC's sweeping knowledge claim. The global ambition of Project Sunshine and its challenges both illustrate the critical role of the Cold War in scaling up or down the level of environmental knowledge production in the nuclear Anthropocene.

ORGANIZED SESSION STANDARD TALKS – MINAS2
Global Perspectives on Human Genetics: Past and Present

Orgs.: Edna Suárez-Díaz (Science and Technology Studies, School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, ednasuarez@ciencias.unam.mx), Rosanna Dent (Department of History and Sociology of Science, University of Pennsylvania, USA, rdent@sas.upenn.edu) and Vivette García-Deister (Science and Technology Studies, School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, vivettegarcia@ciencias.unam.mx)

Chair of the session: Rosanna Dent (Department of History and Sociology of Science, University of Pennsylvania, USA, rdent@sas.upenn.edu)

Papers:

The politics of scientific collaboration and the International Biological Program in the Middle East

Elise Burton (Program in History and Middle Eastern Studies, Harvard University, USA, ekburton@fas.harvard.edu)

The Human Adaptability component of the International Biological Program (1964-1974) had universalist aims, seeking to bring together scientists across the world to study the prospects for the future of humanity as a whole. At the same time, the geopolitical and social dimensions of transnational scientific collaboration exposed the sharp disparities between the West and developing regions like the Middle East--not only in terms of material resources, but also in terms of professional hierarchy. In this talk, I use a postcolonial lens to examine the human genetic surveys carried out in Iran and the Levant under the auspices of IBP investigators. Drawing on scientific publications and archived correspondence, I analyze the collaborative relationships of British and American researchers with Middle Eastern scientists and research subjects. I show that while Middle Eastern researchers were essential to the completion of IBP projects in the region, performing the necessary fieldwork for the collection of blood and genealogical information, Western scientists perceived themselves as engaged in a higher level of scientific labor due to their access to more sophisticated laboratory and statistical equipment. Accordingly, Middle Eastern scientists struggled to have their local interests and contributions recognized as a professional community rather than merely as "collection agents" for a Western-dominated agenda of global science.

"Los migrantes desaparecidos" as a population of cognition: Crisis, unknowability, and the making of the missing

Vivette García-Deister (Science and Technology Studies, School of Sciences, National Autonomous University of Mexico (UNAM), Mexico, vivettegarcia@ciencias.unam.mx) and Lindsay Smith (Geography and Environmental Studies, University of New Mexico, USA)

In August 2010, the Mexican army arrived at the massacre of 72 migrants in a “security house” in the city of San Fernando, in the border state of Tamaulipas. Eight months later, in April 2011, 193 bodies –also from migrants- turned up in 49 different clandestine mass graves in a nearby location. These two incidents came to be known as the “San Fernando massacre”, one of the most notorious events in Felipe Calderón’s deadly intensification of the drug war (2006-2012). We examine missing migrants as a population of cognition that is both made legible and (in)visible through specific technologies and delineations of crisis. We highlight the central role of knowing and not knowing in both the unspoken maintenance of political orders and the emerging spaces of contestation that characterize the Mexican borderlands. Our analysis of forensic genetics and human rights practices highlights the ways in which three population-making technologies (denuncias, biobanks and bodies) render genealogical, geographic, and political space visible, necessary, and encoded on the body. Informed by postwar human genetics practices, and embedded in informatics and database creation, genetic technologies emerge as tools of governance, as they are posited as capable of making visible the missing and dead in their relationship to

biological kin, through kinship analysis and family databases; in time and space through the documentation and discovery of “remains” across migration landscapes; and to the state through discourses of citizenship, recognition, and return. We suggest that forensic science plays a special role in the making of the missing, particularly as an increasingly contested force for both hegemonic and counter-hegemonic discourses about state responsibility and legitimacy.

Accessing prisoners’ bodies: Ethical and administrative challenges in making Brazil’s national DNA database

Vitor Richter (Nucleus of Citizenship Anthropology (NACi), Federal University of Rio Grande do Sul, Brazil, vsrichter@gmail.com)

In 2012, Brazil joined the large group of countries that store individuals’ genetic information in a national database for criminal investigations. The network composed by almost twenty states DNA databases, the largest installation of CODIS technology outside the Unites States, was introduced along appealing promises of facing pressing questions about high crime and low crime solving rates. After a quick legislative process and little public debate on this biotechnology’s legal frame, practical matters of its use started to draw forensic, legal and bioethical experts concerns. Among these concerns, Brazilian forensic experts highlight the collection of individuals inside prisons. In this paper, I’ll address the associations that brought forensic DNA databases to Brazil and the strategies that stakeholders put in place to perform one of its key efforts: the enterprise of collecting sentenced individual’s genetic samples inside Brazilian prisons. The challenges in accessing prisoners’ bodies highlight how technical and ethical aspects are intimate associated in framing the problems around DNA sampling inside prisons and strategies to conduct the sampling. Addressing these challenges faced by Brazilian forensic experts help us expand the understanding of how sociotechnical mediations involved in the stabilization of this biotechnology in Brazil situate practices of rights, citizenship, security policies and the subjects to whom it is directed.

INDIVIDUAL PAPERS SESSION – MINAS3

Medicine and Health Sciences: Philosophical Perspectives

Chair of the session: Megan Delehanty (Department of Philosophy, University of Calgary, Canada, mdelehan@ucalgary.ca)

Papers:

They tried to make me go to rehab

Sara Kolmes (Deparment of Philosophy, Georgetown University, USA, sk1719@georgetown.edu)

Standard treatment for alcoholism in the United States, which tends to focus on a combination of cognitive-behavioral therapy and 12-step programs with medical supervision of withdrawals, has been shown to have mediocre levels of success. This has motivated some thinkers to argue that a western medical paradigm is not appropriate for treating alcoholism. Mindfulness-based treatments for alcoholism informed by Buddhist psychology have shown promise in treating alcoholism. For this reason, treating alcoholism is an excellent test case for the broad project of incorporating non-western medical paradigms into medical treatment in the United States. However, mindfulness-based treatments for alcoholism involve taking a position toward substance withdrawals which precludes providing medication to those experiencing delirium tremens, a potentially fatal withdrawal from alcohol which western medical treatment is extremely successful at preventing from becoming fatal. It seems then that, even once we accept the assertion that non-western paradigms of medicine can suggest superior methods of ending addiction in patients, the work of determining how to treat patients with alcoholism is not done. We need to further investigate the relationship between these paradigms of medical treatment and their views of withdrawals before any useful changes can be made to our standard methods of treating alcoholism. One of three projects is necessary. Either an argument that western medicine has nothing to offer, a method for engaging several models of medicine simultaneously, or a model of how to determine what cases each model of medicine applies to must be developed. To advocate for the adoption of alternative paradigms of medicine therefore requires more work than advocates of mindfulness-based treatment for addiction have done. This work must be done by any advocates of incorporating non-western medical paradigms into standard medical treatment in the United States. More respect for the incompatibility and seriousness of the truth-claims that different medical paradigms make is needed to avoid the confusions that cases of disagreement between paradigms like delirium tremens raises.

Supervenient disease: The biological and the social in Medicine

Shane N. Glackin (EGENIS, the Centre for the Study of Life Sciences, University of Exeter, UK, shane.n.glackin@gmail.com)

Diseases, and the other phenomena with which medicine deals, are unquestionably biological in character. Whether one has leukaemia, then, or a fractured scaphoid, is as objective as anything else in biology is. Yet many theorists, myself included, regard the concept of "disease" as a socially constructed one, whose composition primarily reflects the values of particular societies at particular times. Whether any particular biological state that one is in constitutes a disease or not, on this view, is therefore relative to some evaluative framework.

How are these seemingly opposing views to be reconciled? Over the last half-century or so, analytically-minded philosophers have typically invoked supervenience to explain such relations; the status of disease, for a social constructivist, supervenes upon particular biological states just in case certain social or otherwise evaluative conditions are met. But social constructivists about disease have not, hitherto, spelled out this supervenience relation in anything approaching adequate detail.

In this talk, I offer a conceptual analysis of the disease concept centred on the supervenience relation between the biological states and social conditions in question. "Disease", I argue, supervenes on the relevant biological states if and only if those states meet two pairs of linked evaluative conditions: a biological state is judged to be a disease, on this view, just in case (a) it is not regarded as representing a tolerable state of affairs, but (b) nor is it regarded as representing a moral failing on the part of the individual affected; (c) it is not regarded as worthwhile or advisable to reorganise society so as to fully remove or neutralise the relative impairment caused by the condition, but (d) it is regarded as worthwhile to divert resources to "correct" and/or ameliorate it.

The account presented is silent on whose "regarding" is in question here; different individuals or societies may make different evaluative judgements about particular biological states at different times. But this only means that they disagree about which biological states are diseases; and if they can be mistaken in their evaluative judgements, they can also be mistaken in their judgements about diseases. Accordingly, I argue, social constructivists can escape the common objection that their view leads to relativism about disease; it entails relativism only if one also subscribes to a relativist meta-ethics, in which case relativism about disease will hardly be troubling.

Illness or identity?

Megan Delehanty (Department of Philosophy, University of Calgary, Canada, mdelehan@ucalgary.ca)

The social model of disability has allowed many conditions which the medical model would classify as an illness or disease to be understood simply as forms of difference, to be accepted and welcomed rather than cured. While the original focus was on physical conditions, there has recently been a greater amount of attention paid to conditions involving neurological impairments, most notably autism. An important component of the argument that these conditions ought not to be conceived of as disabilities is the existence and function of a community of individuals living with a particular condition. For example, many have argued that the Deaf community provides a distinct, rich culture, participation in which offers a benefit to deaf people. Similarly, it has argued that autism ought to be considered a social group or identity rather than a medical condition in part because of the development of an autism spectrum community and the claims of individuals with autism to value this identity. In this paper, I will examine more closely what is required of a community and an identity if they are to play this role in removing a diagnosis from the set of conditions seem as being in need of treatment. I will focus on what appears to be a relatively obvious counter-example to the claim that a social identity provides a benefit: the pro-anorexia community. Though it my initially seem obvious that the idea that anorexia should be accepted as a valued identity and not a severe mental illness whose sufferers ought sometimes to receive forcible treatment, I claim that it is not quite so straightforward. Treatment usually involves group therapy and/or support groups which offer at least some of the benefits claimed to be important in the Deaf and autism communities. So a more fine-grained analysis is required to identify just which elements of community are needed to ground the claim that a condition is not an illness or disability but a social identity.

INDIVIDUAL PAPERS SESSION – AG-BOT

Philosophy of Evolution V

Chair of the session: Ariel Jonathan Roffé (Universidad de Buenos Aires/ National Scientific and Technical Research Council (CONICET), Argentina, ariroffe@hotmail.com)

Papers:

Imprecise probability in evolution and mechanism

Marshall Abrams (Department of Philosophy, University of Alabama at Birmingham, USA, mabrams@uab.edu)

Probability assigns precise, real-valued probabilities to outcomes. By contrast, imprecise probability can be understood as associating with an outcome space a set of probability distributions. Each outcome then has a set of probabilities. Imprecise probability is usually discussed as an extension of Bayesian credence. I provide a new argument for the existence of objective imprecise probabilities--imprecise chances, generalizing arguments given by Fine and Strevens. I use my characterization of imprecise chance to argue that there may be imprecisely probabilistic activities in molecular biological mechanisms, and that natural selection may involve imprecise biological fitnesses.

Specifically, I argue that some outcomes are "erratic"--without objective probability--and explain how this fact supports imprecise chance when standard chance setups occur erratically. I then motivate the idea that there can be cases in which molecular mechanisms and biological environments have states that vary erratically. When these states themselves determine alternative probabilities for the same outcomes, these outcomes have imprecise probabilities.

The application of imprecise probability to fitness is particularly interesting. First, in simple cases where precise fitnesses would reasonably be modeled as expected numbers of offspring or as some other kind of expectation, a theory of imprecise fitness can draw upon ideas from imprecise decision theory. There are analogies between strategies recommended as rational for decision making given imprecise probabilities, and natural selection with imprecise fitness. However, natural selection places constraints that intuitions about rationality do not, and several imprecise decision strategies turn out to be irrelevant to evolution.

In certain simple cases of natural selection involving imprecise probabilities, fitnesses will be interval-valued, defined by minimum and maximum values for expectations. Then, for example, when trait A's minimum fitness value is greater than competing trait B's maximum fitness value, natural selection favors A over B. In some other cases, whether A or B is favored is indeterminate.

However, while decision theories are often thought to depend on expected outcomes, it's often been argued that fitness can't always defined in terms of expectations alone. As a result, generalizing imprecise fitness beyond the simplest cases requires development of ways of evaluating fitness differences that must go beyond ideas common in imprecise decision theory. In this talk I take first steps toward such extensions, drawing in part upon methods from imprecise Bayesian networks. Such methods may also be useful for understanding the impact of imprecise fitness on the functioning of mechanisms--for example, on when robustness to variation in entities' states can make probability-imprecision largely irrelevant.

Optimality models and the propensity interpretation of fitness

Ariel Jonathan Roffé (Universidad de Buenos Aires/ National Scientific and Technical Research Council (CONICET), Argentina, ariroffe@hotmail.com) and **Santiago Ginnobili** (Universidad de Buenos Aires/National University of Quilmes/National Scientific and Technical Research Council (CONICET), Argentina, santi75@gmail.com)

The aim of this presentation is to examine the nature of the relation between optimality models and the concept of fitness. More specifically, to scrutinize the role that the so-called "Propensity interpretation of fitness" ascribes to optimality models in evolutionary biology. According to this account, the concept of fitness can be thought of as a probabilistic one; the novelty comes, however, in the way that it proposes to interpret this mathematical concept. Indeed, it is not done frequentially (i.e. the probability of an event A is its relative frequency in an infinite number of experiments), as is usual in most applications of probability theory, but rather as a propensity (i.e. the probability of A is its propensity to take place). Propensities, as dispositions, explain relative frequencies in the long run, so they can be determined/operationalized/estimated throughthem, just as in the frequentist interpretation. The point is that these dispositional properties should also be operationalizable independently of frequencies, otherwise the propensity account would collapse, in practice, into the frequentist one. In the context of fitness as a propensity, this idea translates into the thesis that fitness values can be determined independently of actual reproductive success, via optimality models. So far, proponents of the propensity account have not specified exactly how these independent determinations actually work, but a plausible way is via the models' currency values. For example, many claim that acceptable currencies must be chosen as "proxies" or "substitutes" of fitness values. We will argue that, at least for an important subset of optimality models (those coming from Optimal foraging theory), currency values cannot be taken to be operationalizations of fitness values, and thus cannot be used as "proxies" for them. Additionally, we will hold that the relation between currencies (such as energetic efficiency) and fitness is empirical and not conceptual; that is, that it is also possible to connect a frequentist concept of fitness with ecological considerations through some empirical statement(s). Finally, we suggest that restrictions on acceptable currencies come from functional biology, not from evolutionary biology. We conclude that, if the propensity account cannot adequately capture all of these facts, then it loses some of its initial appeal.

THURSDAY JULY 20
15:30-17:00 – Parallel sessions 13

ORGANIZED SESSION DIVERSE FORMAT – AG-ZOO

Roundtable

History, Philosophy and Sociology of Ethnobiology: A Latin American Perspective

Orgs.: Francisco Vergara-Silva (National Autonomous University of Mexico (UNAM), Mexico, hpssbiolanthropol@gmail.com), Radamés Villagómez-Reséndiz (National Autonomous University of Mexico (UNAM), Mexico, scorphylum@gmail.com) and Tania González-Rivadeneyra (National Autonomous University of Mexico (UNAM), Mexico, taniaivanovagr@gmail.com)

Relationships between the biological sciences and other academic research areas are increasingly attracting the interest of specialists in the history, philosophy and social studies of science. However, the field known as ethnobiology –an interdisciplinary assemblage where ecology, sociocultural anthropology, taxonomy and other biological and anthropological research areas enter in dialogue– has been minimally dealt with at ISHPSSB meetings. In this session, we present initial steps toward an evaluation of the multifaceted historiographic, epistemological and sociological issues suggested by ethnobiology's breadth of subject matters. Given the complexity of the task, as well as our geographical location, this session emphasizes Latin American –especially Mexican– perspectives. At the same time, we intend to call the attention of other colleagues from our region and the rest of the world with both scientific and metascientific interests in the 'biology-culture' interface. We additionally look forward to establish ethnobiology as an interdisciplinary subject that could be investigated in the long term, from the local perspectives of ethnobiologists and historians, philosophers and sociologists of science working in diverse academic, geographical and political settings.

Chair of the session: Francisco Vergara-Silva (National Autonomous University of Mexico (UNAM), Mexico, hpssbiolanthropol@gmail.com)

Papers:

Mapping styles of ethnobiological thinking in Latin America: Two kinds of integration between biology and anthropology

Radamés Villagómez-Reséndiz (National Autonomous University of Mexico (UNAM), Mexico, scorphylum@gmail.com)

Ethnobiology constitutes an academic framework to test the degree to which the research /domains of the biological and the social sciences could become integrated. In Latin America, a group of prominent ethnobiologists currently promote a specific view of their academic field which states that such integration has been already achieved. From the standpoint of the history and philosophy of science, though, declarations of smooth interdisciplinary integration in ethnobiology obscure the fact that there is no unique –or privileged, for that matter– way to bring together the biological and the social in a single academic field. Here, I argue that far from being a unified discipline, ethnobiology in Latin America mainly involves two distinct versions of the integration between biological and anthropological concerns: (i) an eminently ecological perspective which deals with nature as a resource domain, emphasizing the use of statistical methods for its description, explanation and human management, and (ii) a predominantly relational view of 'the natural' and 'the human' as two interdependent spheres of being, with a stronger methodological compromise with ethnographic methods and a closer adherence to sociocultural theoretical conceptions. Instead of reinforcing dichotomies in Latin American ethnobiology, though, I intend to challenge fixed hierarchies and alleged hegemonies between these two conceptions. In this direction, I argue that the two stances in ethnobiology identified above could be understood as styles of reasoning that promote distinct research agendas, none of which could exhaust the breadth of the discipline.

The meaning and use of 'biocultural' in Latin American ethnobiology

Tania González-Rivadeneyra (National Autonomous University of Mexico (UNAM), Mexico, taniaivanovagr@gmail.com) and Arturo Argueta-Villamar (Regional Center of Multidisciplinary Investigations, National Autonomous University of Mexico (UNAM), Mexico, arguetav@unam.mx)

Many ethnobiologists and other life scientists state that the 'biocultural domain' arises from a rather simple, descriptive unification of whatever phenomena or processes are accounted for as interactions between 'nature' and 'culture'. The use of the term 'biocultural' has become more frequent and extended in recent years, not only in academia, but also in public spaces where multiple political stances from a diversity of human communities converge. In this work, we explore four aspects of fundamental importance for a discussion on the meaning of 'biocultural' in Latin America: (a) the origin of 'biocultural' as a concept in ethnobiology, (b) the peculiarities of the ethnobiological notion of 'biocultural' with respect to other disciplinary conceptions of the term, (c) the use of 'biocultural heritage', 'biocultural diversity' and 'biocultural landscape' as auxiliary concepts in ethnobiology, especially in Latin America, and (iv) the relations between local and global research contexts in ethnobiology where 'biocultural' and its derivatives play a salient role. Finally, we suggest ways to go beyond the use of 'biocultural' as an adjective, in order to construct a more nuanced, heuristic concept and clarify conditions for its use in ethnobiology, worldwide.

Centers, peripheries, and the historiography of ethnobiology: Eugene Hunn's periodization as a case study

Alfredo Sáynes-Vásquez (Postgraduate College (Montecillo), Mexico, pichossaynes@gmail.com)

Many life scientists have attempted to reconstruct the history of their own disciplines. Scholars in the history of science have pronounced themselves several times on those accounts, especially when they have dealt with ecology, molecular biology or paleontology. But in the case of ethnobiology –i.e. an investigation of the diversity of representations that different human groups have about organisms and their relationships with the environment– the profession has remained mostly silent. Given its inherent interdisciplinarity and currently multisituated character, ethnobiology would not seem to be a good candidate for schematic historic periodizations, nor would it appear to easily accommodate transitions between research traditions across relatively long periods of time and diverse geographical settings. Here, we critically analyze an account of the history of ethnobiology proposed by Eugene Hunn, an ethnobotanist from the United States of America specialized in plant classification systems used by culturally diverse groups mainly located in the North American subcontinent. Hunn's proposal is an "ethnobiology in four phases": it is organized in a sequence starting with a centuries-long 'utilitarian' era, which gave rise to a properly 'scientific' period (initiated in the 19th century) where a succession of three subsequent 'cognitive/linguistic', 'ecological', and 'collaborative' episodes (with the latter presumably characterizing the current state of the discipline) are distinguished. Bringing together diverse analytical resources from contemporary traditions in science studies, we identify mainly historiographic, but also epistemic, problems with Hunn's proposal. We also argue that addressing the peculiarities of Hunn's reconstruction of the history of ethnobiology inevitably demands confronting a series of political and ethical issues, where the distinction between 'centers' and 'peripheries' in the (global) contemporary network of knowledge production are crucial.

Panel discussion

ORGANIZED SESSION STANDARD TALKS – CD-A1
Nuclear Environments: Geography and Locality in Atomic Age Ecology and Environmental Research

Org.: Judy Johns Schloegel (Independent Scholar, USA, jjschloegel@comcast.net)

Chair of the session: Toshihiro Higuchi (Georgetown University, USA, th233@georgetown.edu)

Papers:

The nuclear sacrifice zone: Fallout, science information, and the American West

E. Jerry Jessee (University of Wisconsin Stevens Point, USA, jjessee@uwsp.edu)

If you look at a map of the continental United States depicting the various nuclear weapons production and testing sites, you would see that most of them are located in the American West. From the production of plutonium at Hanford Works in Washington State to the testing of atomic bombs in Nevada, the region has historically harbored some of the most toxic and risky nuclear industries anywhere in the world. Some, environmental activists as well as academics, have thus characterized this nuclearized western landscape as a "nuclear sacrifice zone," a region that the nation's leaders willingly sacrificed in the name of national security.

In this paper, I critically analyze this notion of the sacrifice of the Western environment by exploring how the scientific knowledge that underpinned scientists' (and thus the publics') understanding of radioactive risk changed through time, which I argue fundamentally shaped one's concept of sacrifice. I do so through a case study of the Western Montana Scientists Committee for Radiation Information (WMSCRI), an anti-nuclear scientific group who came into being toward the end of the atmospheric nuclear weapons testing period (1946-1963). Established by scientists at the University of Montana in Missoula, WMSCRI formed in the late 1950s in order to inform regional citizens of the long-term threat that lingering environmental radiation from nuclear testing fallout at the Nevada Test Site posed to their health. WMSCRI's focus on lasting ecological effects—especially on the contamination of agricultural products like wheat and milk—ran counter to the prevailing understanding of nuclear scientists who held that testing was safe because the risks from being exposed to fallout were fleeting, not unlike getting a routine chest x-ray. The efforts of WMSCRI to highlight the health effects of long-lived radiation in the environment helped to convince many westerners that the dangers of nuclear development in their region were neither straightforward nor merely risky. For many, the perceived benefits of winning the Cold War or generating economic development in the region through nuclear weapons production no longer seemed worth the risk. Nuclear development, in fact, appeared less like risk, and more like sacrifice.

The story of WMSCRI, I argue, not only offers historians a lens into the changing ways that the people within nuclearized environments came to understand nuclear risks. It also challenges historians to more fully historicize the scientific knowledge in which our claims about nuclear sacrifice zones so often depend.

A classical AEC boundary dispute: Thermal studies and the Great Lakes Research Program at Argonne National Laboratory in the 1970s

Judy Johns Schloegel (Independent Scholar, USA, jjschloegel@comcast.net)

Founded in 1946 from the University of Chicago's Manhattan Project-era Metallurgical Laboratory, Argonne National Laboratory developed in the post-war period as a large-scale multi-disciplinary research facility in the US Atomic Energy Commission's (AEC) national laboratory system. From its earliest days, environmental research was carried out at Argonne in the form of meteorological and environmental radiation measurement research associated with the Laboratory's initial role as the nation's center for nuclear reactor development. In the face of rapidly changing AEC priorities circa 1966, when multiple reactor research projects were cancelled, many reactor engineers and physicists sought new opportunities by refashioning their identities as environmental researchers. By the late 1960s, Argonne was an active hub for environmental research, resulting in the creation of the Center for Environmental Research in 1969, while other environmental research expanded and flourished in the Laboratory's Radiological Physics Division.

Two years later, however, Argonne's environmental research programs were significantly disrupted by the Calvert Cliffs' legal ruling that the 1969 National Environmental Policy Act (NEPA) be followed in good faith by the AEC. As the agency responsible for overseeing the safety of the rapidly growing US utility-owned nuclear power industry, the AEC was overwhelmed by its new regulatory responsibility. Argonne and two other national laboratories were tasked with preparing the NEPA-mandated Environmental Impact Statements (EIS) for the siting and building of the country's nuclear power facilities. Within a matter of days, Argonne personnel redirected into EIS work. While ongoing environmental research projects temporary languished due to reduced staffing, new funding associated with EIS work allowed for new hiring broadly in environment research work and new research questions emerged as Argonne researchers labored to fulfill the new regulatory requirements. Answers to these questions—focusing primarily on radioecology and the study of thermal effects, both associated with the release of cooling water from nuclear reactors—were pursued under the auspices of the Laboratory's thriving new Great Lakes Research Program.

This paper explores the multiples tensions that emerged as Argonne leaders sought ongoing financial support for the Great Lakes Research Program and its thermal pollution studies, in particular, within the context of competing and complex AEC priorities in the early 1970s. Regulation vs. research; physical vs. biological studies; site specific vs. general research conclusions; the prioritization of nuclear vs. non-nuclear forms of pollution—all emerged as tensions that threatened a highly productive and motivated Laboratory research program within the AEC context of the early 1970s. As will be considered, the question of locality, arising from the underlying concern of the siting of nuclear power plants, was at the core of these tensions and of the entire research enterprise.

ORGANIZED SESSION DIVERSE FORMAT – CD-A2

Multiple speakers session

Challenges and Opportunities of Data Integration (four talks and one brief commentary)

Org.: Sabina Leonelli (University of Exeter, UK, S.Leonelli@exeter.ac.uk)

How can data produced from different sources and through diverse techniques be integrated and visualized, what role does technology (in the form of experimental instruments, modeling software and digital databases) play in such efforts, and how do the challenges and opportunities offered by data integration affect the development and content of scientific knowledge claims? This symposium approaches these questions by bringing together philosophical studies grounded on the empirical examination of large-scale data integration practices within plant biology, biomedicine, environmental science and neuroscience. We discuss the epistemological challenges involved in bringing together diverse datasets pertaining to different phenomena, target systems and research environments, and in some cases collected on widely disparate materials across different locations around the globe. We place particular emphasis on documenting concerns relating to convoluted and non-linear methods of inference, sampling, modelling and data processing which are often employed in complex data integration exercises, with implications for the extent to which data can be triangulated, reproduced, reused and validated. We also consider the epistemic advantages involved in integration efforts, particularly the potential to cluster data in the absence of formal, unifying theories and related opportunities to bridge across diverging research perspectives and conceptions of science and its uses.

Chair of the session: James R Griesemer (Department of Philosophy; Science and Technology Studies Program, University of California, Davis, USA, jrgriesemer@ucdavis.edu)

Papers:

Studying plant traits across cultures: Data integration strategies in plant phenomics

Sabina Leonelli (University of Exeter, UK, S.Leonelli@exeter.ac.uk)

Within the last two decades, European plant science has increasingly sought to apply fundamental biological insights and new techniques developed through laboratory studies of popular model organisms such as Arabidopsis thaliana to research on crops. This move was accompanied by a growth in attention (and funding) to aspects which, although always central to the economy and research activities in developing countries, had not typically been central to plant science in the UK and Europe, such as efforts to (1)move research outside of the standard laboratory environment and into hybrid spaces (such as field stations, farm platforms and smart glasshouses) that are perceived to better capture some features of the 'natural environment'; (2) integrate agronomic research with 'basic' plant science, so as to harness cutting-edge insights into molecular mechanisms and related technologies to increase food security; (3) study plant species of economic and cultural interest to parts of the world other than Europe and the United States, such as cassava and bambara groundnut; (4) increase knowledge about gene-environment interactions, focusing particularly on phenotypic traits as conduits to understand the impact of genetic modifications and/or environmental changes on plant structures and behaviors; (5) produce 'global' infrastructures and venues where data, materials (such as germplasm) and knowledge about plant species used in different parts of the world can be shared and discussed. This paper will discuss the background and epistemic implications of this trend, focusing on the issues arising from attempts to share phenomic data about crops across different locations, and particularly between high-resourced and low-resourced research environments. My main case study will be the Crop Ontology, a digital infrastructure for the classification and dissemination of data about morphological traits that was developed in France over the last decade specifically to facilitate the sharing of information between plant scientists working in laboratories, experimental farms and plant stations in Europe, the United States, South America, Sub-Saharan

Africa and various Eastern countries (e.g. Malaysia and Thailand). The development of the Crop Ontology has been fraught with challenges relating both to the diversity of tools, terminologies and variables used to describe crops in different parts of the world, and to the differences in expectations, goals and working conditions among researchers and technicians involved in efforts of data collection.

The interaction of technique and data: Insights from neural microscopy
David J. Colaço (University of Pittsburgh, djc60@pitt.edu)

As a result of technical advancements in microscopy, researchers now have the ability to collect increasingly large and complex data sets related to neural systems. In this presentation, I investigate the interaction between the use of techniques and the collection of data in this cutting-edge research, and the driving roles data and technique play in research where a theory of the target system often has yet to be developed. I focus on the studies that have followed the introduction of the preparation technique CLARITY, which makes biological tissue transparent for the purposes of optical and fluorescent imaging. This technique allows researchers to view the structural relationships between neurons, and the findings from these studies provide knowledge of the neural 'mesoscale'. Mesoscale knowledge connects low-level findings from neurobiology and high-level findings from cognitive neuroscience, and thus is considered to be critical for integrating data from these fields. However, theorization of mesoscale biological systems is underdeveloped due to issues in investigating it. These issues are resolved by CLARITY. I discuss the function of this technique and its pairing with high throughput data collection instruments.

Some research that involves the application of CLARITY departs significantly from the schema of traditional, theory-driven research, as the cases involve exploration facilitated by techniques and data collection instruments. An example of this is a recent study on calcium-binding proteins in the dorsal root ganglia. At the time, these proteins "have been explored only to a limited extent and, so far, not at all at the spinal level" (Zhang et al. 2014). The researchers used the technique's function to characterize the project. The kinds of questions the researchers asked and the kinds of structures they looked for were determined by the functional role of CLARITY. They present no hypothesis that guided their research. To determine what would happen to the system under investigation, researchers appealed to theory about how CLARITY affects neural tissue.

In cases like these, there may be no theory of the system to be tested, and no well-formulated hypotheses to confirm. Instead, the function and theoretical background of the technique are used to characterize the findings, while analysis of the data draws upon data modeling strategies. I explore the differences of the roles of technique and data, to determine how the two complement one another in research that departs from a theory-driven paradigm. Further, I discuss ways in which the technique facilitates data integration from low-level and high-level neuroscientific research, as a long-term goal of this research is to develop a more complete theory of neural structure and function.

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Integrating data in Molecular Epidemiology: The case of exposome research

Stefano Canali (Institute for Philosophy, Leibniz University Hannover, Germany, stefano.canali@philos.uni-hannover.de)

In recent years, medicine has undergone a shift towards the use of molecular approaches (Boniolo and Nathan, 2016). In epidemiology, several research projects have recently started focusing on the molecular level to study the relation between environmental elements and disease. In particular, the 'molecularisation' of epidemiology has yielded a new view on exposure, the 'exposome'. Whilst epidemiologists have traditionally focused on the external level of exposure (i.e. presence of chemicals in the surrounding environment), the molecular approach and related technologies like OMICS allow to investigate the internal component of exposure, i.e. body's responses to environmental elements (Rappaport and Smith, 2010; Russo and Vineis, 2016). Hence, in exposome research, epidemiologists rely on an increasing set of evidence and data, concerning different elements of the environment and the body. All of this, in turn, has to be integrated for the study of disease.

In this paper, I offer an account of the different modes of integration involved in exposome research. To concretise my work, I focus on EXPOsOMICS (www.exposomicsproject.eu), which is one of the most important projects currently implementing the molecular approach in epidemiology and, on the basis of funding from the European Commission, aims at assessing risks related with exposure to air and water. EXPOsOMICS is presented by researchers as a novelty in the field, and this novelty is often related to the integration between new and different sources of data. For example, in a recent presentation of the project, Vineis et al. (2016) mention 'integration' and related terms 17 times. In particular, integrating different sources of data is considered a solution to the limitations of traditional studies on external exposure and on single chemicals fractions of the internal component of exposure. Discussing integration in exposome research allows me to engage with current scientific practice as well as existing philosophical literature on the life sciences.

I start by looking at the kind of integration which forms the background of the study. While this has not been studied in depth in the literature, I show how it plays a crucial role in actual research and can be seen in terms of explanatory integration (Mitchell and Dietrich, 2006). I then look more specifically at how data is used in exposome research studies. As for the external component of exposure, I suggest that methodological integration (O'Malley and Soyer, 2012: 61-62) is needed to use data collected through direct observations and model estimates. Concerning the way external exposure data is used in combination with internal exposure data, I underline how data integration is at work (O'Malley and Soyer, 2012: 61). In addition, I argue that, regarding different sorts of phenomena and being aimed at making comparisons, this mode of integration in exposome research may be considered akin to Leonelli's (2012) notion of cross-species data integration. Finally, I consider whether translational integration (Leonelli, 2013) can be considered part of exposome research and the kind of benefits (e.g. access to new datasets) and constraints (e.g. need to publish early results) this poses to research.

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Where health and environment meet: Geolocation as invariance mechanism for integrating diverse data sources

Niccolò Tempini (Exeter Centre for the Study of the Life Sciences, University of Exeter, UK, n.tempini@exeter.ac.uk)

This talk examines current efforts to disseminate, integrate, visualise and interpret large biological, biomedical and environmental datasets, on the basis of extensive historiographic and ethnographic engagement in the development of existing data infrastructures and their use to support scientific discovery (www.datastudies.eu). The use of “big data” to investigate complex real-world situations, such as the spread of infectious diseases or the impact of the built environment on human wellbeing, increasingly involves the integration of diverse datasets documenting a variety of environmental and climatic parameters as well as the health and biological characteristics of the organisms that inhabit such conditions. Such data are typically produced by different research groups, through different techniques and materials, with different goals, and in various time-scales and locations, resulting in potentially diverging data sources, objects, formats, assumptions, parameters, provenance, and methods of storage, dissemination and analysis. What makes it possible to bring together, compare and integrate such diverse data? To which extent does their integration require the articulation and assessment of the similarities and differences in the assumptions made when collecting and disseminating data? What roles do digital data infrastructures play in shaping the parameters, concepts and values through which data are visualized and interpreted? And how do inferential and extrapolation processes work, when researchers are confronted with data so diverse? This paper focuses on geolocation as one of the strategies used by data scientists to approach these complex epistemic issues.

Geolocation (or geo-mapping) constitutes a relatively unsophisticated approach to integration that appeals to what Shavit and Griesemer (2009, 2012) called "exogenous" notions of location. A potential implication of this move is to preclude any deeper amalgamation of the data and conceal significant variation in the conceptualization of location and the characteristics of organisms used by different research groups. Given these serious epistemic issues, the widespread use of this strategy across biomedical databases may appear surprising and misguided. At the same time, however, geolocation does function as an exploratory tool through which to obtain innovative insights on potential correlations among diverse datasets, which can serve as a starting point for further research or for comparisons among assumptions and methods used in data collection.

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INDIVIDUAL PAPERS SESSION – CD-A3

Philosophy of Evolution VI

Chair of the session: Roger Sansom (Department of Philosophy, Texas A & M University, USA, r-sansom@tamu.edu)

Papers:

Stranger in a strange land: A forecasting account of evolutionary mismatch

Rick Morris (Department of Philosophy, University of California, Davis, USA, jemorr@ucdavis.edu)

In evolutionary medicine, researchers characterize some negative health outcomes as mismatch problems. Roughly, mismatch problems are those problems which arise as the result of an organism (or population) living in an environment to which it is poorly-adapted, typically as the result of some rapid environmental change or migration. Obesity, myopia, breast cancer, and numerous other negative health outcomes have all been characterized as problems of evolutionary mismatch. Relatively little philosophical work has been done to define the concept of evolutionary mismatch, with the evolutionary medicine literature often relying on biological examples to do the heavy lifting. Resolving this vagueness is a necessary step in untangling the claims being made. In this paper, I develop what I call a "forecasting" account of evolutionary mismatch, arguing that the physiology of an organism forecasts an environment---which may differ from its actual environment. Thus, I treat mismatch as a relation between environments which affects the organism. My account builds on the hypothesis of Predictive Adaptive Responses (PARs, proposed in Gluckman et al 2005), which argues that during development, some organisms respond to cues from the environment which allow them to "predict" the sort of environment they will encounter in the future, and thus to modify some relatively plastic aspects of their phenotypes for increased fitness. In some cases, the organism will predict incorrectly. Those incorrect predictions, in turn, can have deleterious fitness consequences. The predicted environment and the actual environment are said to be mismatched. PARs do not cover cases of mismatch unrelated to phenotypic plasticity. In this paper, however, I propose that this prediction of the future environment can be extended to more typical cases of mismatch. It is true that many traits relevant to an organism's fitness are relatively non-plastic, and thus do not respond directly to environmental cues over the course of the life cycle. As the result of particular evolutionary histories of particular lineages in particular environments, however, the traits of an organism can be seen as predictions about the sort of environment the organism will encounter---an evolutionary forecast, in other words. Thus, even non-plastic traits are an evolutionary forecast of the sort of environments an organism will encounter. A discordance between an organism's forecast environment and an organism's current environment of sufficient significance to cause deleterious fitness effects is, I argue, an evolutionary mismatch. This proposal has several virtues: (1) it plausibly extends the use of a mismatch concept already in the literature rather than imposing an entirely new mismatch concept onto biology; (2) it directs our attention to possible targets of clinical intervention; (3) it correctly handles at least three paradigm cases of putative mismatch discussed in the literature (maternal nutritional stress, myopia, and scurvy). Although work remains to be done, my forecasting account of evolutionary mismatch provides a plausible analysis of a core concept in the evolutionary medicine literature (a concept which, as Lloyd et al 2011 argue, has implications for mainstream evolutionary biology.)

Why LaPlaceanism is no threat to evolutionary theory

Roger Sansom (Department of Philosophy, Texas A & M University, USA, r-sansom@tamu.edu)

Evolutionary theorists have repeatedly tried to defend the objectivity of evolutionary theory from LaPlacean attack. LaPlaceans contend that the only objective probabilities are those that are derived from complete micro-descriptions of the relevant states. Evolutionary theory is fundamentally probabilistic, but LaPlaceans expect evolutionary theory's probabilities to differ from those complete micro-probabilities, so find evolutionary theory to reflect our ignorance of the micro-details and to have merely subjective value. LaPlaceanism is founded on highly intuitive, but highly demanding, metaphysical principles. Some have tried to show that those metaphysical principles are poorly motivated (e.g. Putnam 1975, Wimsatt, 2007), but they appeal to pragmatic considerations that the LaPlacean denies are relevant. Elliot Sober (2010, 2011) recently tried to show that evolutionary theory can meet Laplacean standards, by attempting to derive evolutionary theory's probabilities from LaPlacean micro-probabilities. Peter Gildenhuys (2016) has shown why Sober's account fails. I will briefly show the best response to Gildenhuys that is available to Sober, but also why that response is unlikely to satisfy the LaPlacean. I shall criticize LaPlaceanism itself, by showing that its metaphysical principles lead to a version of Zeno's dichotomy paradox and why the standard resolution to the paradox is unavailable to the LaPlacean. This leaves a common type of LaPlacean probability undefined in a world such as ours (assuming that our best contemporary empirical theories are true). I shall identify the exact feature of our world that LaPlaceanism cannot account for. Not only does this make LaPlaceanism a failure in our world, but a failure as a philosophical position about objective probabilities generally. Accordingly, LaPlaceanism should be rejected and evolutionary theorists need no longer worry about LaPlacean arguments that evolutionary theory has only subjective value.

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INDIVIDUAL PAPERS SESSION – MINAS1

Cell and Molecular Biology: Philosophical Issues

Chair of the session: Stephan Guttinger (Egenis, the Centre for the Study of Life Sciences, University of Exeter, UK, s.guttinger@exeter.ac.uk)

Papers:

The Central Dogma, Quantum Theory and objective semantic information

Ravi Gomatam (Institute of Semantic Information Sciences and Technology, Mumbai, India, rgomatam@insist.ac.in)

It is significant that efforts to give an entirely physico-chemical account of DNA functioning in a living cell obliged the introduction of the idea of "information flow" as a separate category:

"Our present knowledge of protein synthesis could usefully be set out under three headings, each dealing with a flux: the flow of energy, the flow of matter, and the flow of information…I shall particularly emphasize the third-the flow of information." [Crick, 1958]

Watson too, wrote: “DNA → RNA → protein. The arrows [here] did not signify chemical transformations, but instead expressed the transfer of genetic information from the sequences of nucleotides in DNA molecules to the sequences of amino acids in proteins." [Crick 1968, emphasis added]

Crick [1958] called the idea of “flow of information” a “dogma”, because it was hypothesized to not have a physical basis within science (i.e., to not involve the flow of matter or energy). As a result, there is a continuing philosophical debate over whether ‘information’ in biology is just a name for what are ultimately physico-chemical interactions [Godfrey-Smith 2007]. Clearly, a new physical basis is needed to render information a true biological notion that is scientifically testable.

The emergence of ‘Quantum Information’ as a possible new physical ontology for quantum physics is relevant in this regard. But its definition is not yet in hand. I shall motivate a notion of “objective semantic information” (OSI) as a tenable, new conception of quantum information, and motivate a way to use it to apply the Schrodinger equation at the macroscopic level. Such an OSI at the macro level will be complementary to both current microscopic quantum mechanics and classical mechanics.

The potential implications of OSI and the proposed macroscopic quantum mechanics (MQM) for biology will be drawn out. At present, genetic information is restricted to protein synthesis, a molecular level process. OSI, being in the macroscopic regime, will not refer to atomic and molecular level processes. In this sense, we could treat biological information qua OSI to be complementary to present genetic information. This complementarity will clarify why biological information qua OSI will involve no matter flow or energy flow. Furthermore, being at the macroscopic level, OSI would be present and available everywhere in the cell, not just in the DNA. That will be also consistent with the holism that quantum theory entails. It can lead to a new, consistently semantic informational view of biological functioning at the macroscopic level. I will discuss what it would take to practically implement the envisaged macroscopic quantum physics and OSI within biology.

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When size matters: Lithium and what it means to be part of a cell
Stephan Guttinger (Egenis, the Centre for the Study of Life Sciences, University of Exeter, UK, s.guttinger@exeter.ac.uk)

When thinking about the nature of biological systems philosophers often turn to the natural sciences for information, drawing on knowledge about specific biological entities or processes. One set of entities that over the years has gained a lot of attention in philosophy of biology are the macromolecules, such as DNA, RNA and proteins.

This focus on macromolecules is certainly warranted, as they are powerful players in biological systems and scientists spend a lot of time investigating and talking about them. But macromolecules are not the only key parts of biological systems and – more importantly perhaps – they are a very specific type of player, both in terms of size and quantity (the biologist desperately trying to detect an RNA that is expressed at low levels might disagree with the latter claim).

The starting point of my talk is the thought that it might be interesting to move our gaze away from the 'macro' and focus instead on the smaller players within biological systems. The idea is that by looking at something small (both in terms of quality and quantity) it might be possible to derive new insights into what it means to be a functional part of a biological system.

The object of choice for this investigation will be lithium, which is both small and powerful: first, lithium is not only the smallest chemical element that is not a gas but it is also a 'trace element', i.e. an element that is only present in minute amounts in living systems. At the same time, lithium is an enormously powerful player within (and beyond) living systems. In fact, it is an element that can decide over life and death. In my talk I will review some of the data that supports this claim, from lithium's role as a mood stabiliser used in the treatment of bipolar disorder to the links drawn between lithium levels in drinking water and suicide rates. This investigation will also take us to the lithium-rich springs in Texas called 'Crazy Wells' and the Atacama desert in Chile, where lithium is being extracted as 'white petroleum'.

Such a broad look at lithium and its powers is necessary because only very little is known about its biological mechanism of action; we know lithium is powerful, but we don't really know why. An initial insight that emerges from this broad analysis is that the power of this allegedly well-defined chemical element lies much more in the processes it becomes part of rather than in its intrinsic properties. The discussion of lithium in its different roles will also show that defining 'its' biological properties is a task that can only be pursued if a thoroughly processual understanding of lithium is adopted. Building on these insights I will suggest that lithium, as part of a biological system, has to be understood as a process. I will end by commenting on the methodological consequences this suggestion could have and how it might extend to other biological parts.

INDIVIDUAL PAPERS SESSION – MINAS2

Teleology, Autonomy and Agency

Chair of the session: Bernard Feltz (Philosophy of Sciences and Societies Centre, Superior Institute of Philosophy, Catholic University of Louvain, Belgium, bernard.feltz@uclouvain.be)

Papers:

From self-organization to autonomy

Bernard Feltz (Philosophy of Sciences and Societies Centre, Superior Institute of Philosophy, Catholic University of Louvain, Belgium, bernard.feltz@uclouvain.be)

H. Atlan (1987) refers to Boolean automata networks to simulate the emergence of meaning in a deterministic context. In a more recent book (2011), he proposes to model intentional action in terms of neuronal networks. He finally proposes a global interpretation of human behavior from a Spinozist perspective: free will is completely illusory and linked to our ignorance of determinations.

In a non-deterministic context, G. Edelman (1987, 2007) refers to selectionist explanation to propose a concept of consciousness which is open to free will. Neuronal Group Selection Theory (NGST) proposes a mechanism of learning by trial and error where each behavior contributes to the stabilization of specific neuronal networks. Learning language thus implies a specific stabilization linked to each specific culture. For Edelman, language contributes to representation and conceptualization. That creates a distance between the human being and reality and produces the intentional stance. Human behavior takes place over a long term temporality. For Edelman, in this theoretical context, a certain form of free will can be envisaged.

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Reproduction and auto-production: Kant's idea of organism

Sérgio Izidoro de Souza (Department of Philosophy, University of São Paulo, Brazil, sergio.souza@usp.br)

Immanuel Kant conceived an idea of organism that reconciled the three main doctrines of the Modern Age, namely mechanicism, preformation and epigenesis. Our communication will be limited to exposing their union of theory of preformation with that of epigenesis, based on the concepts of reproduction and auto-production. My main argument is that this conciliation is made under a double teleological formulation of the concept of body: if the teleological cause are the parts to the whole then there is an auto-production; if the teleological cause is the whole (of the organic body) over its parts, then there is a reproduction. This method of solution of the contradiction between theories is common in Kant's philosophy since his first writing in 1747. His method consists in seeking for the extension and limit of each theory and to introduce the other theory into the blanks where the first does not reach out within the same object. According to this method epigenesis complements preformation, i. e. what the preformation doesn't explain the epigenesis does in the organism. In §81 of the *Critique of Judgment*, Kant states that the "system of epigenesis (...) may also be named the system of generic preformation." We will try to demonstrate this union between epigenesis and preformation to be already present in the Analytic of teleological judgment, where according to Kant, it is necessary to think about the organism beyond the mechanism. By that, organism as "natural end" means that its causality is not mechanistic but teleological. But the teleology that Kant employs to think about the organism is twofold: traditional teleology of the whole for the parts; and this new teleology from the parts to the whole, as self-organization. This new teleology arises from the need to naturalize the teleology, expressed in what Kant specifies as "product of nature" (*Naturprodukt*), whose formula is: "a thing exists as a natural end if it is cause and effect of itself". Here the idea of a "cause and effect of itself" is introduced to overcome the externality of the teleological cause (divine teleology). Therefore, it is needed to think about the expression "of itself" (*von sich selbst*) as an internal cause and not as a repetition or a reproduction, but as an auto-production. The example of the tree affirms Kant's statement that there is reproduction and auto-production in the species, individual and parts. The case of the auto-production of the parts is interesting because the example given by Kant is that of regeneration, which should normally be thought by the preformation and reproduction. But Kant thinks about it through epigenesis and auto-production because the part is being thought as the cause of the whole, and not the opposite, that's why he emphasizes that these parts are not identical before and can be even parts with "deformations" (*Mißgestalten*) after the regeneration, however they exercise the same function of preserving the whole. They are auto-produced because the whole is not their cause, but their effect.

Non-mental agency and life

Daniel Sander Hoffmann (State University of Rio Grande do Sul, Brazil, daniel-hoffmann@uergs.edu.br)

I believe that it is beyond dispute the fact that both Stuart Kauffman and Tyler Burge have advanced—starting from admittedly distinct perspectives and backgrounds—significant contributions to the historically important debate surrounding the notion of "agency." Kauffman is well-known for his formal concept of autonomous agents (itself surrounded by a bunch of related concepts), while Burge developed an original philosophical perspective around the idea of primitive agency. I submit that, even though these researchers have very different agendas, both would promptly agree, for instance, that *C. Elegans* or even the *Paramecium* are legitimate agents on their own (in a strong sense, so to speak). The same is true, I argue, of Brian Skyrms, but once again coming from a very different lane (e.g., when he is addressing biological signaling networks in bacteria, within the context of Lewis games). I would like to suggest here that an examination of the work of these authors neatly illustrates the rising academic interest in the development of a generalized approach to agency, concomitantly highlighting the harsh theoretical problems that lay ahead, entailed by such a diversity of methods and viewpoints. In this work, I survey and discuss the way agency is approached and understood by these authors (with emphasis in Kauffman´s ideas), arguing that all of them contemplate, in the end, a particular notion of what one may call "non-mental agency" (alternatively, "amental agency"), in the sense of agency not directly related to "mental representations"—more to the point, agency not even derived from neuronal information processing. I highlight the fact that these proposals do not fit straightforwardly, e.g., into the so-called "standard theories" of action (and of agency), to cite but one specific area of philosophical concern. I also defend the idea that, even though Skyrms and Burge have advanced important contributions to the debate, it is the work of Kauffman that offers a more encompassing and coherent approach to the problem at hand. Finally, I point out some potentially interesting contact points between Kauffman´s work and the insights of biosemioticians such as Kalevi Kull and Jesper Hoffmeyer.

INDIVIDUAL PAPERS SESSION – MINAS3
History of Biology I

Chair of the session: Olivier Perru (University of Lyon, France, olivier.perru@univ-lyon1.fr)

Papers:

Biological and social new orders: Charles Robin (1821-1885) and Comteanism in the Third Republic

Marion Constance Thomas (Sociétés, Acteurs, Gouvernement en Europe (SAGE)/Department of History of Life Sciences and Health (DHVS), University of Strasbourg, France, marion.thomas@unistra.fr)

In this paper, I examine the intertwined links between the science, politics and religion of a major figure of nineteenth-century French biology, the Parisian professor of histology Charles Robin (1821-1885). In the context of the development of cell theory, I show how Robin answered the questions of biological organization and biological individuality not only by applying the precepts of Comte's positive biology, but also by incorporating empirical and philosophical considerations. Like Comte, Robin was convinced of the necessity of anchoring the new science of sociology in biology, but, unlike Comte, no trace of a genuinely "socio-biological" approach can be found in his writings. Similarly, Robin's political activity (marked by his late tenure as senator) may initially appear disconnected from his scientific writings. However, I argue that Robin's approaches to different areas of knowledge (biology, sociology, politics, and metaphysics) were mutually authoritative, especially in the parallel structure of their discourses. Robin's radical materialism was the link between these different realms of knowledge, serving an alternative authority to which Robin appealed in his fight against clerical powers, and also as a way of departing from Comte's "religion of Humanity". Crucially, I seek to demonstrate how Robin's radical materialism expressed itself not only in his biological view of life (including "his" cell theory) but also in his anti-clericalism and Republicanism, which were just as much a part of his political engagement as his role as a senator. For instance, the materialism Robin promoted in his medical lectures incurred the wrath of the clerics, making him a political agitator during the Second Empire. Similarly, I show that Robin's support of secular, mixed, and mandatory schooling, a core tenet of Third Republic politics, tied in with his views on women's nature and on their role in society. Ultimately, I demonstrate that Robin's biological materialism, combined with his outspoken anti-clericalism, constitutes a political stance, and how the concept of "solidarity" helped him to cast a new light on the relations between the parts and the whole, both in biology and sociology.

Travelling olms: Local and global perspectives on the research on Proteus anguinus *(1700-1930)*

Johannes Mattes (Department of History, University of Vienna, Austria, johannes.mattes@univie.ac.at)

Firstly mentioned by Johann Valvasor in 1689, *Proteus anguinus anguinus*, also called "blind cave salamander" or "human fish" by locals because of its rose skin color, represents Europe's only cave-dwelling amphibian. In contrast to its restriction to approximately 200 localities in Slovenia and the surrounding Karst areas in Italy and Croatia, *Proteus anguinus* soon became a world-famous model for troglobites and attracted the attention of locals, visitors, and scholars.

After its first scientific description and illustration by Joseph Nicolaus Laurenti, who received an olm from the Idrija mine doctor and naturalist Giovanni Antonio Scopoli in 1768, *Proteus* began to "travel" through Europe both physically in small fish tanks as well as in the form of colorful illustrations, which aroused interest in this strange-looking animal. Locals shared their experiences with *Proteus* with travelers and learned mediators, who in turn corresponded with well-known naturalists like Carl von Schreibers, Georges Cuvier or Leopold Fitzinger. Living *Proteus* were sent as gifts to scholars, museums, and zoos or were offered for sale to travelers and merchants, who regularly passed through the Dinaric Karst on their way to the Adriatic Sea or Vienna. Some olms can even be traced to the home of naturalists, where they were closely observed and examined from a zoological and evolutionary point of view. Biological research stations, which conducted experiments on *Proteus'* sensory system and regressed eyes, were set up in Vienna and Postojna (Slovenia) at the beginning of the 20th century and thus encouraged the exchange of species and scientific concepts.

On the basis of a cultural-historical approach, the paper examines these long-distance networks, cycles of exchange and regimes of accumulation as a process of local and global knowledge circulation. Addressing global matters at local scales and vice versa, the paper serves as a contribution to the question of how local and global practices of exchange influenced knowledge production.

The Brothers of the Christian Schools and the botanical research at the beginning of the 20th century: Some examples of their works

Olivier Perru (University of Lyon, France, olivier.perru@univ-lyon1.fr)

Jean-Baptiste Caumeil, known as Brother Héribaud-Joseph (1841-1917), was a French Brother of the Christian Schools. He was the author of various works in Botany, including the Flora of Auvergne and the Muscinea of Auvergne, and made new discoveries in paleobotany, particularly concerning the fossil data on diatom taxa. In the years 1880-1900, several Brothers of the Christian Schools were botanists and they collaborated with Brother Heribaud-Joseph. In this communication, we shall synthesize the works of some of these Brothers who were in relationship with Brother Héribaud-Joseph and who had to leave France for South America during the abolition of congregations and public establishments of religion in France in 1904-1905. We shall particularly consider Brother Arsène Brouard's papers (known as Brother Gerfroy-Arsène, 1867-1938), in which he introduced a systematic study of the Mexican Flora. We shall also glance at Jean-Sylvestre Sauget's research (known as Brother Quadrat-Léon, 1871-1955), who explored the botanical resources in Cuba. In this paper, we try to understand the meaning of their research.

INDIVIDUAL PAPERS SESSION – AG-BOT
Evolutionary Psychology and Ethics

Chair of the session: Douglas Allchin (Minnesota Center for Philosophy of Science, University of Minnesota, USA, allch001@umn.edu)

Papers:

The naturalizing error

Douglas Allchin (Minnesota Center for Philosophy of Science, University of Minnesota, USA, allch001@umn.edu)

I extend the concept of error types in characterizing the naturalizing error: an appeal to nature as a self-justified description dictating or limiting our choices in moral, economic, political, and other social contexts. "That's the way nature is." "You can't argue with nature." "It's only natural." Such claims are common in everyday discourse, from gossip and social commentary to political grandstanding and academic arguments. They are presented, for example, to justify the virtues of a "Paleolithic" diet, the "natural" appropriateness of nuclear families, the evolutionary "inevitability" of male infidelity in relationships, and the "inherent" unhealthiness and dangers of genetically modified crops. In all these cases and others, normative cultural perspectives are subtly and subconsciously inscribed into purportedly neutral descriptions of nature, often with the apparent authority of science. Yet they are not fully warranted by a systematic or complete consideration of the evidence. The failures in evidence exhibit a significant pattern.

For example, Herbert Spencer's error was not, I claim, a lapse in ethical reasoning, as described by G.E. Moore in defining the naturalistic fallacy. Rather, Spencer's error was scientific. He imported cultural ideology about progress and social hierarchy into descriptive claims about evolution and the relationship of species: a prime example of the naturalizing error. A similar analysis leads me to recharacterize the core concerns of biological determinism as biological essentialism, an appeal to intuitive teleology.

The naturalizing error embodies familiar concerns about the social construction of science. Yet the sociologists' typically relativist (and nihilistic) posture is replaced with a more active philosophical stance that strives to analyze any epistemic weakness and seek a methodological solution. The aim is to transform any adverse aspect of "social constructivism" into identifiable error types that are then susceptible to remedy.

Finally, a cognitive analysis can help identify the psychological processes that contribute to these particular lapses in scientific reasoning, especially the frequent failure to notice them. By articulating this error type at a general level, one may hope to raise awareness of this pervasive error type and to facilitate critiques of claims that appeal to what is "natural" as inevitable or unchangeable.

What is a context in the cognitive psychology of reasoning?

Jonatan Garcia-Campos (Instituto of Social Sciences, Juárez University of the State of Durango, Mexico, jongarcam@yahoo.com.mx) and Saul Sarabia-Lopez (Juárez University of the State of Durango, Mexico, saulsarabia24@gmail.com)

The goal of this paper is to clarify how the notion of context can be understood in two theories of cognitive psychology of reasoning: evolutionary psychology and ecological rationality. These theories share the view that reasoning mechanisms were shaped by natural selection and, therefore, the relation between subjects and their environment is important to understand how human beings reason and how this ability depends on the context of reasoning. Even though the notion of context appears systematically in the evolutionary psychology and ecological rationality literature, we defend that this literature does not offer a clear description of what a context is. By focusing on the Wason selection task and the tasks that concern probabilistic judgment (particularly, the so-called conjunction problems), we shall argue in this paper that the notion of context can make reference to different ideas. Among those ideas we can identify: 1) the familiarity or lack of familiarity of the reasoning tasks (Cosmides and Tooby, 1992), 2) the format in which a problem is represented (Cosmides and Tooby, 1996), 3) the subject's perspective on the reasoning task (Cosmides y Tooby, 2004), 4) the nature of the logical connective (Fodor, 2000, Buller, 2005, Buller, Fodor and Crummer, 2005), and 5) the notion of environment (Gigerenzer, 1991, Gigerenzer and Sturm, 2012, Arnau et al. 2013). We shall show that these ways to conceive a context have some similarities, but it is far from clear that they could be identical or interchangeable. We shall defend that distinguishing between different ways to conceive what a context is can help us to understand how human beings reason and how they ought to do it from an evolutionary perspective.

The multiple embedded functions model: A conciliatory approach to functional/adaptive understanding based on multi-layered spatio-temporal structure

Marco Antonio Correa Varella (Department of Experimental Psychology, Institute of Psychology, University of São Paulo, São Paulo, Brazil, macvarella@gmail.com)

Functional/adaptive thinking fosters insights, discoveries and broadens understanding of biopsychosocial systems. However, the term 'function' has been used in many different ways, mostly unitarily or as if different uses were mutually exclusive. This has led to misunderstandings obstructing consilience and progress in behavioral sciences. The Multiple Embedded Functions Model addresses this problem by placing different functional explanations of life-history problem-solving into a coherent multi-layered structure. Within life-history, it aims to emphasize the multi-step causal chain of functional effects/beneficial consequences: from maintaining the body, through achieving social status, to finally contributing to reproductive success. The multi-layered structure varies spatially from intra-individual to population level and temporally from proximal to distal (evolutionary).

The multi-layered structure is represented in a matrix where the columns, from micro to macro, are the five spatial/problem-solving layers in each of which a different and non-overlapping functional explanation is placed: 1) the functioning of a psychological mechanism - what it does; 2) its intra-individual beneficial role - why it is good for the body, how it helps the maintenance of the body; 3) subjective personal intentions - why people say they do it, individual rationalizations; 4) socioecological beneficial roles - why is it good for social life, how it helps foraging, protecting and forming social alliances; 5) fitness beneficial roles - how does it help survival and foster reproduction. For example: our mating psychology 1) generates sexual desires, motivations, tactics and actions - our sex life; 2) our sex life helps the body by boosting immunity, improving sleep, circulatory health, and pain relief; 3) our sex life is also subjectively justified in terms of seeking pleasure, love/commitment, resource/status, or self-esteem, among others; 4) our sex life also helps socially by boosting interpersonal cohesion, bonding and conflict resolution; 5) our sex life also increases fitness by fostering direct reproduction. The temporal dimension of the multi-layered structure is in the table lines where the further down the bigger the time unity and the more to the past; the three main temporal layers are proximate (which includes current, chronobiological and ontogenetic levels), historical level, and distal (which includes recent ancestry and deep phylogenetic levels). Ancestral adaptive values thus result from past fitness-pathways in terms of all possible interrelated steps: organismal, socioecological, survival and reproductive beneficial-roles. Any current-level beneficial role could be different from the ontogenetic, historical or phylogenetic level for the same type of role. Therefore, the model presents a 5 x 6 matrix of non-exclusive interrelated functional explanations specified spatio-temporally which are applicable to any behavioral trait. Its heuristic value brings a conciliatory pluralistic and integrated framework to understand and illustrate functional/adaptive reasoning. Finally, by avoiding 'promiscuous anthropomorphism' this framework can help teachers visually clarify for students the organized complexity of functional attributions in classes of behavioral sciences/evolutionary psychology.
biology.

THURSDAY JULY 20

18:00-19:30 – **Awards ceremony and ISHPSSB general meeting**
20:00-23:00 – Conference dinner

FRIDAY JULY 21
09:00-10:30 – Parallel sessions 14

ORGANIZED SESSION DIVERSE FORMAT – AG-ZOO
Author Meets Critics
The Eugenic Mind Project

Org. and chair of the session: Rob Wilson (University of Alberta, Canada, rwilson.robert@gmail.com)

This session will provide an overview of Rob Wilson's recent book, *The Eugenic Mind Project* (MIT Press, 2017), with discussion by Katie Kendig, Alan Love and Judy Johns Schloegel, and a response by the author. The book enters an ongoing discussion amongst historians, philosophers, sociologists, medical professionals, bioethicists, biologists, psychologists, and disability activists and scholars about the eugenic past and its significance. The book has five central, novel themes: (i) the epistemic value and depth of the standpoints of eugenic survivors in understanding both the eugenic past and contemporary disability; (ii) the salience of intellectual or cognitive disability in our perception of, and reactions to, human variability and its significance; (iii) past and ongoing subhumanization of certain kinds of people in the name of eugenics and the introduction of a framework for understanding such dehumanization; (iv) an articulation of what the author calls the problem of marked variation and its role in making sense of eugenic reactions to those deemed sub-normal; (v) the conceptualization of eugenics as wrongful accusation and how this contributes to an account of the social mechanics of eugenics.

Discussants:
Katie Kendig (Michigan State University, USA, c.kendig@gmail.com)
Alan C. Love (Department of Philosophy, University of Minnesota, USA, aclove@umn.edu)
Judy Johns Schloegel (Independent Scholar, USA, jjschloegel@comcast.net)

Respondent:
Rob Wilson (University of Alberta, Canada, rwilson.robert@gmail.com)

ORGANIZED SESSION DIVERSE FORMAT – CD-A1

Four-papers session – Talks and discussion (two interrelated sessions)

Organisms and Us: Part I: Conceptual, Institutional, and Social Forces Shaping Organism Choice and Use

Org. and chair of the session: Rachel A. Ankeny (School of Humanities, University of Adelaide, Australia, rachel.ankeny@adelaide.edu.au)

How do researchers learn from and 'think with' non-human organisms? The list of organisms used for research purposes includes hundreds of species, from the ubiquitous fly and mouse to 'emerging' models such as tomato, honeybees, and jerboas. Through presentation of shorter length papers and allowance for cross-paper discussion, this two-part session explores historical, philosophical, and sociological accounts of choice, use, and development of a range of experimental organisms. Although historical scholarship on key experimental organisms is voluminous, it has tended to focus on classic or well-established organisms particularly as used in the Anglo–American context. In addition, limited research has been done which integrates historical, philosophical, and sociological approaches, or that pursues comparisons between projects focused on organisms or particular uses of organisms. This session aims to begin to address these gaps, and to foster dialogue that can support ongoing research on topics associated with how organisms are used to understand and reliably represent various phenomena, ranging from developmental, physiological, and genomic processes to communication and cognition. The papers also utilize a range of methods including more quantitative approaches and emphasis on science in practice, thus contributing to discussions on emerging techniques for doing history, philosophy, and social studies of biology. The first half of the session is focused on the conceptual, institutional, and social forces that shape organism choice and use, while the second half explores a series of more 'atypical' cases of organism choice and use as well as reflecting historically and philosophically on criteria relating to choice and use. The session has been sponsored in part through the Australian Research Council Discovery Project DP150102122 "Organisms and Us: How Living Things Help Us to Understand Our World."

Papers:

From Michurin fish to transgenic carp: Material legacies of socialist science in Chinese biotech

Lijing Jiang (Chemical Heritage Foundation, USA, Jiang.Lijing@gmail.com)

Largely due to the impacts of Lysenko's doctrines and the Cultural Revolution, genetics in China under Mao had been hindered from speedy development before the economic reform starting in the late 1970s. In the early years of the reform, a number of Chinese biologists visited North America for training in molecular biology. These programs usually used viruses, bacteria, or mice as models. Given the late development of molecular biology in China and the rare use of fish for transgenic work at the time, it may be surprising that in the 1980s, a few Chinese laboratories led research in genetic modification of fish. In the first issue of *The Journal of Applied Ichthyology* published in 1985, researchers at the *Institute of Hydrobiology of the Chinese Academy of Science*, Wuhan, reported the genetic integration and fast growth in the goldfish resulting from the injection of human growth hormone gene. In the early 1990s, the same group isolated carp-specific growth hormone gene and reported the first genetically modified carp with extra growth hormone copies in its DNA. How could the Wuhan group quickly develop the line of research on transgenic carp during the reform? I argue the long-term focus in improving carp aquaculture through an 'ideologically correct' science in Maoist China had formed its pivotal material and technical foundations.

Focusing on the local, historical, and transnational sources of material and technical components in the Wuhan laboratory's work led by Zhu Zuoyan, this paper analyzes the hybridity of origins that made the Chinese transgenic carp, which went far beyond a simple transfer of molecular biology into China. The crucial methods in preparing fish eggs and artificially reproducing carp, for example, were originally invented for earlier programs on studies of Michurinist biology and on boosting socialist aquaculture during the Great Leap Forward. The persistent focus on the carp, for some biologists, resulted from a state mobilization to make biology useful for socialist production. Before the 'reopening of China' during the reform, these earlier programs already produced a number of hybrid fish variants through nuclear transplantation and molecular injections. The transgenic fish program during the reform, which recently began to promote GMO carp for the market, should be seen as a continuation of earlier work in socialist China, though with newly gained narratives of scientific 'catch-up' and practices of state capitalism.

Of windows and worlds: Foundational concepts and their roles in the study of honeybee (A.M.) cognition

Dook Shepherd (Department of Philosophy, University of Adelaide, Australia, dook.shepherd@adelaide.edu.au)

Karl von Frisch's seminal work on honeybee communication has fascinated and inspired biologists, linguists, philosophers, ethologists, and cognitive scientists throughout a century (Munz 2016). In order to characterise, measure and explain honeybee recruitment and orientation strategies, Frisch operationalised a number of foundational concepts relevant to the cognitive sciences (eg. symbol, language, information, transformation), and his interpretations continue to inform much of the ethological, philosophical, and biological praxis in leading contemporary studies with bees today. For Frisch, the superior content in bee signals was unparalleled in the animal kingdom, and given our unprecedented access to some of that content, bees have come to be regarded as cognitive model organisms for the study and analysis of communication and its evolution (Frisch 1967; Dyer 2002). Situated within a broader multidisciplinary project which explores the relationships and understandings between model and human organisms, I will here take communication in bees as a well defined case study to analyse the use of these key cognitive concepts in scientific praxis and explanation. I analyse in depth those notions operationalised by Frisch, before turning to a discussion of their acceptance and use in contemporary bee research practice, grounded in both the literature and primary fieldwork with active researchers today. From these findings, I connect scientific use and understanding of these core notions with philosophical analysis in order to determine what we have gained via their application, if/how the concepts from each domain align, where our theoretical commitments rest, and the concrete biological processes we identify our theoretical concepts with. I conclude that our relationships with bees as cognitive model organisms provides a great opportunity for us to correlate our philosophical theories with concrete biological instances and test what coincides.

References:

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Why study sex by the sea? Marine organisms and the problem of fertilization and cell cleavage

Michael Dietrich (Department of Biological Sciences, Dartmouth College, USA, michael.dietrich@dartmouth.edu)

The process of fertilization and the first divisions of the resulting zygote are fundamental questions in developmental and cell biology. Attempts to answer these questions in the twentieth century have taken place almost exclusively at marine stations in the United States, Japan, Italy, and elsewhere. In this presentation, we unravel how marine stations and marine organisms became so closely associated with the scientific investigation of fertilization and cell cleavage. Using data from the General Embryological Information Service, we will describe the organismal landscape during the post-war period for everyone in the world studying fertilization and cleavage before focusing on particular choices of marine organisms. Given their role in the discovery and description of the acrosomal reaction during fertilization, we will concentrate on the scientific work of Katsuma and Jean Dan at Misaki Marine Biological Station in Japan and the Marine Biological Laboratory at Woods Hole, as well as the research of Arthur and Laura Colwin at the Marine Biological Laboratory. Rather than find the one right organism to investigate fertilization and cleavage, the Dans and the Colwins deliberately explored a suite of organisms. Their approach was intentionally comparative, but always limited to marine organisms.

Mapping institutional networks in Human and Animal Genomics: A bibliometric and 'Big Data' study, 1980–2015

Mark Tsun On Wong (Science, Technology and Innovation Studies, University of Edinburgh, UK, Tsun.On.Wong@ed.ac.uk)

The sequencing of genomes and its translation for medical advancements has been an important issue in biomedical research. The Human Genome Project exemplifies the vision that the majority of the biomedical community, as well as public and health institutions, endorsed in the 1990s and early 2000s: mapping and sequencing the entire genome would foster human health. This marks a significant shift in the history of modern biomedicine, not only for ‘us’ (humans), but also for the development of sequencing initiatives addressed to other species. This study aims to examine the actors and institutions which were involved in sequencing the human, pig and yeast genomes. Moreover, it highlights how the actors involved and the network between them may have changed over time. The dynamics and changes of the networks are compared across the three different genome projects. This involves understanding: i) the collaborations across institutions and different species; ii) identities of the key actors and their influence, and; iii) the funding structures of sequencing work in each genome.

The paper outlines the bibliometric approach developed by this study. It illustrates how the networks are mapped based on information from a major sequence database (European Nucleotide Archive) and literature and citation databases (European PubMed Central, Web of Science and SCOPUS). It also discusses techniques and challenges of working with ‘big data’ in this context. The study identified sequence submission records of the human genome from 1985 to 2005, the yeast (1980–2000), and the pig (1990–2015). The number of records ranged from 18,000 to 10 million. In addition, by developing an automated search process in programming language ‘R,’ it collected authors’ affiliation, citation, funding and submission information where available. This involved working with more than 3 million publications and bibliographic records. The paper therefore demonstrates the potential of combining digital research methods and social network analysis for research in the history of biological sciences. This helps address important questions regarding how the sequencing initiatives developed and evolved.

According to initial results, the genome initiatives went through significant transitions, particularly in the human strand. It began as a ‘bottom-up’ approach, which was characterized by decentralized efforts and involved diverse actors and institutions who conducted work on specific, small parts of the genome. In this approach, the medical use of sequence information was a major drive for sequencing efforts. However, from the 1990s onwards, a ‘top-down’ approach emerged and sequencing efforts became more centralized. There was an expansion of large-scale sequencing centers, which had advanced sequencing technologies and became key players in the field. The sequencing of the whole genome became the main agenda, regardless of the immediate medical usability of the collected information. The study provides a novel comparison among genomic initiatives of three species, and provides quantitative data to interrogate how close the developments of other initiatives are with the narrative of the human genome.

ORGANIZED SESSION STANDARD TALKS – CD-A2
Species in the Age of Discordance

Org. and chair of the session: Matt Haber (Department of Philosophy, University of Utah, USA, matt.haber@utah.edu)

Biological lineages move through time, space, and each other. As they do, they diversify, diverge, and grade away from and into one another. One result of this is genealogical discordance, i.e., the lineages of a biological entity may have different histories. We see this on many levels, from microbial networks, to holobionts, to population-level lineages.

The focus of this project is whether and how this and other sorts of biological discordance impacts our views on species. To promote a cross-disciplinary examination of this question, investigators from a variety of fields will participate in a series of interdisciplinary meetings. This includes researchers working on phylogenetics, microbiology, symbiosis, population genetics, taxonomy, philosophy, and history.

The ISHPSSB session will be the third of three meetings on this topic. It follows sessions at the University of Utah (March 2017) and the 2017 Evolution Meeting (Portland, OR).

Papers:

An anti-realist theory of reference for species names

Jerzy Brzozowski (Federal University of the South Frontier, Brazil, jerzyab@gmail.com)

The theme of this paper is at the intersection of two major philosophical problems – the question of reference in philosophy of language and the species problem in philosophy of biology. Here, I will propose an anti-realist theory of reference for the names of biological species. This anti-realist theory is intended as an alternative to the causal-historical stance towards species names, first put forward by Ghiselin and Hull in their defence of the species-as-individuals thesis. Recently, causal-historicism has revived its Kripkean essentialist roots with the work of so-called “new essentialist” philosophers such as Devitt, Ellis, LaPorte and Okasha. I argue that, in order for an essentialist causal-historical theory of reference to work, species should be constituted of strictly monophyletic lineages. But, to put things in terms of Haber's (2012) concept of multilevel lineages, as a matter of fact monophyly often fails to hold at several of the lineage levels that are part of any given species.

Thus, my anti-realist theory of reference for species names tries to take genealogical discordance into account, by construing species names as referring to the resultant of the sum of a criterion of application, provided by a formal code of nomenclature, and a criterion of identity, which is typically presented in the form of a species concept. However, a clear statement of the underlying species concept for any given phylogenetic study is not always available. This fact, I will argue, renders vacuous any attempt to apply the causal-historical theory to species names. In line with Dummett, the upshot is that knowledge of criteria of identity for species is a kind of practical knowledge that cannot be cashed into any sort of knowledge of biological essences. A species name is perhaps best understood as the name of a family of scientific models or hypotheses, each attempting to describe a certain aspect of the multilevel, often discordant, lineage that is the species itself. In conclusion, I suggest three applications of the FD account: in the discussion of polar and brown bear phylogenies, in the misidentification of type specimen example suggested by Haber (2012), and in the debate about the theory-ladenness of the PhyloCode.

Model reductions and competing paradigms in phylogenetic inference
Aleta Quinn (California Institute of Technology; National Museum of Natural History, USA, aletaquinn@gmail.com)

In this paper I analyze a contentious debate between proponents of coalescence methods and proponents of concatenation methods for phylogenetic inference. First, I clarify claims that phylogenetics can be reduced to genetics, and that concatenation can be reduced to coalescence. Concatenation can be mathematically reduced to a special case of the coalescent model by specifying parameters in the coalescent model to match empirical assumptions made by concatenation methods. Concatenation proponents claim that empirically realistic application of coalescent methods will amount to concatenation, but these claims have not been adequately supported. The shape of this debate reiterates earlier arguments that resulted in the mathematical reduction of parsimony to maximum likelihood. Proponents of concatenation appeal to many of the same philosophical claims that were used to justify parsimony, while coalescence models are a natural extension of the maximum likelihood framework. In light of the historical development of methods of phylogenetic inference, these debates can be interpreted as conflict points between competing paradigms. The asymmetry in arguments about reduction suggests that concatenation (an outgrowth of "total evidence") is a paradigm in decline.

Individual essence and species form: a lesson from polymorphic rust fungi

Dan Molter (Department of Philosophy, University of Utah, USA, dan.molter@utah.edu)

Kind essentialism, in which species are construed as classes defined by membership conditions that are severally necessary and jointly sufficient, is untenable in light of evolution, as the forms of organisms in an evolving species change from generation to generation. If species are individual evolving lineages, then they are not kinds that share an essential form. But might a species-level lineage have an individual essence, rather than a kind essence, a species form, that if lost in future generations would make the lineage a different species, much like reshaping a clay statue makes for a new statue? An example from rust fungi shows that species forms are not instantiated in any one organism, but are instead spread out over multiple organisms in different places and times. Like a chain composed of differently shaped links, a typical rust fungus lineage exhibits five alternating life cycle stages, such that no one rust fungus thallus instantiates the entire species form. While most rust fungus species exhibit five forms, some rusts have evolved simplified life cycles that include only two alternating forms. Mycologists consider two-stage rusts to be distinct species from their five-stage parents, the radical alteration to life cycle, and thus to form, being sufficient for speciation. While it is not possible to give necessary and sufficient conditions for a species, aspects of morphology such as lifecycle stages seem to be necessary for species identity, and thus partially constitute a species' essence.

ORGANIZED SESSION STANDARD TALKS – CD-A3
Methodology in Non-primate Cognition

Org.: Shereen Chang (Department of Philosophy, University of Pennsylvania, USA, shereenc@sas.upenn.edu)

Much work in comparative cognition focuses on comparing humans to great apes or other primates. This session investigates different ways to think about how human and non-primate cognition relate. What lessons can we learn from human cognition to illuminate issues in non-primate cognition and vice versa?

Shereen Chang considers how to justify analogical inferences about the cognitive mechanisms of parrots who exhibit communicative behaviour similar to that of humans. Chang argues that a causal isomorphism approach that analyzes functional components can provide justification for a functional equivalence claim and provide guidance about the kinds of causal factors that may be relevant and worthy of further scientific investigation.

Sidney Diamante shows how the sophisticated behavioural repertoire of the octopus arises from a form of cognition that represents a major departure from "traditional" cognitive science. The octopus's nervous system is functionally decentralized, with peripheral components that are embodied and dynamical, rather than representational and computational. Diamante argues that octopus cognition serves as "evolved empirical proof for the heterogeneity of cognition."

Ivan Gonzalez-Cabrera, Dairon Rodriguez, and Christoph Völter's paper provides a new empirical framework that "facilitates the integration of psychological and neurocomputational research in nonhuman animals". They argue that non-linguistic animals can represent causal relations in cognitively rich ways that are compositional, belief-like and counterfactually structured.

Chair of the session: Joyce Havstad (Philosophy Department, Oakland University, USA, jhavstad@oakland.edu)

Papers:

Reasoning by analogy from the cognition of humans to parrots

Shereen Chang (Department of Philosophy, University of Pennsylvania, USA, shereenc@sas.upenn.edu)

How do we justify analogical inferences about the cognitive capacities of animals who behave similarly to humans? Consider Alex the grey parrot, who was trained by Irene Pepperberg to use certain

English words appropriately. Presented with an array of different objects, Alex could vocalize in English the correct answers to questions such as "How many green blocks?" Given a parrot who can understand spoken English words, on what basis might we infer that the cognitive mechanisms involved in his behaviour are similar to those in analogous human behaviour? When direct evidence is not available, we might try to impute similar mental mechanisms for similar behaviours on the basis of analogical inference. Two plausible proposed justifications for such inferences include Elliott Sober's justification from a common cause and Sandra Mitchell's justification from causal isomorphism. On Sober's common cause view, if two individuals have behaviours that are inherited from a common ancestor, then we can infer that they share underlying mental mechanisms. In Mitchell's view, if the functional components of both causal systems correspond, then we can infer that the underlying mechanisms are similar. Both approaches give similar results in intraspecific inferences, but work differently in interspecific inferences, especially between species that are phylogenetically distant, as in the human-to-parrot case. On my analysis, Mitchell's approach might justify a claim that the parrot's cognitive mechanisms are functionally equivalent to that of humans and provide useful guidance about the kinds of causal factors that may be relevant and worthy of further scientific investigation. In this way, we can use insights about human cognition to guide research about the mechanisms at work in the cognition of animals that we do not understand as well. In cases of less-studied animals, we may need to employ a hybrid approach that integrates reasoning about phylogeny and causal factors.

The octopus and Cognitive Science

Sidney Diamante (University of Auckland, New Zealand, sdia185@aucklanduni.ac.nz)

What special interest does the octopus hold for cognitive science? To begin with, the sophisticated behavioural repertoire of the octopus—which is comparable to that of vertebrates—is unexpected, given the functional decentralization of its nervous system. It also challenges received views on motor control. Proprioception and somatotopy (point-for-point mapping of the body), internal mechanisms that facilitate motor control, are significantly downplayed in the octopus nervous system—which is astonishing considering the unbounded flexibility afforded by its soft body. Instead, motor control in the octopus is the outcome of a unique division of neural labour between the brain and the peripheral nervous system.

As though these neuropsychological features of the octopus were not fascinating enough, the very nature of octopus cognition is itself a treasure trove. Not only is octopus cognition resistant to straightforward explanation by familiar, vertebrate-based models of cognition, but it also instantiates three of the major departures from "traditional" cognitive science. First, the cognitive architecture of the octopus is characterized by extensive decentralization, with the bulk of sensorimotor processing and control operations relegated to the periphery. This stands in contrast to centralized control models advocated by traditional cognitive science. Second, these peripheral components of cognition—which take place within the nervous system of the arms—are embodied and dynamical, rather than representational and computational. Finally, octopus cognition as a whole is comprised of non-redundant, distinct components that come in dissimilar formats, serving as evolved empirical proof for the heterogeneity of cognition.

INDIVIDUAL PAPERS SESSION – MINAS1
History of Biology II

Chair of the session: João Felipe Ginefra Toni (Department of Botany, University of Basel, Switzerland and Institute of Contextual Science at Goetheanum, Switzerland, ipegtoni@gmail.com)

Papers:

Henry of Ghent and the two-headed monster: A casuistry of the extremes of life

Gustavo Barreto Vilhena de Paiva (Department of Philosophy, University of São Paulo, Brazil, gustavo.barreto.paiva@usp.br)

According to Foucault (1995), since the Middle Ages until more recent times 'human monsters' ('monstre humain') were seem as troublesome elements for society not only because they seemed to violate natural laws, but also because it seemed hard to fit them in normal juridical regulations. One such consideration can be found in the works of Henry of Ghent (a. 1240-1293), a late 13th-century master of theology at the University of Paris. In his "Quodlibet" 6, questions 14-15 (from 1281-2 – cf. LAARMANN, 1999), he asks [i] "whether, if two heads appear in a monster [in monstro], two names or one should be imposed upon him during baptism" and [ii] "whether, if two heads appear in a monster and if the priest says 'I baptize you', both or only one of them is baptized" (ed. WILSON, 1987). In both questions the problem is clearly practical: one is not interested in understanding natural difficulties posed by such monster, but rather how it should be dealt with in Christian religion and practices. As Henry puts it, it is asked "whether such monster is a person with one soul, who should be given one name, or two [persons], who should be given two names, since names must be in agreement with things" (cf. LIBERA, 2008). Here it is noticeable how a physical problem (the natural formation of monsters, described in the text as a result of flaws in the process of insemination and pregnancy) can bring about the discussion of an ethical problem, namely the philosophical characterization of a 'person' ('persona') as someone able to participate in religious and juridical (according to Canon Law) practices. The discussion about an extreme case of life – here, the two-headed human monster – and the possibility of its being able to participate as a person in religious and juridical affairs leads to the consideration of the normal characteristics of a person. Thus, departing from an extreme case of human life (on this kind of casuistry in the 13th century philosophy, cf. BOUREAU, 1992), Henry of Ghent ends up establishing precisely some of its normal characteristics. Following Canguilhem (e.g., 1965), we may say that here too the pathological and the monstrous emerge as part of the description of the normal human being. Here I analyze some excerpts of Henry of Ghent's "Quodl". 6, qq. 14-15, from this point of view.

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João Felipe Ginefra Toni (Department of Botany, University of Basel, Switzerland and Institute of Contextual Science at Goetheanum, Switzerland, ipegtoni@gmail.com) and Ruth Richter (Institute of Contextual Science at Goetheanum, Switzerland, ruth.richter@goetheanum.ch)

In the context of evolutionary developmental biology and phylogenetic research, where development and generative processes of organismal form are taken on board, the Goethean motto: Form (μορφή) as Formation (*Bildung*) and Transformation (*Umbildung*) provides morphology with a new meaning. The seminal research program that Goethe conceived under the rubric of Morphology does not include development, rather it is the science of development itself. It has become a keyword among contemporary biologists proclaiming its renaissance in our understanding of evolution. Consequently, it is also not surprising that Goethe has been cited by many plant developmental geneticists, due to a number of findings that could possibly, by way of molecular models and experimental tests, corroborate the foreseen ideas in his essay *An attempt to explain the metamorphosis of plants* published in 1790.

Moreover, the Goethean concept of *Bildung* carries in its core an educational aspect, which invites the morphologist to engage, develop and evolve her/his cognitive capacities in a peculiar kind of process one could call Participation. Goethe himself proposed in one of his *Maxims and Reflections,* a Delicate Empiricism connecting with the conceptual content of a phenomenon. Thus, morphology is a participative science, in so far as it provides the possibility of recognizing the intrinsic correlation between mind and form. Therefore it is simultaneously a Morphology of Human Knowledge.

Beside celebrating the 200 years of the publication of Goethe's *morphological notebooks, Zur Naturwissenschaft überhaupt, besonders zur Morphologie* (On Natural Science in general, Morphology in particular), the aim of the paper is firstly to trace back Goethe’s inceptions of the original dynamic way of seeing by revisiting the conceptual and empirical foundations of his morphology; secondly to prospect for its place and role in contemporary research and education in biology, and finally to point out its ethical implications in questions of environmental and ecological public awareness.

A structuralist analysis of Mendel’s two hybridist theories and of their intertheoretical relationships

Pablo Lorenzano (Center of Studies in Philosophy and History of Science, National University of Quilmes/National Scientific and Technical Research Council (CONICET), Argentina, pablo.lorenzano@gmail.com)

The main problem Mendel faced and tried to solve was possibly that of "hybridism" ("can new species be originated by means of hybridization of preexisting species?") and not of inheritance. Based on a statistical analysis of his experiments, and seeking a "generally applicable law governing the formation and development of hybrids" (Mendel 1865: 3), Mendel states "the law of development/evolution found for Pisum" (p. 32), which decomposes in "the law of simple combination of characters" (p. 32) and in "the law of combination of different characters" (p. 32). But neither of them is identical to the laws usually attributed to him. Mendel's laws are formulated in terms of characters, not of "factors" or "genes". But, when Mendel tries to provide the "foundation and explanation" (Mendel 1865: 32) of the law of formation and development of hybrids, he does it in terms of the production and behavior of egg cells and pollen cells, and, ultimately, in terms of the nature and behavior of what he calls "elements" (p. 41) or "cell elements" (p. 42). However, Mendel's concept of cell element is different from Classical Genetics' concept of factor or gen. Mendel's elements are of a different nature of, and behave in a different way as, factors, alleles or genes. Furthermore, Mendel recognizes the existence not just of hybrids that behave like those of *Pisum* – i.e. of "variable hybrids" – but also of hybrids that "remain perfectly like the hybrid and continue constant in their offspring" (Mendel 1865: 38) and "acquire the status of new species" (p. 40). Thus, Mendel supports "hybridism (in the narrow sense)", i.e. hybridism understood as establishing a mechanism of speciation, that is, of evolution.

For all these reasons, it can hardly be said that Mendel had been a proponent, even less the first proponent, of Genetics. He was actually an excellent "hybridist". His hybridism consists of two theories: a first theory that moves on a level more "empirical" or "phenomenological" (according to Schleiden 1849: 141-146), which can be called "Mendel's theory of the development/evolution of hybrids" (DEH), and a second theory that moves on a level more "theoretical" (according to Schleiden 1849: 146-148), which can be called "Mendel's theory on the cellular foundation of the development/evolution of hybrids" (CFH).

The aim of this communication is to present an analysis of these two theories and of their intertheoretical relationships, carried out within the framework of the so-called Metatheoretical Structuralism (Balzer, Moulines & Sneed 1987).

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INDIVIDUAL PAPERS SESSION – MINAS2

General Epistemology and Biology II

Chair of the session: Gustavo Caponi (Department of Philosophy, Federal University of Santa Catarina, Brazil, gustavoandrescaponi@gmail.com)

Papers:

Characterizing and evaluating a rationalist approach to biology

Yoshinari Yoshida (Department of Philosophy, University of Minnesota, USA, yoshi077@umn.edu)

Rationalism in epistemology is the view that we can obtain knowledge or concepts without appealing to sense experience. Many philosophers have been interested in whether some form of rationalism is true in mathematics or physics, i.e., whether we can know some fact or construct a formal system in these domains without appealing to empirical knowledge. Although there seems to be little room in the biological sciences for a strict rationalism (as defined above), I argue that we can characterize a rationalist approach that is applicable to various fields of science, including biology. A rationalist approach seeks to formulate a theory, model, or hypothesis mainly by reasoning based on some premise or set of premises (hereafter, a "basis") derived from another field, not by direct investigation of the objects of study. A process of theorizing, model construction or hypothesizing is considered rationalist relative to a designated basis. For example, a rationalist approach to theoretical physics might appeal to a basis from metaphysical necessity; a rationalist approach to molecular biology might take particular physical or chemical properties as a basis. In addition to characterizing what a rationalist approach consists in, it is also important to evaluate when it is warranted. There are both successful and unsuccessful cases of rationalist approaches in the history of science and sometimes we observe direct conflicts between rationalist and empiricist approaches in contemporary biology. Under what conditions is a rationalist approach likely to succeed (or fail)? I use two examples from the history of biology (one successful, one unsuccessful) to explore conditions relevant for adopting a rationalist approach in biology: (1) the development and refinement of generic reaction-diffusion models to help explain pattern formation in living systems, and (2) early attempts to crack the genetic code based on mathematical considerations, which ultimately failed where biochemical studies succeeded. In light of these examples, I discuss whether rationalist and empiricist approaches should be viewed as competing or complementary and how they might be integrated fruitfully in specific cases.

The logic of simulation

Rafael Ventura (Department of Philosophy, Duke University, USA, rhtventura@gmail.com)

In this paper, I argue that simulation studies in phylogenetics militate against constructive empiricism. The argument is best stated in the form of a reductio. Assume first that constructive empiricism is correct: the aim of science is empirical adequacy. To choose between theories, the constructive empiricist chooses the theory that best predicts the data. For example, consider theories T1 and T2. Both predict the occurrence of the same events: e1 and e2. Now suppose T1 says that the probability of e1 is higher than that of e2, and that T2 says e2 is more likely than e1. If e1 is observed, then T1 is more empirically adequate than T2.

Maximum-likelihood methods in phylogenetics seem to provide the perfect grist for the constructive empiricist's mill. Constructive empiricism requires us to select the theory that maximizes the probability of the data. And this is what maximum-likelihood methods are designed to do. In phylogenetics, maximum-likelihood methods find the parameters of the evolutionary process that maximize the probability of the data. That is, maximum-likelihood methods select the hypothesis that is most empirically adequate.

Consider now simulation studies. Simulations generate data under known conditions. Inference methods are then applied to the data in an attempt to recover the conditions used in the simulation. It is known how the data were generated, so it is possible to assess how reliable inference methods are in selecting true hypotheses about the conditions under which the data were generated. The purpose of simulations is thus to assess the reliability of inference methods.

In simulation studies, the parameters of the evolutionary process are observable since whoever is running the simulation specifies them. Obviously, no inference method is required when parameters are directly observable. The purpose of simulation studies is thus not to assess the reliability of inference methods in the artificial environment created by a computer simulation. The goal of simulation studies is to estimate the reliability of inference methods in the real world, where parameters are not observable.

This means, however, that simulations are necessary only when they are immaterial to constructive empiricism. When it comes to the unobservable, the constructive empiricist takes no interest in reliability. The debate on reliability is sparse and usually framed in terms of the reliability of belief-forming process. But the emerging consensus is that a process is reliable if it delivers beliefs that are likely to be true on the basis of the available evidence. Given that simulation studies assess the reliability of inference methods when parameters are unobservable, the purpose of simulation studies is to assess whether phylogenetic methods are conducive to truth about the unobservable.

Yet, the constructive empiricist withholds judgment about the unobservable. So the constructive empiricist cannot justify simulation studies in phylogenetics. My conclusion is thus that either constructive empiricism is false, or else that simulation studies cannot be justified. To dismiss simulation studies as unjustified is too stark a departure from scientific practice. So rejecting constructive empiricism is the only feasible option.

The Biolinguistic enterprise: A case in epistemological anarchism?

Paulo Jeferson Pilar Araújo (Comunication, Letters and Arts Center, Federal University of Roraima, Brazil, paulo.pilar@ufrr.br)

From Lenneberg's masterpiece "Biological Foundations of Language" (1967) to the version of Biolinguistics advocated by Chomsky and followers (Di Sciullo & Boeckx, 2011), linguists have used biological models to address some theoretical issues, notably those related to the question of the innate nature of the human capacity for language. In the past decades, besides the Biolinguistic Enterprise, some other scholars have appropriated biological models, especially evolutionary ones, to approach specific theories of language emergence and change (McMahon & McMahon, 2012). Considering the evolution of those disciplines one should ask: when did Linguistics become biological, and how? In this paper, I analyze the epistemological relations between Linguistics and Biology from a Feyerabendian view of science, following the epistemological anarchist view on the development of science (Feyerabend 1975). I argue that the attempts of doing Linguistics as biology, or in other words, Biolinguistics, have an anarchic epistemological ground, even though those interested in the intersection of Biology and Linguistics assume a Lakatosian conception of science. In order to verify that Biolinguistics is a case of epistemological anarchism, I defend the thesis that even though the researchers of the Biolinguistic Enterprise defend a Lakatosian perspective of science in their research program, maintaining the hardcore assumptions of the Chomskyan generative linguistics, the field of Biolinguistics is anarchic in essence. As a result of that Lakatosian idealization of Biolinguistics, I hypothesize that not assuming Biolinguistis as anarchic in nature could be one of the reasons why the intersection between Biology and Linguistics has not been as pluralistic as it could be, according to a Feyerabendian perspective. Accepting that Biolinguistics is a case of epistemological anarchism would help linguists and biologists to work in a more efficient partnership seeking a real transdisciplinary enterprise.

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INDIVIDUAL PAPERS SESSION – MINAS3

Genetic Drift: Theoretical and Philosophical Perspectives

Chair of the session: Cristian Saborido (Department of Logic, History and Philosophy of Science, National University of Distance Education (UNED), Spain, cristian.saborido@fsof.uned.es)

Papers:

Interpreting drift physically

Pierrick Bourrat (Department of Philosophy, Macquarie University, Sydney, Australia, p.bourrat@gmail.com)

Genetic Drift is often characterized in statistical terms as resulting from deviations from expected reproductive outputs or expected fitness. Yet a purely statistical notion of drift cannot be satisfactory if one aims at distinguishing two or more distinct types of causal processes that can lead to the very same evolutionary outcome. With this aim in mind, it thus seems desirable to have a concept of drift in which deviations from expected values are explained physically rather than assumed as mathematical/statistical truths.

I this paper, I start by presenting Godfrey-Smith's (2009) framework for drift, which permits to conceptualize drift physically rather than statistically. More particularly, I present his view that drift results, on the one hand, from differences in reproductive output due to differences in extrinsic properties as opposed to difference in intrinsic properties (which, under this view, should be attributed to natural selection), and on the other hand from the population exhibiting what Godfrey-Smith calls a 'low continuity'. In the second part, I demonstrate that although it is on the right track, this framework is problematic for a number of reasons. Starting from Godfrey-Smith's framework, I expose my own physical account of drift. In the last part, I respond to some objections one might have with my framework. This leads me to show that under some particular conditions I briefly describe, my view is compatible with a new objective interpretation of probability in deterministic setups. I call this interpretation "natural-range interpretation of probability", following Rosenthal (2010).

References:

Godfrey-Smith, P. 2009. *Darwinian populations and natural selection*. Oxford: Oxford University Press.

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On genetic drift as an evolutionary force

Ariel Jonathan Roffé (Universidad de Buenos Aires/ National Scientific and Technical Research Council (CONICET), Argentina, ariroffe@hotmail.com)

In 1984, Elliott Sober posited an analogy between classical mechanics and evolutionary theory, according to which both theories have similar explanatory structures. That is, they would both explain their respective phenomena via a zero-force law (the principle of inertia and the Hardy-Weinberg law, respectively) and a set of forces that can alter the zero-force state (selection, mutation, migration and drift, in the evolutionary case), which can also add up to produce complex effects (Sober, 1984). More recently, McShea and Brandon have argued against this view, claiming that there is an evolutionary factor (genetic drift), which Sober had identified with a force, that has no structural analogue in Newton's theory (Brandon, 2006; McShea & Brandon, 2010). They present two arguments in favor of this thesis. Firstly, they claim that drift does not have a direction, and since Newtonian forces are vectorial quantities that have both a magnitude and a direction, drift should not be considered a force. Secondly, they argue that drift as a factor is "constitutive" of evolutionary processes, and not "imposed" on them, as Newtonian forces are on the processes on which they operate. Hence, again, drift should not be equated with a force. In this presentation I evaluate these two arguments. I will reject the first, by showing that there is a significant sense, not considered before, in which drift can be said to be a directional factor (even an a priori specifiable one), as it can bias populations to go towards some specific region of the evolutionary space. Contrarily, I will show why we must accept a version of the second argument. This is accomplished via an explication of the concept of "constitutivity" at stake, by means of a formal reconstruction of population genetic theory. The reconstruction will show that drift must be incorporated into the formal apparatus in a different manner than the rest of the evolutionary factors, and that it plays a structurally different role in the evolutionary explanations in which it figures. Lastly, some general consequences are drawn from this discussion, which go beyond the question of the adequacy of the force analogy.

References:

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Sober, E. 1984. *The nature of Selection: Evolutionary theory in philosophical focus*. Chicago: University of Chicago Press.

What is the place of genetic drift in Price equation?
Cristian Saborido (Department of Logic, History and Philosophy of Science, National University of Distance Education (UNED), Spain, cristian.saborido@fsof.uned.es), Victor Luque (Cavanilles Institute of Biodiversity and Evolutionary Biology and Department of Logic and Philosophy of Science University of Valencia, Spain, victor.luque@uv.es) and Giorgio Airoldi (Department of Logic, History and Philosophy of Science, National University of Distance Education (UNED), Spain, airoldi@tin.it)

The Price equation plays a prominent role in biology as it provides a formal model with which to capture a wide range of phenomena. Given its abstract and complete character, we expect the Price equation to easily account for drift as well; however, due to the different and not always coherent meanings often assigned to this concept, there is no universal agreement on where drift should be placed in the equation.

As a matter of fact, some authors interpret drift simply as an inevitable statistical error that makes real phenomena deviate from their theoretical path, while others consider drift as an autonomous process or even an evolutionary force comparable to natural selection. Consequently, the side of the Price equation in which drift should be located has not yet been properly clarified: each notion of drift has its place in a different locus in the Price equation.

To illustrate this point, we analyse Alan Grafen's Formal Darwinism Project, which refers to different interpretations of drift and, as a consequence, puts drift alternatively on both sides of the Price equation. We consider that this fact, far from showing an internal contradiction in Grafen's project, is an inevitable outcome of a loose definition of drift.

In this talk, we introduce the Price equation and explain its role in contemporary biology. We then present the different concepts of drift through an extensive review of proposals to be found in the specialised literature. We analyse some examples on how drift is considered in relation to the Price equation and, in particular, we focus on the formal treatment of drift in two articles by Alan Grafen, as an example of how the definition of drift (although implicit to a certain degree in these cases) impacts its formalisation and the very scope of the Price equation in evolutionary biology.

INDIVIDUAL PAPERS SESSION – AG-BOT
Genetics: Philosophical Perspectives
Chair of the session: Brandon Allen Conley (Sage School of Philosophy, Cornell University, USA, bac248@cornell.edu)

Papers:

Revisiting the notion of interaction in the nature-nurture debate
Qiaoying Lu (Department of Philosophy, Sun Yat-sen University, China, luqiaoy@mail2.sysu.edu.cn)

James Tabery in his recent book proposes that the controversy of the nature-nurture debate stems largely from the fact that biometricians and developmental biologists or interactionists use the same term "gene-environment interaction" to refer to different concepts. In this paper, I first distinguish three notions of interaction in terms of biometric analysis, namely, trivial interaction, vernacular interaction and statistical interaction, based on which three kinds of gene-environment interdependence can be given. By examining those notions in the interactionist context, I show that only the interdependence reflected by statistical interaction posits a challenge for biometric explanations. Second, by applying my notions to Tabery's case study of the debate between Hogben and Fisher, I show that their dispute concerns the notion of statistical interaction, and it amounts ultimately to answering an empirical question of whether this kind of interdependence is common in nature. Finally, I propose a potential challenge regarding the interpretation of statistical interaction in biometric studies: when there are changes of one or more unknown environmental factor(s) affecting the developmental processes of individuals, it might lead to the detection of statistical interaction in the absence of a genuine interdependence of genes and the targeting environmental parameter.

Taking genetic representation seriously
Brandon Allen Conley (Sage School of Philosophy, Cornell University, USA, bac248@cornell.edu)

Biologists often apply representational notions to the genome, variously invoking "genetic coding," "genetic programs," "genetic blueprints," etc. Historians and philosophers of biology have tended to assume that representational notions applied to genes are metaphorical; however, some biologists have explicitly claimed that genes literally possess intentionality. (That is, like words or concepts, genes possess representational content; genes refer to traits.) Philosophers have generally been critical of these claims, offering a number of arguments to the conclusion that genes cannot possess representational content. Here I argue that we should take genetic intentionality more seriously on the grounds that (1) the motivations for attributing intentional content to genes are the same as those motivating representational theories of mind in cognitive science, and (2) those arguments with any force against genetic intentionality are specific instances of extant arguments that have already been leveled against invoking representational notions in cognitive science. Thus, there is no special problem for genetic intentionality over and above the problems already associated with intentionality applied to language, belief-desire psychology, and other representational systems. Therefore, while it does not follow that genetic intentionality stands or falls with the representational theory of mind, or that genes do in fact possess representational content, the lack of a gene-specific problem with intentionality suggests that specific accounts of genetic representation should be developed and scrutinized before the notion is rejected. (To date, only one account, Nicolas Shea's "Infotel" account, has been developed in any depth). Furthermore, the parallels in both motivations for and challenges facing theories of genetic and other forms of representation, along with recent work on language as an inheritance system in cultural evolution, suggests that seeking a unified account of intentionality—encompassing genes, mental representation, animal signals, natural language, and more—may be fruitful.

FRIDAY JULY 21
11:00-12:30 – Parallel sessions 15

ORGANIZED SESSION DIVERSE FORMAT – AG-ZOO

Four-papers session – Talks and discussion (two interrelated sessions)

Organisms and Us: Part II: Using Typical and Atypical Organisms to Represent

Org. and chair of the session: Rachel A. Ankeny (School of Humanities, University of Adelaide, Australia, rachel.ankeny@adelaide.edu.au)

Papers:

Plant blindness and model organism selection in the Cognitive Sciences
Laura Bottrill (Department of Philosophy, University of Adelaide, Australia, lauramay.bottrill@adelaide.edu.au)

Plants, so conventional wisdom goes, are very simple, stimulus-driven organisms that demonstrate little (if any) interesting behavior. Their capacities are often presented in contrast to the flexible, active, responsive and diverse range of behavioral and cognitive activities in which animals of various sorts (including ourselves) engage. However, this view of plants is changing. Recent developments in the plant sciences have seen the emergence of a literature around the study of plant intelligence and an increase in the use of informational, representational, and even cognitive terminology to describe what plants do and how they do it. This has been fueled partly by a wave of recent empirical findings suggesting a surprising level of flexibility and sophistication in plant behavior, and partly by evolving theoretical frameworks for understanding cognition as a biological phenomenon. A minority but increasingly popular view has advocated that plants are active, intelligent organisms with basic cognitive capacities, the study of which can contribute novel insights in fields that draw upon these concepts. However, this shift is not without its critics. Many theorists still hold that the application of these concepts to non-neural organisms like plants is fundamentally misguided.

In this talk, I examine sources of conventional ways of theorizing and conceptualizing plants that have traditionally lead to their exclusion as model organisms from the domain of cognitive science. I draw upon the concept of plant blindness to argue that because plants have historically been overlooked, disregarded, and mischaracterized by philosophers and cognitive scientists, we have missed potentially fruitful avenues for research and models to draw upon in our attempts to understand cognition. I identify and discuss three broad reasons for this: (1) the early history and philosophy of plant theorizing, (2) human perceptual/cognitive biases in ascription of properties like aliveness and intelligence, and (3) educational/social/institutional trends and structures that serve to reinforce outdated beliefs about plants as well as our tendencies to overlook them as active and interesting organisms. By examining the processes that have shaped and sustain theorists' intuitions about plants in light of growing evidence that challenges these, I aim to motivate a step back from such intuitions and towards viewing plants through new eyes and new concepts in order to reassess and recognize their value as model organisms in cognitive research.

How much can a Koala 'bear'? A history of the development of Australian marsupial models in psychological research

Karina Burns (Department of History, University of Adelaide, Australia, karina.burns@adelaide.edu.au)

Marsupials native to Australia have been largely overlooked as potential models for research in the behavioral sciences, despite evidence that they perform as well as or better than commonly used laboratory mammals. Currently, new 'model organisms' are being established, extending on those originally designated by the National Institute of Health (NIH), thus diversifying the narrow confines that previously were associated with research generated by the primarily genetic focus. For example, the Australian tammar wallaby (*Macropus eugenii*) is discussed in the second volume of *Emerging Model Organisms: A Laboratory Manual* (Behringer, Johnson, and Krumlauf 2009; see also CSHL 2010) as a model for developmental and reproductive biology, and has been studied previously in vision research (e.g., see Ebeling and Hemmi 2014; Hemmi, Maddess, and Mark 2000). Another example of an emergent marsupial model is found in the preliminary research on human ageing on the brown antechinus (*Antechinus stuartii*), a small marsupial mouse of the Dasyuridae family, which is claimed to be a promising model for Alzheimer's disease (McAllan 2006).

This paper explores the current state of the field of psychological research with regard to the use of marsupial models with particular focus on the rationales provided by researchers particularly with regard to the characteristics of these models. This research is part of a larger project on the history of animal research ethics in Australia, with a specific focus on the field of psychology. A key motivating question for the broader project is whether and how Australia is historically unique in its choice and use of animal models for research, and how legislation, activism, and other political and social forces have shaped animal-based research. Hence this presentation focuses on the history and development of the use of marsupial models in psychology in order to explore whether there are Australia-specific research foci or practices.

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Choosing the right organism: On the role and reliability of the August Krogh Principle

Sara Green (Department of Science Education, University of Copenhagen, Denmark, saraehrenreichgreen@gmail.com)

Classical physiologists like Claude Bernard and August Krogh emphasized the importance of organism choice for observational, experimental and comparative studies in biological research. What has later become known as the Krogh principle states that "for a large number of problems there will be some animal of choice, or a few such animals, on which it can be most conveniently studied" (Krogh 1929; see also Krebs 1975). Krogh's claim was that some biological mechanisms are best studied via organisms that exhibit distinct adaptations, or organisms that are experimentally convenient to study. Examples are sea tortoises exhibiting a specialized lung physiology that are convenient for studies of respiration, or the anatomy of the giant squid that allows for isolation of a large nerve fiber (axon) to study the action potential. Studying extreme adaptations is often argued to be relevant for understanding human physiology. For instance, mechanisms that up- and down-regulate the digestive system in snakes are adapted to long fasting periods and are hypothesized to bring insights to mechanisms controlling human metabolism.

The Krogh principle thus raises important philosophical questions about the generality of physiological mechanisms, as well as about the methodological implications of this heuristic in different fields of biology. The principle was formulated in the context of comparative physiology, and Krogh emphasized the importance of studying biological mechanisms in all their modifications across species. Yet the principle has often been interpreted as a justification for generalization from one optimal or optimized model organism to other species. Thus understood, an obvious limitation of the principle is the risk of making generalizations from a special case that is not representative of the physiology or functional organization of other species. In this paper, I explore the range of biological fields and research contexts in which the principle has been applied and discussed. I investigate a range of interpretations made in relation to Krogh's principle and specify the conditions for which the principle is likely to be useful or potentially misleading.

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Using organisms as representations

Rachel A. Ankeny (School of Humanities, University of Adelaide, Australia, rachel.ankeny@adelaide.edu.au) and **Sabina Leonelli** (University of Exeter, UK, S.Leonelli@exeter.ac.uk)

In this paper, we examine how organisms have come to serve as models for a range of biological phenomena, and how such models differ from those utilized in other contexts within the sciences, with particular attention to the material and historical contingencies at issue in the case of experimental organisms. Models clearly come in an endless variety of types, given that different types and combinations of them are required in various forms of scientific practice. Due to this dramatic diversity, much attention has been paid to the actual features of models employed in scientific practice, and clarifying the epistemological status of each type of model as both a product of and a tool used for scientific theorizing (e.g., Weisberg 2013, Levy and Currie 2014, Frigg and Nguyen 2016). Relatively less attention has been devoted to the range of activities that need to be performed in order to generate adequate models (Knuuttila 2011; see also work on extrapolation processes, e.g. Steel 2007 and Baetu 2016). Examining modelling activities, rather than solely focusing on their products, is a particularly useful approach when trying to understand how experimental organisms help to create knowledge which can be projected beyond the immediate domain in which it was produced, and what makes such projections more (or less) plausible. These issues are especially significant given that organisms often are taken as models for phenomena that are arguably not directly observable in the organisms themselves (e.g., the use of mice to explore alcoholism) or as models for organisms that are very dissimilar to them (e.g., the use of yeast as models for cancer in human), two representational forms that we have characterized as the model's target and scope, respectively, in previous work (Ankeny and Leonelli 2011). In this paper, we provide a philosophical framework that allows us to understand the epistemic grounds on which certain modelling roles attributed to organism are viewed as fruitful and plausible (or as problematic and unrealistic), and particularly the representational power of such models within specific research situations.

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ORGANIZED SESSION STANDARD TALKS – CD-A1

The Evolutionary and Psychological Bases of Mindreading, Metacognition, and Folk Epistemology

Orgs.: Ximena Gonzalez-Grandon (Institute of Philosophy and Complex Science (IFICC), Chile, glezgrandon@gmail.com), Edouard Machery (Department of History and Philosophy of Science , University of Pittsburgh, USA, machery@pitt.edu) and Melina Gastelum-Vargas

(National Autonomous University of Mexico (UNAM), Mexico, megava@gmail.com)

The evolutionary and psychological bases of metacognition and theory of mind (or 'mindreading') are widely believed to be interconnected. This is in part because both rely on metarepresentation, that is, the representation of mental states. Mindreading involves attributing mental states to oneself and to others, and its function is often believed to be to explain and predict behavior by ascribing beliefs, desires, and intentions. While metacognition consists in self-directed mindreading – during metacognition, we attribute mental states to ourselves– its function is to evaluate one's certainty in a cognitive task. Some theorists assert that metacognition is a by-product of the general ability of mindreading, but a second theory denies that metacognition is related to theory of mind; rather, on this alternative view, it is a set of knowing-that and knowing-how procedures that allow human beings (and perhaps some animals) to control and monitor their first-order cognitive abilities and their practical embodied abilities. On this view, metacognition results from some kind of selective pressure on cognitive systems leading to the evolution of a capacity to monitor one's procedural and working memory. Similarly, there is an on-going debate about the relation between the evolutionary and psychological bases of folk epistemology (the lay understanding of justification or knowledge) and mindreading. In this organized session contribution we will emphasize the different approaches to mindreading, folk epistemology, and metacognition, taking into consideration their underlying, evolutionary and psychological bases.

Chair of the session: Juan Manuel Arguelles-San Millan (National Institute of Anthropology and History (INAH), Mexico, juan.manuel.arguelles@gmail.com)

Papers:

The evolution of epistemology

Edouard Machery (Department of History and Philosophy of Science , University of Pittsburgh, USA, machery@pitt.edu)

This talk will present several functional hypotheses about the concept of knowledge, and will assess them in light of empirical work in primatology (e.g., Santos) and on the psychological study of knowledge ascription (experimental epistemology) coming from developmental psychology and from cross-cultural experimental philosophy. In particular, the talk will discuss the hypothesis that the function of the concept of knowledge is to flag trustworthy sources of information (assessing testimony), as proposed by Craig, to track actionable facts, as proposed by Turri, and to guarantee testimony, as proposed by Austin. These functional hypotheses predict that knowledge ascription should have various properties (functional analysis), and experimental work can be used to determine whether it really has such properties.

Practical metacognition and feeling of knowledge
Ximena Gonzalez-Grandon (Institute of Philosophy and Complex Science (IFICC), Chile, glezgrandon@gmail.com)

The discussion about the feeling of knowing (FOK) have focused on Know that. Where FOK is the subjective experience of knowing that what the agent can retrieve from long-term memory (episodic and semantically meaningful stored information). This description assumes that there are feeling's judgments that are inferential in nature, based on cues that are draw on the declarative content available in memory of domain-specific beliefs retrieved. Most previous studies addressed the question of FOK accuracy, because they seem to guide and affect our behavior relying on the accessibility of correct and incorrect information. But there is not much work done with regard to how the processes assumed to underlie FOK and also account for its accuracy happening when knowing how. In this talk my primary hypothesis is based on the idea that felling of knowing how could be retrieved from different kinds of memories, not being inferential in nature, its cues deriving from the automatic and embodied experience of learning, remembering, or acting rather than from the content of thought, and its accuracy could come from a lot of dynamics of the embodied mind–world interactions that calibrate the epistemic feelings as reliable indicators of correct or incorrect practical epistemic norms. The distintion could be useful for meta-cognitive and phenomenological issues, but also because implies different monitoring processes that contribute to the strategic regulation of learning to have a better performance in the world.

INDIVIDUAL PAPERS SESSION – CD-A2
Genes and Information

Chair of the session: María Cerezo (Department of Philosophy, University of Murcia, Spain, mmcerezo@um.es)

Papers:

Recent developments in the debates about the gene concept: The dynamic, systemic gene

Charbel N. El-Hani (History, Philosophy, and Biology Teaching Lab, Institute of Biology, Federal University of Bahia, Brazil. National Institute of Science and Technology in Interdisciplinary and Transdisciplinary Studies in Ecology and Evolution (INCT IN-TREE), charbel.elhani@gmail.com)

The gene concept has been one of the hallmarks in 20th century history of science, but is currently shrouded in controversy, given the difficulty for understanding the structural limits of the gene or the meaning of its function. Once conceived according to the so-called classical molecular concept, as a stretch of DNA coding for a functional product, which can be a single polypeptide chain or a functional RNA molecule, the gene amounted to a structural unit clearly delineated in the genome, to which one could ascribe a clear function. Currently, it is not a simple task to delimit what is a gene or explain how it functions. The gene concept is challenged by many problems. Consequently, a number of proposals for reconceptualizing the gene appeared in recent years, in the so-called postgenomic era. In this paper, I will discuss proposals that emerged in the last 10 years, in order to appraise their advances and shortcomings. I will also report on the results of a citation analysis that gives some hints as to their reception. The analysis will focus on Keller and Harel's proposal of the genetic functor, Scherrer and Jost's genon theory, Prohaska and Stadler's computational approach to the gene, Portin's relational or systemic gene concept, and Baetu's approach to syntax-based gene concepts. From the discussion of these proposals, I will derive some ideas regarding the understanding of what is a gene and how a gene functions in the postgenomic era, particularly focusing on the idea of the dynamic, systemic gene.

Conflations in the parity thesis: Causation and information

María José Ferreira Ruiz (Department of Philosophy, University of Buenos Aires/ National Scientific and Technical Research Council (CONICET), Argentina, mariaferreiraruiz@gmail.com) and Jon Umerez

(Department of Logic and Philosophy of Science, University of the Basque Country, Spain; IAS Research, jon.umerez@ehu.es)

Although well established in the biological discourse, the concept of information has proved unclear. Lately, philosophers of biology have advocated either to elucidate its meaning or to reject its legitimacy. This has been a tricky debate, plagued with confusions and misunderstandings.

Over the last two decades an unorthodox view on certain biological matters, known as the Developmental Systems Theory (hereafter, DST), has gained attention due to claims opposing the mainstream in biology. Particularly, DST has sought to remove the focus put on the role of genes in development and to emphasize the role of what they refer to as other developmental resources of an organism (Griffiths & Gray 1994). Their slogan is that genes are but one among several resources that organisms count on in order to develop, all of which are “on a par” in this respect. A gene, in short, is not a special resource, nor is its role more important than that of other resources, an idea expressed by the so-called “causal parity thesis”.

Naturally, some of the ideas of DST have implications for the debate on the concept of information. The inherent pluralism of the ‘developmental resources’-view led some DST authors to claim that genes are not the only informational units within an organism. Genes and other resources are, from this perspective, on a par even with regard to their informational nature. Thus, they fall into a striking version of the parity thesis: an informational parity thesis (henceforth, IPT) (Stegmann 2012).

However, a careful examination of the debates and arguments reveals that DST is wrong in making the step from the causal parity thesis to the informational version. In this contribution, we will argue that IPT is grounded in a conflation between the concepts of information and causation. This conflation will be shown to have a twofold origin: (i) a rough understanding of causation and (ii) a misreading of information theory. Regarding (i), IPT faces the general problem that the causal notions it presupposes are too rough to reveal interesting differences among causal factors (v.g., Woodward 2010). As to (ii), in the debate on genetic information, Shannon’s information is simply assumed to provide a causal information concept (v.g., Griffiths 2001), which in fact cannot be taken for granted.

Revealing the underlying conflations enables the acknowledgment that even when many biological entities do indeed contribute to development, it can be called into question whether all or some of them act in a way worthy of being qualified as informational, and enables determining the conceptual requirements to both support and reject IPT.

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Pros and cons of a causal dispositionalist theory of genes: Parity, complexity and simultaneity

María Cerezo (Department of Philosophy, University of Murcia, Spain, mmcerezo@um.es)

Recent work in Metaphysics of Science has given rise to an increased interest in dispositions and powers as a way of accounting for causation. In particular, Mumford and Anjum (2011) have developed a dispositional theory of causation in which effects are brought about by means of powers manifesting themselves. An important feature of the approach is that it distinguishes causal production from causal necessitation, which allows for causes as not being sufficient conditions for their effects. This particular feature makes the approach suitable to account for biological processes, which are strongly context-sensitive and causally complex. In fact, Mumford and Anjum choose biological processes and biological causality as a nice example of their model (ch. 10 of Mumford and Anjum 2011). In particular, they argue for a dispositional concept of genes, one in which genes seem to be conceived as powers or bundles of powers "coded" into the structural complexity of DNA strands, and they show how empirical data and contemporary research in Molecular Biology and Genetics square well with their dispositionalist account. Postgenomic scientific advances are hence presented by them as motivating their metaphysical theory.

In this paper, I intend to deploy a dialogue between this metaphysical conception and the traditional approaches to the problem of the ontology and definition of gene in contemporary Philosophy of Biology. In particular, I will reassess whether a strong causal dispositionalist account of genes can handle the traditional and well accepted difficulties raised in the postgenomic era (from now on, "postgenomic difficulties") which have led to eliminativist, processual or strongly contingent positions (Dupré and Barnes 2008, Griffiths and Neumann-Held 1999, Griffiths and Stotz 2013, Oyama 2000). In order to explore these difficulties, I will pay attention to a particular biological phenomenon that lies behind some of them, namely, RNA alternative splicing.

In my talk, I will firstly present the central features of causal dispositionalism (from now on: CD), highlighting some advantages in its account of biological cases. In particular, I will pay attention to the parity thesis in a CD framework and discuss recent work by Austin (2015). The central part of my presentation will address postgenomic difficulties and the issues they raise for CD. I will focus on a problem that stems from the simultaneity of cause and effect proper to CD and some basic tenets in contemporary genetics. In the last part of the talk, I will explore several strategies that a dispositionalist might employ to strengthen his account.

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INDIVIDUAL PAPERS SESSION – CD-A3

History of Biology III

Chair of the session: Gregory J. Morgan (College of Arts and Letters, Stevens Institute of Technology, USA, gmorgan@stevens.edu)

Papers:

The birth of Evolutionary Biology in Great-Britain: A stylometric peek behind a 19th century veil of anonymity

Koen B. Tanghe (Department of Philosophy and Moral Sciences, University of Ghent, Belgium, koenbernard.tanghe@ugent.be) and Mike Kestemont (Department of Literature, University of Antwerpen, Belgium, mike.kestemont@gmail.com)

The 18th century evolutionary verses of doctor Erasmus Darwin were isolated and ephemeral philosophical speculations. The time was not yet ready for the empirical study of what later would be called 'evolution'. By some strange, or not so strange, coincidence, the actual 'birth' of British evolutionary biology took place in Edinburgh during the approximately 2 years (1825-1827) that Erasmus' grandson Charles was enrolled at the local University as a reluctant student of medicine. In recent years, several publications have shed new light on this intriguing first flowering of evolutionary thought in British academic circles. There are even tentative indications that Charles Darwin's research during the early years of his voyage with HMS Beagle (1831-1836) was inspired by it. Unfortunately, the two articles which are the two main published exponents of this efflorescence appeared anonymously in, respectively, 1826 and 1827. They have not yet been definitively attributed to one or another of the Edinburgh naturalists. We have used modern author verification software to identify their author. The results confirm the suspected pivotal role played by Darwin's geology professor Robert Jameson in this efflorescence.

Lynn Margulis, architect of the endosymbiotic theory

Jennifer Bernard (University of Lyon, France, jennifer.bernard@univ-lyon1.fr)

Lynn Margulis is known as the scientist who advanced the endosymbiotic theory in the late 60's (Sagan, 1967) and brought it from its rejection to its acceptance by the scientific community in the 80's. Nevertheless, Margulis' contribution was neither new, nor decisive in terms of conclusive experiments. The hypothesis of an endosymbiotic origin of chloroplast was first proposed in the late 19th century. In the 60's, Margulis professor's Hans Ris showed convincingly that plastids contain their own genetic material and revived the endosymbiotic hypothesis (Ris & Plaut, 1962). Similar hypotheses about mitochondria were made in the early 20th century and their DNA was then discovered in the same period than plastidial DNA. The passionate 70's debate opposing symbiotic origin supporters and opponents remained unresolved until the development of a new field of biology to which Margulis addressed much criticism: molecular phylogeny. Moreover, the aspects of the theory she was the only scientist to defend (the symbiotic origin of the microtubule system) were not confirmed after 50 years of research. One could wonder which role Margulis played in reaching the consensus.

I will argue that the original contribution of Margulis lies in her efforts to contextualize the mitochondrial and plastidial nature in a complete and coherent scenario of the evolution of life on Earth, and to combine all biological disciplines (and beyond): cell biology, biochemistry, genetics, symbiosis studies, systematics, paleontology. Thanks to her, this event of life history became a cross-disciplinary subject in debate at an international level. It allowed to review scattered and sometimes seemingly contradictory data. It stimulated research into this topic, whose results contributed in turn to support the theory. Margulis started a fruitful research program.

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The rise of Tumor Virology at Cold Spring Harbor Laboratory, 1968-1980

Gregory J. Morgan (College of Arts and Letters, Stevens Institute of Technology, USA, gmorgan@stevens.edu)

The Cold Spring Harbor Laboratory (CSHL) in Long Island, New York, became one of the preeminent places for the study of tumor viruses in the early 1970s after having no real presence in the area a decade earlier. What explains its stratospheric rise? I will argue that the rise of CSHL in this area can be understood by examining the intersecting careers of Joseph Sambrook, James Watson, and Renato Dulbecco. Watson and Dulbecco were trained in virology by Salvador Luria in the late 1940s. When Watson became Directory of the Cold Spring Harbor Laboratory in 1968, he recruited three talented scientists from Renato Dulbecco's Salk Institute laboratory, Joe Sambrook, Heiner Westphal, and Carel Mulder. Dulbecco’s laboratory had pioneered new assays that drove animal virology into a more quantitative phase and Sambrook had shown that animal viruses can integrate into the genome of a host cell. Watson's foresight in picking tumor virology as an area of focus and his eye for talent to lead that focus allowed CSHL to win significant Federal funds as part of the "War on Cancer.” The mixture of talent, goals, and funding propelled the laboratory to the forefront of research on the genetics of tumor viruses. The discovery of oncogenes, tumor suppressor genes, and RNA splicing were among the fruits of this genetic, quantitative approach to cancer causing viruses. The new research also raised ethical questions about recombinant DNA and helped shape new safety policy.

INDIVIDUAL PAPERS SESSION – MINAS1
History/Philosophy of Biology and Anthropology

Chair of the session: Susanne Lettow (Margherita-von-Brentano Centre for Gender Studies, Free University Berlin, Germany, lettow2@zedat.fu-berlin.de)

Papers:

Niche construction as a tool to understand parasitism: The case of a Mbyá Guaraní community

Susana Gisela Lamas (Faculty of Natural Sciences and Museum, National University of La Plata, Argentina, sglamas@yahoo.com.ar), Marta Crivos (Faculty of Natural Sciences and Museum, National University of La Plata/National Scientific and Technical Research Council (CONICET), Argentina, martacrivos@yahoo.com.ar) and Vicente Dressino (Faculty of Natural Sciences and Museum, National University of La Plata, vdressino@gmail.com)

This research is the result of an interdisciplinary work carried out by biologists, ethnographers and philosophers. We consider the epistemological and methodological usefulness of the concept of niche construction for understanding the relationships among certain biological phenomena. This work will be based on the way in which an Mbyá Guaraní community -from the Valley of Cuña Pirú in the Province of Misiones, Argentina- conceives its relationship with parasites. It is worth mentioning that this ethnic group has inhabited the Paranaense forest for around 10,000 years, which means having a deep knowledge of and relationship with its environment. For the Mbyá people, parasites are not pathogens per se, but instead, based on their relationship with the internal and external environment and on certain specific conditions (in which natural and cultural aspects are not separated), beneficial or pathogenic results are perceived in their presence.

The Mbyá people believe that humans are born with a parasitic burden (known as the parasite mother), without which they could never survive since it assists in physiological processes related to feeding and digestion. Therefore, parasites are a vital constituent of the body. The parasite mother is born and dies with the individual, so none of them could survive on their own. This conception opposes that of parasitologists, for whom parasites entail a "sanitary problem" due to a strange, external agent in our body and immune system, and whose spread derives in mild to serious pathologies. The Mbyá people acknowledge that parasites may cause illnesses. However, these are parasites that "come from the outside", since the Mbyá do not comply with certain cultural rules such as feeding children or pregnant women with certain types of meat, drinking polluted water or eating candy provided by the white man. On the other hand, internal parasites are in perfect balance with the body and are necessary to live. In this case, we may wonder whether this concept might be understood from the niche construction perspective as a process of interspecific associations that have shaped particular relationships for parasites and human beings. In effect, most of the parasites that the Mbyá people have are only found in humans; under the Mbya viewpoint, thanks to those parasites, they are able to nourish themselves with the resources provided by the forest.

In this respect, the microscale characterization –typical of ethnographic studies- of the lifestyle of human populations with different settlement histories in specific environments offers valuable information about the weave of interchanges that enables the existence, coexistence and subsistence of biotic and non-biotic entities. We consider that the niche construction perspective may be a useful conceptual tool to understand the Mbyá conception about parasite species that perform basic physiological functions in order to survive in their environment. And we believe it would be interesting to conduct other parasitological studies with this new theoretical perspective in mind.

Life, Earth, human diversity. Henrik Steffen's Anthropology and the invention of race

Susanne Lettow (Margherita-von-Brentano Centre for Gender Studies, Free University Berlin, Germany, lettow2@zedat.fu-berlin.de)

In 1822, Henrik Steffens, a naturalist and one of the German Naturphilosophen, published his *Anthropology*. This book contributed significantly to the invention of ‘race’ as a political and scientific category in the German-speaking lands. In contrast to Kant’s genealogical concept of race that focuses on relations of reproduction and hereditary transmission, Steffens mainly refers to geological knowledge in order to draw distinctions and hierarchies between different populations of the world. Anthropology, he argues, is basically ‘geological anthropology’. This means that he conceives of the human as a product of the developmental history of the Earth. The Earth, for Steffens, is a ‘total organism’, which produces its different members, who ‘account for each other’. These different ‘members’ of the geological organism are called ‘races’. They are, as Steffens puts it, ‘built into’ their specific region. In my talk, I will situate Henrik Steffen’s account of race within the history of race and anthropology. In particular, I will reconstruct the ways in which he refers to geological, geographical and biological knowledge. These forms of knowledge also play a crucial role in Kant’s Physical Geography and in his essays on race, as well as in Alexander von Humboldt’s project of a physical geography. Against this backdrop, I will discuss the question of how concepts of life, earth and human diversity are articulated differently in the writings of Kant, Humboldt and Steffens, and how extensively these articulations converge. My aim is to specify the nature of Steffen’s contribution to the formation of the race discourse in the early nineteenth century.

Author Index

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