# ABSTRACTS

**Evaluating 'Evaluating Evidence of Mechanisms in Medicine': a systematic and philosophical review**
*Daniel Auker-Howlett - University of Kent*

The principles of evidence based medicine dictate that evidence from clinical trials is the only way to base decisions and does not consider evidence of mechanism sufficient to establish effectiveness of medical interventions. One reason for this is that the quality of evidence of mechanisms is often low. This problem is compounded by a lack of procedures for evaluating evidence of mechanism. The EBM+ consortium has recently released such a framework. In this paper I use the EBM+ framework to perform a systematic review of the evidence of mechanism for an intervention (combination therapy) to treat middle east respiratory syndrome (MERS). I conclude that evidence of mechanism makes the effectiveness of combination therapy plausible. In turn, I critically evaluate the EBM+ guidance, and propose improvements and alterations. Finally I argue that the framework effectively deals with common objections to the general use of evidence of mechanism in basing clinical decisions.

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**Diagnostic Parsimony: Ockham meets Bayes**
*Bengt Autzen - University College Cork*

Ockham's razor, sometimes referred to as the principle of parsimony or simplicity, is the idea that simpler hypotheses are to be preferred over more complex hypotheses. In a medical context this is taken to mean that when a patient has multiple symptoms, a single diagnosis should be sought that accounts for all the clinical features rather than attributing a different diagnosis to each. While Ockham's razor is widely applied in medical diagnosis, it conflicts with other diagnostic principles invoked by clinicians. Hickam's dictum, for instance, states that multiple symptoms may be due to more than one disease. To complicate things further, it is widely held that Bayesian decision theory offers an adequate framework for medical decision making. The paper aims to address the question of how Ockham's razor and other conflicting diagnostic principles such as Hickam's dictum fit into a general Bayesian framework of medical decision making.





**Spacetime as a Quantum Error-Correcting Code?**
*Jonathan Bain - New York University*

I consider an interpretation of the AdS/CFT correspondence under which the bulk and the boundary emerge from a more fundamental condensed matter system that realizes the structure of a quantum error-correcting code (QECC). In this interpretation, bulk states form a subspace of the space of boundary states that protects boundary information from erasure, and this state space structure is realized by a discrete system of spins on a negatively curved lattice. The AdS/CFT correspondence is thus viewed as a version of the condensed matter approach to quantum gravity, under which both quantum field theory (in the boundary) and general relativity (in the bulk) emerge from a condensed matter system. I consider the extent to which this view suggests that spacetime is a QECC (as some authors have suggested), and how it fits into recent schemes of realist interpretative options for dualities.

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**Information, unreal genes and biological function**
*Antonios Basoukos - University of Exeter*

In this presentation I use the example of Marfan syndrome caused by allele deletion in order to argue that the causal-informational measure of biological specificity recently proposed by Paul Griffiths and his colleagues is erroneously defended as independent of material contributions. I argue that experimenters cannot afford to ignore material contributions. The conditional probabilities included in the equation of Griffiths' measure of specificity are in some cases, exemplified by the Marfan syndrome case study, indefinable. The root of this difficulty is the causal role of genes.
I use the distinction by Lenny Moss between Genes-P and Genes-D to show that only Genes-D are real according to the criteria of Ian Hacking's entity realism. Genes-D, which are material entities, are not causally privileged.
I propose that Griffiths' approach is viable if we re-conceptualise it as measuring biological function.

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**Causal Complexity in Functional Biology and Medicine**
*William Bechtel - University of California, San Diego*
*Lauren Ross - University of California, Irvine*

Causal complexity, resulting from multiple ways in which components of biological systems interact causally, presents serious challenges for understanding both normal functioning of organisms and pathologies. In particular, Simon's assumption that systems are organized in modular hierarchies fails in systems exhibiting what Wimsatt characterized as "interactional complexity." These four talks identify distinct types of causal complexity in contemporary biology and medicine and analyze four strategies scientists in these fields are deploying to manage this complexity: developing and deploying multiple decompositions of the same system, invoking causal concepts distinct from mechanism such as pathways and cascades, extracting meaningful causal information from highly-connected modules in network biology, and investigating how physical factors constrain the possibility-space for biological variation.

**On the Dispositional Conception of Preferences**
*Lukas Beck - University of Cambridge*

There is a lively debate about the nature of preferences in economics. The debate aims at finding a coherent conception of preferences that captures the actual use of the term in economics. Yet, it is also interested in a conception that can guide economic research, e.g. by informing us about how much economists must rely on psychological findings to build models of choice-behavior. Recently, the so-called dispositional conception of preferences (DCP) gained traction. DCP identifies preferences as belief-dependent multiply-realizable dispositions. While I agree with proponents of DCP that it better captures the actual use of preferences in economics than alternative accounts, I will argue that DCP is too shallow to guide research in economics unless we augment it with additional commitments about preferences. To show this, I will explicate how different additional commitments have different implications on the relevance of research from the psychology of decision-making for economics.

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**Formalizing Mental Causation**
*Sander Beckers - Utrecht University*

The exclusion argument presents a challenge to the non-reductive physicalist: how can there be mental causation in a physically closed world? The non-reductive physicalist holds that a mental state supervenes on a physical state, but is not reducible to it. Therefore she seems forced to accept that many actions have two distinct sufficient causes, and are thus overdetermined. But overdetermination of an event by two causes is deemed to be highly exceptional, to the extent that it is highly implausible to be as widespread as mundane cases of mental causation are. This paper takes up this challenge.

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**Citizen science: a challenge to scientific objectivity?**
*Baptiste Bedessem - IRPHIL/Lyon 3*
*Stéphanie Ruphy - Université de Lyon*

The growing participation of nonacademic citizens in science, referred to as "citizen science" (CS), takes many different forms (collection of data, orientation of science, co-construction of knowledge) and involves distinct actors (individuals, militants, NGOs). CS is the object of a growing philosophical and institutional interest at the international scale. Studies mainly focus on the phenomenon in a sociological, political or ethical perspectives. By contrast, contemporaneous philosophy is quite silent on this subject. In this paper, we propose to develop an epistemology of citizen science, by focusing on the issue of scientific objectivity. This paper investigates how objectivity, in its many dimensions, can be guaranteed or promoted in citizen science programs. To do so, we establish a cartography of the different epistemological burdens and benefits posed by CS to scientific objectivity, based on a coupling of typologies of CS and a risk account of scientific objectivity.





**How Darwinian and how general is "generalised Darwinism"? Economic change, evolution and R. A. Fisher's "Fundamental Theorem of Natural Selection"**
*Nicola Bertoldi - Université de Paris 1*

This paper deals with two questions about evolutionary theories of economic change: to which extent are such theories Darwinian and in which respects does the reference to evolution allow them to grasp economic realities better than "orthodox" theories do? However, answering such questions requires focusing on a particular research program in evolutionary economics, i.e. Hodgson et al.'s "generalised Darwinism". More precisely, this paper aims at determining how Darwinian and how general (in the sense of the extent to which it can be applied to economics) generalised Darwinism is, by comparing it to the view of evolution that is embedded in R. A. Fisher's "Fundamental Theorem of Natural Selection". Such a comparison will assess which one of those two ways of generalising Darwinian evolution is better equipped to capture commonalities between biological and social populations, as well as to define the conditions for an evolutionary equilibrium that may also apply to economic agents.

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**Structure and Composition in Chemistry**
*Geoffrey Blumenthal - University of Bristol*
*James Ladyman - University of Bristol*
*Sarah Hijmans - Université Paris-Diderot*
*Justin Price - University of South Carolina*
*Karoliina Pulkkinen - University of Cambridge/KTH Royal Institute of Technology*
*Vanessa Seifert - University of Bristol*

Our proposed symposium consists of five papers on two important topics in the philosophy of chemistry, namely structure and composition. Two papers examine philosophical issues about the nature and reality of molecular structure: one considers how cross-domain modelling and its results affects the concept of the chemical bond; the other asks if chemical bonds are real patterns. The second pair of papers examine how concepts about chemical composition are established: one investigates how several researchers with differing practices of experiment, description and inference, reached a common conclusion concerning the nature and constituents of a specific substance, namely nitrous acid; and the other looks at criteria for elementhood in nineteenth-century chemistry. The fifth paper investigates both structure and composition. It examines the role of values in structuring information about chemical composition, in the form of periodic systems of elements.

**Simulation-Modeling at the LHC: Semi-Hierarchies and Networks**

*Florian J. Boge - RWTH Aachen University*
*Christian Zeitnitz*

Complex, large scale LHC experiments such as ATLAS rely heavily on computer simulations (CSs). Karaca (2018), suggests complexity here necessitates a breakdown of traditional accounts of simulation models as ordered into hierarchies. We significantly extend Karaca's analysis in two ways: we (a) show that on the level of individual components of the overall simulation, at least semi-hierarchical structures exist. We then (b) show that a network-like structure emerges already when one focuses on the relations between individual components, i.e., disregards connections to experimental data and established theories. These results will require two intermediate steps: (i) a description of the modeling steps standardly implemented in ATLAS' CSs; and (ii) a classification of models according to elements relevant to their generation as well as their functioning in the overall simulation. In a final step, we will compare our analysis to Karaca's and show how our network can be embedded into his.

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**Metabolism, biological identity and the challenges from microbiome**

*research: a historical-philosophical approach*
*Cécilia Bognon - CEFISES - UCLouvain*

This paper builds a theoretical framework for thinking of biological identity able to articulate a metabolism-based notion of identity with recent findings about the relevance of microbiota for vital functions. Considering the constitutive role of heterogeneous symbiotic bacteria within organisms, philosophers have suggested that biological identity needs a conceptual clarification. I argue that the concept of metabolism has played a key role in elaborating such notions of organismic individuality and identity, providing biology with a view of organisms as bounded and autonomous entities, able to self-organize and self-maintain in a wide variety of contexts. The recent idea that heterogeneous elements could participate to the organism's identity seems therefore challenging. Relying on previous analyses of the constitution of a concept of metabolism, I indicate which aspects of this concept should be retained in order to reconcile those competing takes on biological identity.

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**Modeling Bias and Deception in Scientific Inquiry**

*Annemarie Borg - LMU Munich*
*Daniel Frey, Dunja Seselja and Christian Strasser*

The problem of bias and deception in science has increasingly gained attention of scholars employing agent-based models (ABMs) to study mechanisms that produce, or those that mitigate the risk of biased or deceptive behavior. In this paper we study the impact of biased and deceptive agents on the efficiency of scientific inquiry by employing a model structurally different from those that have previously been used to this end, namely, the argumentation-based ABM (ArgABM). Our study focuses on the question whether certain conditions of scientific inquiry help as mitigating strategies for reducing the risk of biased and/or deceptive part of the community. Our results suggest that different types of theory-choice procedures have a major impact on the ability of the community to defend itself from biased and/or deceptive agents, that highly connected communities tend to perform better than the less connected ones, and that cautious decision making isn't always helpful.





**Aggregating belief models: a unifying theory of aggregation**

*Seamus Bradley - University of Leeds*

A "Belief Structure" is a very general formal structure for representing an agents rational beliefs, introduced by Gert de Cooman in 2005 ("Belief models: an order-theoretic investigation." Annals of Mathematics and Artificial Intelligence 45.1-2 (2005): 5-34.). Propositional logic, ordinal ranking functions and lower previsions are all instances of belief structures, as are certain kinds of preference relations and choice functions. So this theory has a great unifying power that has been somewhat overlooked in philosophical circles. This paper presents a belief structural approach to aggregation. We present a general theory of aggregation for belief models, before applying this to the case of lower previsions. Since probability theory is a special case of lower previsions, this promises to yield new insights on aggregating probabilities.

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**Natural Kinds, Mind-Dependence, and the A-Word**

*Zdenka Brzovic - University of Rijeka*

Many authors agree that natural kinds need not be mind-independent. Mind-independence is traditionally considered a criterion for realism. Accordingly, in the standard framing of the debate, proponents of the mind-dependent kinds would be considered antirealists. A lot of them, however, dread the label of antirealism as they equate it with the extreme view that there are no natural kinds and that all categorizations of the world are equally arbitrary. The arguments against using mind-independence as a criterion for realism about natural kinds proceed via two strategies: (1) by showing that there are different types of mind-dependence, some problematic for the realist and others which are not; (2) by pointing to examples of legitimate natural kinds that are mind-dependent across all varieties of mind-dependence. I argue against both strategies and show how keeping the label of antirealism for mind-dependent kinds carves the positions at the most interesting joint.

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**Perspectivism in Current Epigenetics**

*Karim Bschir - University St. Gallen*

One way of ascribing a positive role to scientific disagreement is to understand disagreeing positions as different perspectives. This paper assess the perspectivist approach to disagreement against the background of an ongoing controversy in epigenetics. In particular, I will discuss the question whether disagreeing perspectives can be beneficial even if there is not much interaction between them. I will build on a suggestion made by Miriam Solomon that dissent in science is epistemically valuable, not because it fosters critical discussion, but because each side of the controversy is associated with particular evidence, that leads to insights, which are useful to the entire domain. In this view, disagreement can be valuable even if no critical discussion between disagreeing camps takes place. This is in fact the case in the current epigenetics controversy.
I show how this result lends support to perspectivism as an epistemological position about how scientific knowledge is generated.

**Epistemic Injustice and Psychiatric Classification**
*Anke Bueter - Leibniz Universität Hannover*

This paper supports calls for an increased integration of patients into taxonomic decision-making in psychiatry by arguing that their exclusion constitutes a special kind of epistemic injustice: Pre-emptive testimonial injustice, which precludes the opportunity for testimony due to a wrongly presumed irrelevance or lack of expertise. Here, this presumption is misguided for two reasons: (1) the role of values in psychiatric classification and (2) the potential function of first-person knowledge as a corrective means against implicitly value-laden, inaccurate, or incomplete diagnostic criteria sets. This kind of epistemic injustice leads to preventable epistemic losses in psychiatric classification, diagnosis, and treatment.

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**The Exposome as a Postgenomic Repertoire:**
**Exploring Scientific Change in Contemporary Epidemiology**
*Stefano Canali - Leibniz Universität Hannover*

In the last decade, a new notion has emerged in epidemiology: the 'exposome', defined as the totality of exposures experienced by individuals. The notion is often presented as a new paradigm for the study of the relation between health and the environment. In the paper, I analyse the conditions in which the exposome was conceived, developed and established. I argue that these point to the establishment of an exposome repertoire, not a paradigm. I use this framework to show the alignment of the epistemic elements of the exposome with material, financial, institutional and technological factors. I argue that some of these factors were transferred from other areas of the life and health sciences, including sequencing, exposure science and biomarkers research. I then discuss the innovations of the exposome in the context of other discussions on the life and health sciences, including postgenomics and data-intensive science.

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**Artificial Intelligence and In/scrutability**
*Annamaria Carusi - University of Sheffield*

Artificial Intelligence is an emerging technology that is frequently invoked as a solution to problems or an enabler of progress in a wide range of contexts, that range across social, commercial, transport and health sectors. As often as high hopes are pinned on the development of Artificial Intelligence, are warnings issued regarding its potentially negative consequences. This presentation will focus on one issue at the forefront of debate around AI, and that is its opacity or inscrutability. This is an issue on which epistemological and ethical concerns converge. The presentation analyses the issue of scrutability and inscrutability, considers its framing in cognitivist and instrumentalist terms, discusses other examples of a similar issue in medical settings, and goes on to give an alternative framing of AI as a socio-technical system that makes the issue of inscrutability more tractable.



EPSA19 **Abstracts**

**Abandoning Models: When Non-Empirical Theory Assessment Ends**
*Cristin Chall - University of Bonn*

It is possible to provide some degree of non-empirical justification for models and theories which lack experimental evidence. This is particularly important in particle physics, where the energies involved make testing difficult. However, this raises the question of which criteria can lead to the abandonment of models in the absence of experiment as a criterion of discrimination. I propose that particle physicists lose confidence and eventually abandon models because of two related factors: decreasing prospects and changes in the perceptions of the underlying problems. First, although non-empirical justifications can preserve the core of these models and theories for a time, as the prospects of finding evidence for new physics diminish, there is an equivalent depreciation of confidence in the models as a consequence of this lack of fruitfulness. Second, changes in the perception of the problems motivating such models can decrease confidence in possible solutions.

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**What Can Cultural Selection Explain?**
*Azita Chellappoo - University of Cambridge*

Despite claims by some cultural evolutionists that progress in the social sciences has been slow, it is undeniable that there is a substantial body of knowledge in disciplines such as anthropology, that study culture using their own frameworks and methodologies. The challenge for cultural evolution proponents is to show that there are significant aspects of culture lacking explanation, and that an evolutionary approach can make meaningful contributions to that understanding. I focus on cultural selection, a research programme which aims to understand sets of cultural phenomena as adaptations. I argue that a lack of attention has been paid to the precise explanatory gains we should expect from utilising cultural selection frameworks, using a case study of the application of cultural selection to sustainability science. I argue that we need to find evidence of cumulative selection in cultural phenomena in order for selection frameworks to give meaningful explanatory benefits.

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**A Real Problem for Unreal Waves:**
**is Bohmian Mechanics Indeterministic?**
*Eugene Chua - University of California, San Diego*

I propose an argument for the indeterminism of a popular version of non-relativistic Bohmian mechanics. On one hand, (1) the particles of Bohmian mechanics have deterministic trajectories; this is often lauded as an selling point of Bohmian mechanics. On the other hand, (2) Bohmian mechanics is also taken to be time-reversal invariant. However, given (3) a popular interpretative approach to Bohmian mechanics which I call the no-wave approach - on which the only quantity intrinsic to the state of a quantum system is the position of particles, and where the wave-function is merely a nomological representation - I argue that (1) and (2) cannot be true at the same time. At least one of (1) - (3) has to go, and by considering five possible replies to my argument, I suggest that (3), the no-wave approach, is the weakest link: forsaking it seems to be the simplest solution to this problem of indeterminism.

**Can Rational Expectation Models Coherently Guide Policy?**
*Christopher Clarke - University of Cambridge / University of Rotterdam*

This paper intervenes in a debate between Le Roy (1995) and Hoover (2001) over the interpretation of macro-economic models, specifically models that assume model-consistent expectations (also known as rational expectations). In particular, they disagree over how it is possible to use these models for policy decisions. Hoover contends that the only coherent way to use these models for policy decisions is to deliberate over the values of the government policy variables in the model. Le Roy, in contrast, contends that the only coherent way to use these models for policy decisions is to deliberate over the values of the disturbance terms in the model.

I argue that any use of model-consistent expectations models for policy decisions involves a degree of incoherence. The extent to which this degree of incoherent is tolerable is ultimately a practical rather than a philosophical matter.

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**Robustness, Invariance to Perturbations, and Multiple Determination**
*Klodian Coko - University of Western Ontario*

I argue that the epistemic strategy of multiple determination (i.e. the epistemic strategy of using multiple, independent procedures to establish "the same" result) is not a form of robustness. There are many characteristics that distinguish multiple determination from robustness. They are all, however, related to the same core difference: whereas the different robustness variants can be considered as involving some invariance to different types of perturbations, multiple determination cannot. Multiple determination is better distinguished by its ability to support a specific type of a no-coincidence argument. Namely, it would be an improbable coincidence for independent procedures to establish the same result and yet for the result to be incorrect. No such argument can be construed from invariance to perturbations.

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**Robots as surrogates for intervention**
*Edoardo Datteri - University of Milano-Bicocca*

Robots have been often used to discover the mechanisms of living system behaviour. The talk will focus on a robot-based methodology for the study of the determinants of collective behaviour – called here surrogative intervention strategy – whose epistemology has never been discussed so far. The idea is as follows. To discover how the behaviour and appearance of an individual living system modulates the behaviour of the group, one replaces the individual with a robot, selectively intervenes on its behaviour and appearance, and observes the resulting collective behavioural changes. Based on the analysis of two representative case studies, it will be argued that the surrogative intervention strategy differs from other epistemic uses of robots widely adopted in biorobotics and Artificial Intelligence which not involve interaction between robots and living organisms. The role of biomimicry and acceptability in surrogative intervention strategies will be discussed too.





**Understanding Scientific Understanding**
*Henk de Regt - Free University, Amsterdam*

It is widely acknowledged that a central aim of science is to achieve understanding of the world around us. But what precisely is scientific understanding, and when is it achieved? In my book Understanding Scientific Understanding (OUP, 2017), I present a philosophical theory of scientific understanding that answers these questions. This contextual theory describes and explains the historical variation of criteria for understanding actually employed by scientists. In my talk I will outline the theory and illustrate it with a historical case study of the genesis of quantum theory in the first decades of the twentieth century. I will show that debates about the nature of scientific understanding, and about the conditions for the intelligibility of physical theories, played a crucial role in this important period in the history of physics.

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**Is Organismic Agency a Mere Heuristic?**
*Hugh Desmond - KU Leuven*
*Philippe Huneman - CNRS Paris*
*Anne Sophie Meincke - University of Vienna*

Denis Walsh - University of Toronto Bacteria swim up a sucrose gradient in order to get better access to the source of sucrose. Upon detection of predators, a vervet monkey may give an alarm call, in order to help others in the group (but at potential cost to itself). When biologists explain organisms' behavior by referring to their goals in this way, then they are using what can be called 'agential explanations'. Such explanations make sense of organisms' behavior as if they were agents with goals.
The received view on organismic agency has long been that it is a mere heuristic: organisms are not really agents and are only represented as such because of explanatory expedience. However, philosophers and biologists are now challenging this view from various perspectives. The proposed symposium draws on general philosophy of science, developments in the extended evolutionary synthesis, and on process ontology in order to make significant progress towards weighing the received view against alternatives.

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**Perspectival realism about mechanistic functions**
*Joe Dewhurst - LMU Munich*

The attribution of a function to a (putative) mechanism plays an important role in mechanistic explanation, both when determining the phenomenon that is to be explained and in developing an explanation of that phenomenon. Advocates of mechanistic explanation must therefore offer some account of functional attribution, and they typically do so either in teleological terms, endorsing the idea that each mechanism has a distinct and determinable proper function, or in completely perspectival terms, where any causal process can potentially qualify as functional. In this paper I will explore an alternative, perspectival realist approach to functional attribution, where the function performed by a mechanism depends on the explanatory context, but is also constrained by objective features of the world, such as the physical structure of the mechanism and its environmental context.

**Contours of Science and Justice**
*Heather Douglas - Michigan State University*

What is the relationship between science and distributive justice? Science is a resource, a source of power for supporting decisions, for categorizing, and for revealing levers of action. As such, it is a matter of justice how this resource is distributed. The history of science over the past century reveals many ways in which the pursuit of science can be structurally unjust as well as ways it can be part of the pursuit of a more just society. I will describe aspects of science and justice in the access to science, the use of human subjects, the relationship with communities, and the shaping of the research agenda. This overview of some of the key aspects of science and justice will be used to show that the values that drive research agendas are not just an ethical matter, but also a political matter. Scientists, and philosophers of science, need to attend not just to ethical values in science but also to power, and how science can ameliorate past injustices and current inequalities.

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**Scientific Metaphysics and the Manifest Image**
*Matthias Egg - University of Bern*

I propose a way forward in debates on scientific metaphysics that have reached a stalemate due to the availability of mutually incompatible but equally well-supported ontological variants of scientific theories. My guiding example is the disagreement between wave function realists and supporters of the primitive ontology approach to quantum mechanics, which is sometimes framed in Sellarsian terms, as a competition between different ways to reconcile the scientific image with the manifest one. I argue that the significance of this framing has not been sufficiently appreciated, because Sellars's notion of the manifest image is actually much richer than contemporary ontologists realize. I demonstrate how the recent shift from doctrines to stances in the understanding of metaphysical positions is a step in the right direction, but needs to be taken further by recognizing the ways in which Sellars's manifest image is much more than just naive physics.

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**Science, public participation, and democracy – why analyses of "pure public" are relevant for philosophical arguments**
*Jaana Eigi - University of Tartu*

Several philosophers of science, including Heather Douglas and Alison Wylie, have recommended some involvement of non-scientists in science. The aim of my presentation is to argue that such arguments can benefit from analyses of public participation initiatives in practice. Specifically, I discuss work on different types of the public, with a special focus on the notion of "pure public" and important criticisms against it. I argue that philosophers who recommend forms of public participation that rely on "pure public" should take these criticisms into account. Philosophical arguments that focus on alternative forms of public participation avoid this issue. Nevertheless, their discussion can also benefit from awareness of different expectations about public participation and different types of the public, since a mismatch may cause disappointment in public participation.





**Black Hole Coalescence: Models and Measurement**
*Jamee Elder - University of Notre Dame*

In this paper, I examine the methodology and epistemology of LIGO, with a focus on the role of models and simulations in the experimental process. This includes post-Newtonian approximations, models generated through the effective one-body formalism, and numerical relativity simulations, as well as hybrid models that incorporate aspects of all three approaches. I then present an apparent puzzle concerning the validation of these models: how can we successfully validate these models and simulations through our observations of black holes, given that our observations rely on our having valid models of the systems being observed? I argue that there is a problematic circularity here in how we make inferences about the properties of compact binaries. The problem is particularly acute when we consider these experiments as empirical tests of general relativity. I then consider strategies for responding to this challenge, especially in light of the advent of multi-messenger astronomy.

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**What's So Spatial About Time Anyway?**
*Peter Evans - University of Queensland*
*Sam Baron - University of Western Australia*

In his recent book, Callender (2017) argues that time can be distinguished from space due to the special role it plays in our laws of nature: our laws determine the behaviour of physical systems across time, but not across space. In assessing the claim that the laws of nature might provide the basis for distinguishing time from space, this talk develops a radical reading of Callender's view and proposes a novel approach to differentiating time and space that we call temporal perspectivalism. This is the view according to which the difference between time and space is a function of the agentive perspective.

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**Is the No-miracles argument an Inference to the Best Explanation?**
*Ludwig Fahrbach - University of Bern*

The No-miracles argument is usually explicated as an inference to the best explanation. I offer an alternative explication, an improved version of hypothetico-deductivism, which states: "If T is a reasonably simple theory, the given body of data D is excellent, and T covers D, then T is approximately true." This principle only refers to the given hypothesis T, not to any rival theo-ries of T. It allows us to infer the truth of T without having to consider any rival theories of T. I argue that this is how the No-miracles argument should be understood.

**The Ontology of Patterns**
*Tiziano Ferrando - Université de Lausanne*

Ladyman and Ross (2007, 2013) propose an ontology of real patterns based on previous work by Dennett (1991) and Ross (2004). Real patterns are supposed to give a precise way of understanding what emergence is and the relation between fundamental physics and special sciences. I argue that although the theory is tenable, it stands in need of elaboration with respect to some relevant issues: (1) Clarify the relation between the three existing approaches to describe real patterns: information-theoretic, statistic, and dynamic; (2) Establish the mind-independence of real patterns; (3) Introduce a notion of ontological dependence between emergent entities; (4) give an account of scale relativity that incorporates ways emergence occurs at scales others than size or time, particularly with respect to energy and complexity. The aim of the paper is to address these issues.

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**A dilemma for informational parity**
*María Ferreira Ruiz - University of Buenos Aires*

Parity claims in biology express the idea that genes and other, non-genetic factors are on a par in some respect, typically causal (i.e. qua relevant causal factors in development). Arguments for causal parity are commonly intertwined with considerations regarding the received view of genes according to which they are information carriers and are thus connected to an informational version of parity, as the idea that genes and non-genetic factors are on a par as information carriers. I contend that arguments leading from causal to informational parity rest upon the assumption that information and causation are undisputedly related. After exposing the underlying conflations in such ways of reasoning, I show that informational parity faces a dilemma: it can either be defended on the grounds of the endorsement of causal parity, or independently of it, but the two roads lead to begging the question of whether genes and non-genetic factors stand on equal foot as information carriers.

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**Concepts of approximate solutions and the finite element method**
*Nicolas Fillion - Simon Fraser University*

I discuss epistemological problems arising from the finite element method (FEM), which is used to solve multidimensional systems with irregular boundary conditions. FEM is the most dependable computational method used by modelers handling complex real-world systems to overcome the inferential opacity of their models. Beyond acceptance grounded in its tremendous practical success, FEM's justification lies in conceptions of good approximation, as it is an inexact numerical method that involves error-control strategies. Yet, its more complex discretization scheme fails to be justified in the traditional asymptotic sense, for it commits so-called "variational crime." I explain how committing such crimes is a paradigmatic violation of epistemological principles that are typically used to make sense of approximation in applied mathematics, and articulate an alternative, context-dependent concept of approximation that is in line with recently developed methods of a posteriori error analysis.





**Causation, Intervention, and Responsibility**
*Enno Fischer - Leibniz Universität Hannover*

In this talk I will present a novel taxonomy of causal claims. Based on the taxonomy I will provide a more fine-grained analysis of the function of these causal claims. In particular, I will indicate which kinds of causal claims are better explained in terms of responsibility than in terms of intervention. This sheds new light on the limitations of the interventionist theory, which has often been considered particularly plausible in explaining the reasons for our interest in causation.

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**The Role of Replication in Psychological Science**
*Samuel Fletcher - University of Minnesota*

The reproducibility crisis in psychological science has led to renewed attention to philosophical aspects of its methodology. In particular, Zwaan et al. have recently argued that direct replications of important experiments in psychology should be made a mainstream component of research in that field. Their argument draws on work in the philosophy of science, in particular Lakatos' Methodology of Scientific Research Programmes and his "sophisticated falsificationism."

I elaborate three problems with their suggestion, and argue for three solutions. Two of these involve weakening their commitment to certain aspects of Lakatos' account of scientific rationality to take into their more circumspect goals. The third involves a new explication of replication itself, which requires distinguishing between replication as an activity from replication as a designation of success; I advocate only for the former.

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**BaBayesianism: On the Origins of Bayesian Hypotheses**
*Nir Fresco and Itzhak Aharon - Ben-Gurion University of the Negev*

The Predictive Processing and Bayesian Inference frameworks have been proposed as empirical and theoretical models of perception, action, and cognition. Underlying these frameworks is the tenet that good predictions increase the posterior probability of the animal's model of the world (a model being a set of hypotheses). Animals operate under uncertainty, and, by assumption, attempt to approximate an "optimal" solution prescribed by Bayesian statistics. But what is the source of the initial hypotheses the animal has at "birth"? When an animal is "born" into a new environment its brain is (a) tabula rasa (an 'empiricist' answer), (b) innately equipped with some initial hypotheses (a 'rationalist' answer), or (c) innately endowed with hypotheses-generating mechanisms (a 'core cognition' answer). What each answer entails depends on what qualifies as a hypothesis, and how these hypotheses-generating mechanisms work neurophysiologically. In this talk, we discuss these three answers.

**Modeling Consensus and consensus models**
*Mathias Frisch - Leibniz University Hannover*
*Eva Barlösius - Leibniz University Hannover*
*Julie Jebeile - Universität Bern*

Our symposium will discuss the epistemic status of consensus forming mechanisms and the interplay between consensus and dissensus in scientific research from an interdisciplinary perspective, bringing together philosophers of science, a sociologist and an economist to explore this issue both conceptually and empirically. Talks will explore this issue from the perspective of judgment aggregation theory, from the perspective of empirical sociology, and from the perspective of climate modeling as in depth case study.

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**Scientific Laws and Closeness to the Truth**
*Alfonso García Lapeña - University of Barcelona*

Truthlikeness is a property of a theory or a proposition that represents its closeness to the truth. Quantitative deterministic laws (QDL) typically have a real function representation in some state-space. According to the similarity approach, truthlikeness for QDL is well defined by the Minkowski metric. We will present some counterexamples to the definition and argue that it fails because it considers truthlikeness for QDL to be just a function accuracy, but an accurate law can be wrong about the actual "causal structure" of the world. We will expose a proposal that defines truthlikeness for QDL according to two parameters: accuracy and nomicity. The first parameter is correctly measure by the Minkowski metric. The second parameter can be measure by the difference of the derivatives. Finally, we will apply our proposal to a real case study. We will estimate the degrees of truthlikeness of four laws (Ideal gas, Van der Waals, Beattie–Bridgeman and BWR) for Nitrogen in its gas state.

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**Modeling Creative Abduction Bayes Net Style**
*Alexander Gebharter - University of Groningen*
*Christian J. Feldbacher-Escamilla - University of Duesseldorf*

Schurz (Synthese 164:201-234, 2008) proposed a justification of creative abduction on the basis of the Reichenbachian principle of the common cause. In this paper we take up the idea of combining creative abduction with causal principles and model instances of successful creative abduction within a Bayes net framework. We identify necessary conditions for such inferences and investigate their unificatory power. We also sketch several interesting applications of modeling creative abduction Bayes net style. In particular, we discuss use-novel predictions, confirmation, and the problem of underdetermination in the context of abductive inferences.





**Similarity of performance as a source of evidence for hypothesis generation and evaluation**
*Raoul Gervais - University of Antwerp*

In this paper, I will explicate and discuss performance-similarity reasoning, or PS reasoning, as a strategy for hypothesis generation and evaluation. It is possible to distinguish at least two types of PS reasoning, one comparing the performance of two systems, and another comparing the performance of two systems under intervention. Briefly, if two systems not only perform a similar capacity, but these capacities are similarly effected under an intervention (e.g. both break down, or both are enhanced), then this constitutes important evidence for mechanistic similarity, as I will illustrate with various examples taken from cognitive science. Thus, although PS reasoning is certainly fallible (I will argue that it is a species of Inference to Best Explanation), it is a widely used strategy in cognitive science, not only for generating hypotheses, but also for evaluating them.

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**Why the world is regular**
*Victor Gijsbers - Universiteit Leiden*

Our world is highly regular. According to the popular Humean theory of laws, however, this is to be regarded as a cosmic accident: there is no underlying metaphysical entity that generates or explains the regularity. Isn't it absurd to believe in such an accident? Galen Strawson and Patrick Cronin have developed this feeling of absurdity into a probabilistic argument against Humeanism. In this talk, I will first argue that their argument – while valid – fails to close off all the escape routes for the Humean. In particular, there is a strategy due to Barry Loewer and Helen Beebee in which the Humean simply extends her original theory by postulating that we live in a highly regular world; as Loewer and Beebee point out, there is no contradiction involved in such a theory. However, I will then go on to show that this escape route can be closed through a judicious appeal to David Lewis's Principal Principle. Hence, it will turn out that the Humean account of laws is indeed absurd.

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**A Causal Account of Initial Distributions**
*Márton Gömöri - Institute of Philosophy, Hungarian Academy of Sciences*

Probabilities employed in describing deterministic dynamical systems, such as in classical statistical mechanics or in gambling games, are often referred to as "deterministic probabilities." Many believe that the main issue in understanding deterministic probabilities is to account for the meaning and emergence of probability distributions over initial conditions pertaining to the deterministic dynamics in question. In the talk, I will propose a reformulation of this problem that doesn't invoke probabilistic terms but instead refers to finite frequencies. I will then point out that standard considerations—appealing to the principle of indifference, the method of arbitrary functions, the notion of typicality, and objective randomness—don't provide a satisfactory answer to the reformulated problem. Lastly, I will outline a new answer based on the notion of causal independence, with its central ingredient being the Principle of the Common Cause.

**How to understand causal claims about changing microbiota in an aging host?**

*Gregor Greslehner - Université de Bordeaux*
*Maël Lemoine - Université de Bordeaux*

Changes in microbial composition - taxonomically and functionally - greatly impact the physiology of its host. While relatively stable throughout the adult life, microbial composition changes considerably at the beginning and end of the host's life. The main question is now: is this change in microbiota composition cause or effect of the host's aging? We argue that while certain microbial phenomena are clearly an effect of processes belonging to the host's aging, particular microbes can be attributed a causal role in phenomena that are part of the host's aging. We think that spelling out the mechanistic details of these phenomena and processes is more promising than pitting generalized causal claims in either direction against each other. This should go with a proper analysis not only of the presumptive cause, the microbiota, but also of its purported effect, aging. Thus, the bidirectional relationship of interactions between host and microbiota becomes structured and comprehensible.

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**Ambiguity and symmetry in the Past Hypothesis**

*Sean Gryb - University of Groningen*

Many processes in Nature are known to occur in a time-directed way despite the fundamental time-symmetry of the known fundamental laws of physics. A popular explanation for this is to postulate an unimaginably unlikely state for the early Universe, a `Past Hypothesis', that seeds a time-asymmetry from which all others follow. I will first briefly review the logic of the Past Hypothesis and then draw upon both existing and original lines of criticism to provide a systematic analytic framework for assessing its status. I outline three broad categories of criticism of the proposal and identify a list of key assumptions that these critiques put into question. I then advance an argument that establishes a fundamental obstruction to obtaining an appropriate typicality measure that is simultaneously unique and invariant under all cosmological symmetries. Taken together this analysis raises significant challenges for using any version of a Past Hypothesis as an explanation for time-asymmetry.

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**Bad arguments against naturalism in the philosophy of social science**

*Francesco Guala - University of Milan*

In the philosophy of social science naturalism is still facing a strong opposition from influential scholars who argue that philosophical analysis must be autonomous from scientific investigation. Anti-naturalists exploits philosophers' traditional diffidence toward social science and nurture the ambition to provide new foundations for social research. A classic anti-naturalist strategy is to identify a feature of social reality that prevents scientific explanation and prediction. An all-time favourite is the dependence of social phenomena on human representation. I will examine two prominent versions of the dependence thesis and conclude that they both fail. Contemporary social science is capable of accounting for the causal dependence of social reality on representation, and there is no reason to believe that social entities are ontologically dependent on the acceptance of so-called constitutive rules.





**Alternatives to Robustness**

*Marie Gueguen - University of Western Ontario*

While the Cold Dark Matter model is well supported by evidence on large scales, it does not fare well on small scales, where simulations do not reproduce the observed abundance and demographics of dark matter halos. Since these properties are the prime discriminators between different dark matter models, predicting them accurately is crucial for determining the nature of dark matter. At such a scale though, only numerical approaches to determining them are possible; and understanding in which case a simulation can succeed in (dis)confirming a model is still a challenge. In other disciplines, such as biology, this question has been addressed through robustness analysis. In this talk, I will argue that robustness is not a sufficient criterion for determining when a simulation is reliable and that alternatives to robustness should be pursued. I motivate the use of crucial simulations, meant to put the numerical or physical origin of a prediction under a crucial test.

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**How strong is the argument from inductive risk?**

*Tobias Henschen - University College Freiburg*

Jeffrey objects to the so-called argument from inductive risk that the activity proper to the scientist is the assignment of probabilities to hypotheses, and not the acceptance or rejection of hypotheses. And Levi can be read as objecting that the argument is ambiguous: that its premises switch between decisions to believe and decisions to act, that only the latter presuppose value judgments, and that the scientist qua scientist only needs to decide what to believe. The paper is supposed to defend these objections against counter-objections raised by Rudner, Douglas, and Wilholt. It will argue against Rudner and Douglas that Jeffrey's objection doesn't lead into a vicious regress, and against Wilholt that Levi's conception of a decision about what to believe is accurate in the case of particle physics, and that there is no a priori reason why the same conception should not be applicable in special sciences at the upper levels.

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**Commutativity, simultaneous measurability, and contextuality in the Kochen-Specker arguments**

*Gábor Hofer-Szabó - Research Center for the Humanities, Budapest*

Kochen-Specker arguments are devised to prove that quantum mechanics does not admit a noncontextual ontological (hidden variable) model. If noncontextuality is understood as the robusticity of the systems' response to a measurement against other simultaneous measurements, then, for the Kochen-Specker arguments to be effective, one needs to assume that commuting operators represent simultaneous measurements. In the paper Kochen-Specker arguments will grouped into different types according to how many sets of mutually commuting operators do not represent simultaneous measurements. The different types will be investigated concerning their efficacy to prove quantum contextuality. It will be argued that there is no state-independent (algebraic) Kochen-Specker argument proving quantum contextuality in the above sense.

**A constructive critique of Hausman's "standard model" of choice**
*Paul Hoyningen-Huene - Leibniz Universität Hannover*

In his 2012 book *Preference, Value, Choice, and Welfare*, Daniel Hausman has presented a "standard model" of choice in economics, based on his view of preferences as total subjective comparative evaluations. This model has several weaknesses. 1. In examples that should illustrate the effect of belief in addition to preferences, the belief in fact forces a reworking of the preferences. 2. Some connections between the elements of the model are missing, and 3. the interesting case of external moral constraint discussed in the book is not represented. 4. Choice and action are treated simultaneously, which leads to unclarities regarding the effects of the constraints themselves and of beliefs about constraints. 5. Contra Hausman, some of the arrows do not represent causal relations, but complicated epistemic relations. After discussing these weaknesses and correcting them, I shall present an "improved model of choice".

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**How Laws Explain**
*Andreas Hüttemann - Universität zu Köln*

In this paper I argue that laws explain in terms of what I call internal generalisations. A consequence of this view is that laws don't explain their instantiations.

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**Exploring biological possibility through synthetic biology**
*Tero Ijäs - University of Helsinki*
*Rami Koskinen - University of Vienna*

This paper analyzes the notion of possibility in biology and demonstrates how synthetic biology can provide understanding on the modal dimension of biological systems. Two prominent strategies for this are identified and analyzed: the design of functionally new biological systems and the redesign of natural systems. These approaches allow synthetic biologists to probe systems that are not normally evolutionarily accessible. Furthermore, we draw a distinction between knowledge about global biological possibility and knowledge about more or less local contrafactual scenarios. We argue that synthetic biology presents one method to explore biological possibility and assess the relative plausibility of evolutionary alternatives. Subsequently, these results in synthetic biology can also be relevant for the discussion on evolutionary contingency, providing new methods and insight to the study of path-dependence of biological traits as well as the prevalence of various biological constraints.





**Mechanisms as Causal Pathways**
*Stavros Ioannidis - University of Athens*

A main aim in the recent mechanistic literature has been to find a common and general notion of mechanism in the sciences that is present in diverse scientific fields. Such a concept is assumed to have both methodological value, as well as ontological significance: it can be used to understand scientific practice, but also to construct a comprehensive metaphysics of nature. The main claim of this paper is that it is not at all clear whether such a notion can fulfil both these roles at once. In particular, I will argue that a promising candidate for the methodological role of mechanism is a Causal account of Mechanism (CM), according to which a mechanism is a causal pathway that produces a phenomenon. By using examples from molecular biology, I will argue that CM, in contrast to prevalent general notions of mechanism, is ontologically minimal and I will defend it against the criticism that the notion of constitution is necessary in understanding what a mechanism in science is.

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**Time and Physical Modality:**
**Problems with Callender's Best Systems Project**
*Lucy James - University of Bristol*

I criticise Callender's use of the Best Systems Account of laws of nature (the BSA) to unify features of time on two counts: the first focuses on the unsuitability of the BSA in general, and the second focuses on the restrictiveness of the way in which Callender applies it. I respond to my first objection by suggesting a more flexible notion of physical modality, inspired by the BSA but with a more realistic portrayal of the role of mathematical form. I respond to my second objection by expanding the domain of inquiry, drawing comparisons between the form of the physical laws identified by Callender and that of a different but related set of laws. Finally, I close with some remarks about what this shows us about connections between time and modality in general.

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**Are intentions necessary for self-deception?**
**Exploring the limits of the predictive processing paradigm**
*Marko Jurjako - University of Rijeka*

The prediction error minimization (PEM) framework comprises a family of views that provide a unified account of perception, cognition, and action. In the paper, I use self-deception as a case study for exploring the limits of the PEM framework. The argument goes as follows. Self-deception presupposes the belief-desire psychology. PEM seems to eschew the concept of desire. Thus, PEM cannot capture standard cases of self-deception. However, some authors argue that intentions are necessary for explaining self-deception. It seems that PEM has resources to capture intentions, at least construed as beliefs about what one will do. I dispute the claim that intentions are necessary for self-deception. Moreover, I explore in what way this discussion indicates that a proper explanatory framework for capturing high-level phenomena such as self-deception requires reliance on psychological constructs (e.g. personality traits) that seem to outstrip the conceptual framework of the PEM paradigm.

**Explanation in Psychiatry:**
**From Pluralism to Integration – and Back Again?**
*Lena Kästner - Saarland University*
*Josephine Lenssen*
*Matteo Colombo - Tilburg University*
*Markus Eronen - University of Groningen*

Psychiatry is characterized by multiple approaches - genetic, neurological, pharmacological, psychological, behavioral - each revealing some aspect of mental illness. It is also characterized by a plurality of classificatory and diagnostic schemes, and diverse strategies for explanation and treatment. This symposium examines to what extent plurality is an ineliminable feature of psychiatry and what explanatory approaches may promote epistemically valuable integration. Specifically, it will address two sets of questions: How can relevant variables and causes be identified for a given psychiatric phenomenon? And how can relevant factors be integrated for the purposes of explanation and effective treatment? Bringing concepts and tools from mechanistic explanation, network analysis, and computational modeling to bear on detailed case studies, this symposium will advance our understanding of the plurality inherent in psychiatry and of the explanatory frameworks that can accommodate it.

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**Explanation and Effective Field Theories**
*Martin King - University of Bonn*

Since the Higgs boson discovery in 2012, there have been no indications of physics beyond the standard model (BSM). Concrete BSM models have been pushed to the edges of their parameter spaces and as a result model-independent approaches, such as effective field theories (EFTs), have become increasingly popular in particle physics. The EFTs employed in new physics searches at the Large Hadron Collider (LHC) are what are known as bottom-up EFTs and are quite distinct from the top-down ETFs that have been more thoroughly treated in the philosophical literature. The aim of the paper is to examine the role of bottom-up EFTs in potentially explaining new physics. I argue that EFTs can differ significantly with respect to their ability to explain, depending on whether they are top-down or bottom-up.





**Biological Individuality and the Metaphysics**
**of Mammalian Reproduction.**
*Elselijn Kingma - University of Southampton*
*Arantza Etxeberria - University of the Basque Country UPV/EHU*
*Suki Finn - University of Southampton*
*Alexander Geddes - University of Southampton*

Every mammal is the product of a pregnancy: something ubiquitous, utterly familiar and taken for granted but, simultaneously, exotic, deeply puzzling and philosophically challenging. Philosophers have explored some issues related to pregnancy, most obviously abortion and the value and metaphysics of coming into existence, but have paid relatively little philosophical attention to the actual biological processes of pregnancy. That is a remarkable omission since pregnancy raises many fascinating philosophical questions.

This symposium focuses on questions at the level of the organism, at the intersection of metaphysics and philosophy of biology. We aim to develop a biologically informed metaphysics of pregnancy, connecting pregnancy with the philosophy of science in two directions. Firstly, applying contemporary literature in philosophy of biology can improve our understanding of pregnancy. Secondly, considering pregnancy may improve our understanding of biological individuality.

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**Algorithmic Causal Modeling as a More General Model of Inductive**
*Inference David Kinney - Santa Fe Institute*

Probabilistic approaches to causal inference are beset by several inductive problems. As just one example, it is possible that the structure of a causal graph is not faithful to the probability distribution over that graph, due to cancelling causal paths. This possibility can hinder our ability to learn the true causal structure of a system from observational data. In this talk, I will argue that approaches to causal modeling based on Kolmogorov complexity, rather than probability, avoid this problem.

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**Understanding the Climate System**
**and the Dilemma of Data-Driven Models**
*Benedikt Knüsel - ETH Zürich*

In this paper, we develop a framework to assess the adequacy of a climate model to provide understanding that allows for different degrees of understanding. We then apply it to assess whether data-driven models built with machine learning can be used for obtaining understanding of aspects of the climate system. We argue that data-driven models face a dilemma: They are in principle adequate for providing understanding of aspects of the climate system under some circumstances. However, in these cases, process-based models could typically be constructed that allow to obtain to a higher degree of understanding. In situations in which process-based models cannot be constructed, the lack of restrictive background theories and the opacity of machine learning methods impair the adequacy of data-driven models for providing understanding. We conclude by suggesting ways in which machine learning can still be useful for the purpose of understanding in climate science.

**Model-based Theorizing: An Artefactual Account**
*Tarja Knuuttila - University of Viena*

In the current discussion, several philosophers have argued that model-based theorizing makes use of a particular epistemic strategy: surrogate reasoning. More often than not, models as surrogate objects are envisaged in terms of abstract structures or fictions. In contrast, I will argue for an artefactual approach to modelling. The artefactual account focuses on the erotetic function of modelling and the various external representational tools used in model construction that enable, but also delimit scientific reasoning. Models as epistemic artefacts are designed in view of some pending scientific questions, allowing for further exploration and repurposing. I will exemplify the artefactual account through an example from synthetic biology that showcases the different modes and media that models can embody.

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**Non-causal understanding via spatially embedded networks in the brain**
*Daniel Kostic - University Bordeaux Montaigne*

I argue that the explanation of spatial embedding of networks in the brain provides understanding that is factive, but due to the fact that such topological explanation is non-causal, the facticity that it provides is different in kind from facticity via causal explanations. Given that the topological explanation explains by describing mathematical counterfactual dependency relations between topological variables in the network, which hold in virtue of axioms and proofs in graph theory, the representational falsehoods involved in the idealizations don't affect the facticity of understanding, because the truth of propositions that describe the topology of the network does not depend on the representational fidelity in the first place.I conclude that the distinction between different kinds of facticity (causal and non-causal) perhaps better accommodates the diversity of scientific explanatory practices than the distinction between factivism and non-factivism.

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**Foundational Issues in Climate Science and Climate Modelling**
*Vincent Lam - University of Bern*
*Claus Beisbart - University of Bern*
*Margherita Harris - London School of Economics*
*Wendy Parker - Durham University*

This symposium investigates crucial epistemic and methodological issues in climate science and climate modelling from a philosophy of science perspective. The expectation is that such investigations of the methodological and epistemic foundations of climate science and climate modelling may help to provide a better understanding of the climate challenge and of the various ways to address it (e.g. through appropriate decision- and policy-making). The speakers will address central foundational issues related to confirmation, reliability, uncertainty characterization and extreme weather events attribution in the context of climate science and climate modelling. The symposium will allow ample discussion time, thereby providing an excellent opportunity for addressing these foundational issues crucial to the climate challenge.





**Progress on the Entropy-Limit Conjecture**
*Juergen Landes - LMU Munich*

Soroush Rafiee Rad and Jon Williamson Carnap hoped to isolate a single inductive logic that could be applied both to assess the extent to which evidence confirms a scientific theory and also for inductive inference within science itself. One reason why Carnap's programme faltered is that he only managed to isolate a continuum of inductive logics. Recently, researchers have attempted to develop an inductive logic based on the maximum entropy principle. However, two different ways to do this have emerged in the literature, each with its merits. Again, this multiplicity of approaches seems to confound the search for a canonical inductive logic. However, it has been suggested that the two methods for implementing the maximum entropy principle agree where they can both be applied. We show in this paper that this entropy-limit conjecture holds under a range of general conditions. We thus offer further inductive support for the conjecture and thereby for the inductive logic programme.

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**Biases in the Sciences and Science-Based Policy**
*Jürgen Landes - MCMP LMU Munich*
*Lorenzo Casini - University of Geneva*
*Bennett Holman - Yonsei University*
*Saana Jukola - Bielefeld University*

Incentive structures in and outside science have resulted in biased research(ers). While there has been much recent work on biases in medicine, biases in nutrition science have received scant attention. Jukola discusses the different standards for evidence in nutrition research and medicine and concludes that the recommendation to include sustainability as a goal of the Dietary Guidelines for Americans can be taken to be science-based and not representing political bias. Holman explores the role of the sugar industry in dietary guidelines and shows that incentive structures can bias an epistemic community without corrupting any individual community member.
Landes presents a paradox in social epistemology regarding the assessed bias of groups of scientists. He explains the paradox and argues that science is in need of good PR. Casini discusses 3 strategies for obtaining confirmation from meta-analyses of biased RCTs, and argues that a combination of these strategies must be used.

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**Competing Scientific Traditions Integrated Through Interdisciplinary Development of Mathematical Constructs as Epistemic Templates**
*Chia-Hua Lin - University of South Carolina*

This paper reports a case study of how the interdisciplinary development of a mathematical construct called formal language theory (FLT) integrates two unlikely scientific traditions into one research field in cognitive biology. FLT is the study of mathematically defined languages, originally constructed by Chomsky to investigate natural languages.
Recently, cognitive biologists have been applying FLT experimentally to test artificial grammars learning (AGL) in nonhuman animals. I argue that crucial to developing this FLT-powered AGL experiment are two episodes of interdisciplinary exchange: (1) the exchange between linguistics and psychology, and (2) the exchange between linguistics and computer science. Together, these two episodes pave the way for the cognitive biologists to integrate the behaviorist and the cognitivist approaches by introducing animals model organism to inform the study of human linguistic capacity.

**Quantisation as a method of discovery: the nature and prospects of quantisation approaches to quantum gravity**

*Niels Linnemann - Université de Genève*

Given that quantisation is a highly ambiguous mapping from a classical to a quantum theory, why think that quantisation can be a sensible rationale for the theory change from general relativity (GR) to quantum gravity (QG) at all? In the first half of my talk, I will work out that we in fact face a genuine challenge here, and argue that we can only address it through the imposition of well-chosen principles. Quantisation thereby provides the ideal showcase for demonstrating the centrality of principles in theory construction.
Under the question for the prospects of a specific quantisation project such as that of gravity, lies an arguably even deeper and more general one: What kind of procedure is quantisation? I will address these issues in the second part of my talk. For this, I will cash out the saying that quantisation is a form of recipe for translating between two theoretical frameworks --- namely a classical and a quantum one.

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**Time symmetry in three dimensions**

*Cristian López - University of Buenos Aires / University of Lausanne*

The aim of this presentation is to assess the role that time symmetry plays in philosophy of physics and metaphysics of time in drawing metaphysical conclusions about the nature of time. I shall pursue my analysis in light of the following questions: (i) What is symmetry supposed to be predicated of?, (ii) What is any symmetry transformation supposed to act upon and to perform?, and (iii) What role is any symmetry supposed to play in physical theories? I propose that all three questions should be analyzed along three dimensions: (a) modal, (b) metaphysical, and (c) heuristic. In particular, I argue that questions (i)-(iii), when looked through these three dimensions, admit of divergent answers that may steer our understanding of time symmetry towards different directions. This, I conclude, leads to different consequences for philosophical concerns that have heavily relied on the notion of time symmetry, for instance, whether time is objectively directed.

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**Asymmetry and the Geometry of Reason**

*Stefan Lukits - British Columbia Institute of Technology*

The geometry of reason is the view that the underlying topology for credence functions is a metric space, on the basis of which axioms and theorems of epistemic utility for partial beliefs are formulated. It implies that Jeffrey conditioning must cede to an alternative form of conditioning. The latter fails a long list of plausible expectations. One solution to this problem is to reject the geometry of reason and accept information theory in its stead. Information theory comes fully equipped with an axiomatic approach which covers probabilism, standard conditioning, and Jeffrey conditioning. It is not based on an underlying topology of a metric space, but uses a non-commutative divergence instead of a symmetric distance measure. I show that information theory, despite initial promise, also fails to accommodate basic epistemic intuitions.



EPSA19 **Abstracts**

**The Case for Bidualism in the Interpretation of Algebraic Quantum Field Theory**

*Tracy Lupher - James Madison University*

In algebraic quantum field theory (AQFT), the main interpretive options philosophers have discussed include algebraic imperialism, Hilbert space conservatism, universalism, and the coalescence approach. One of the key motivating factors for these positions has been their attitude towards the appearance of unitarily inequivalent representations (UIRs) of an abstract algebra of observables. The algebraic imperialist and Hilbert space conservative deny that UIRs have physical significance, while the universalist and coalescence approach advocate argue that UIRs can have physical significance.
A new interpretation of AQFT at the abstract algebra level, which I call bidualism, provides a unified mathematical formalism for comparing different UIRs, solves Ruetsche's [2011] concerns about "parochial" observables, and shows how universalism and bidualism are connected.

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**Morals from minimal structural essentialism in philosophy of spacetime**

*Damian Luty - Adam Mickiewicz University*

The main aims of my presentation are a) to analyze and to criticize D. Glick's minimal structural essentialism (henceforth: MSE); b) to draw some positive morals from MSE. I shall argue: i) why MSE leads to arbitral selectivism towards the space of solutions of Einstein field equations; ii) why the distinction between actual and possible structure is rendered useless in MSE; iii) why the explanation of GP provided by MSE is highly obscured by the ambiguity of what type of structure really counts when it comes to the possibility of being "obtainable" in the world.
Finally, I will formulate my main claim: that MSE points towards a possibility of in-world structural individuation of fundamental objects such as spacetime points. This in-world structural individuation of spacetime points yields a very special type of objects – non-individuals Lowe called "quasi-individuals". I shall argue why non-essentialist approaches are more suitable in this context.

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**Towards a theory of interdisciplinarity**

*Miles Macleod - University of Twente*

In this paper I propose a theoretical account of interdisciplinary collaboration which supports several generalizations we can see in interdisciplinary research practices. This account draws on an understanding of the structure of interdisciplinary problem spaces and of the cognitive structure of scientific disciplines. Aspects of both tend to predict that most interdisciplinary integration when it occurs will be relatively conservative, and exploit modification to less embedded comparatively downstream principles and practices. Understanding current practices in these theoretical terms helps to understand why institutional reforms and incentives often fail to produce high-level integration.

**Knowledge Transfer and Its Contexts**
*Carlo Martini - UniSR (Milan) and University of Helsinki*
*Chiara Lisciandra - University of Groningen*
*Catherine Herfeld - University of Zurich*

In this symposium, we will present and discuss a number of cases from the natural and the social sciences that illustrate some of the main aspects that enable and constrain the process of knowledge transfer across contexts. Scientific research is characterized by a tension between specialization and pluralism on the one hand and interdisciplinarity and unification on the other. As examples, climate change and economic exchanges on global markets are issues whose study calls for the combination of different disciplines and expertises. Pursuing an interdisciplinary approach, however, often entails the transfer of highly specialized theories, concepts, methods, and models that were originally targeted towards specific problems to problems that are in the domain of several other disciplines. In subsequent applications, such theories, concepts and models become removed from their original 'epistemic habitat' and are applied as multipurpose tools for distinct goals and in various contexts.

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**Data-driven science and the applicability of mathematics**
*Colin McCullough-Benner - University of Leeds*

Work on the nature of mathematical scientific representations typically focuses on the role of mathematics in formulating scientific theories and idealized models. However, recent computational data analysis techniques have yielded mathematical representations that fit comfortably in neither category. In these cases, general-purpose mathematical techniques are used to produce answers to specific questions without aiming to find a mathematical structure appropriately morphic, even in a very loose sense, to the structure of the general phenomenon under consideration. Focusing on the examples of artificial neural networks and clustering algorithms, I argue that these representations highlight shortcomings of the standard account of mathematical scientific representations, the mapping account, and favor the robustly inferential conception of mathematical representation proposed by McCullough-Benner (forthcoming).

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**Revisiting instruments in biology from a project knowledge perspective: A comparative look at two research projects in behavioral genetics**
*Robert Meunier - University of Kassel*

The paper provides an account of instruments in biology based on the notion of project knowledge, which includes goal knowledge, i.e. knowledge about the kinds of possible results one might achieve, as well as methodological knowledge, i.e. knowledge about suitable strategies to achieve a given goal. On this basis questions of theory-ladenness are reconsidered, the intrinsic historicity of instruments and the creativity of the design process as well as the question of the nature of epistemic activities are addressed. Finally, the notion of perspectives constituted by different practices is discussed. The account is developed based on a case study from behavioral genetics in the 1960s. The respective research projects of Jerry Hirsch and Seymour Benzer are analyzed. Tensions are reconstructed in terms of different approaches in genetics embodied in different screening instruments.



EPSA19 **Abstracts**

**Structural and organisational conditions for being a machine**
*Guglielmo Militello - University of the Basque Country & IAS Group*

Although the analogy between macroscopic machines and biological molecular devices plays an important role both in the theoretical framework of both neo-mechanistic accounts and nanotechnology, it has recently been claimed that certain complex molecular devices (consisting of biological or synthetic macromolecular aggregates) cannot be considered machines since they are subject to physicochemical forces that are different from those of macroscopic machines. This paper aims at exploring the structural and physicochemical conditions that allow both macroscopic machines and some microscopic devices to do work and perform functions through a combination of elemental parts. In spite of some important structural and organisational differences, the paper identifies a common conceptual core that allows us to consider some molecular devices 'machines'.

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**Making use of inconsistent empirical literature**
*Robert Mróz - University of Warsaw*
*Mariusz Maziarz*

Quantitative studies of observational data are susceptible to the phenomenon of recalcitrant results – even though the same or similar data-set is analysed, authors of separate studies come up with contrary answers to the same questions. In fields such as econometrics, epidemiology, or nutrition science the existence of models implying inconsistent policy actions undermines drawing informative conclusions from empirical literature. As a first step towards proposing guidelines for making useful inferences, we focus on existing methods of analysing empirical literature (meta-analysis, systematic literature review) and provide a critique. We then conceptualise new approaches to dealing with recalcitrant results on the basis of these methods. We also show how these methods of drawing informative conclusions work in practice by discussing a case study of inconsistent empirical literature.

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**Towards a Philosophy of Sustainability Science**
*Michiru Nagatsu - University of Helsinki*
*Miles MacLeod - University of Twente*
*Milutin Stojanovic - University of Helsinki*
*Henrik Thoren - Helsinki University*
*Evelyn Brister - Rochester Institute of Technology*

Sustainability science is a new and increasingly important field of research devoted to exploring the constitution of—and pathways to—sustainability in human-nature systems. It is a field marked by inter- and transdisciplinary ambitions. Sustainability science is often thought to be radically integrative and inclusive in bridging the divide between the natural and social sciences and as well as the science–society boundary. This raises important and unresolved conceptual and methodological challenges. What is sustainability? How central methodological and conceptual issues shape the cognitive scaffoldings that support interdisciplinary efforts? How can scientific quality and rigour be maintained in radically collaborative research? How are epistemic virtues to be protected and promoted in transdisciplinary science? How should conflicts and trade-offs between different non-epistemic values (e.g. economic, social and ecological) be negotiated among researchers as well as stakeholders?

**Prediction markets and extrapolation**
*Robert Northcott - Birkbeck College*

The extrapolator's circle states, roughly, that in order to extrapolate a model or causal relation it is necessary to know that it applies in a new domain, but that in order to establish the latter it is necessary in turn to examine that new domain – which is precisely what extrapolation is supposed to enable us to avoid (Steel 2008). Prediction markets are markets for placing bets on future events. They have a track record of predictive success of events in new domains. Individual traders on a market might make any number of theoretical assumptions, but the market maker need presuppose almost no theory whatsoever. Prediction markets are thus mechanisms that extrapolate easily because they require unusually minimal assumptions. In particular, they require only that there exist some informed traders, plus that there is sufficient market liquidity, available data, legal infrastructure, and so forth. Thus, where applicable, they solve the extrapolator's circle.

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**Is there a Bayesian justification of hypothetico-deductive inference?**
*Samir Okasha - University of Bristol*
*Karim Thebault - University of Bristol*

Many philosophers have claimed that Bayesianism can provide a justification for hypothetico-deductive (H-D) inference, long regarded as a cornerstone of the scientific method. Following up a remark of van Fraassen, we analyze a problem for the putative Bayesian justification of H-D inference in the case where what we learn from observation is logically stronger than what our theory implies. We show that in such cases the simple Bayesian justification does not necessarily apply. We identify a set of sufficient conditions for the mismatch in logical strength to be justifiably ignored as a ``harmless idealization''. Finally we argue, based upon scientific examples, that the pattern of H-D inference of which there is a ready Bayesian justification is only rarely the pattern that one actually finds at work in science. Whatever the virtues of Bayesianism, the idea that it yields a simple justification of a pervasive pattern of scientific inference appears to have been oversold.

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**An Internal Realist Interpretation of the Primitive Ontology Programme**
*Andrea Oldofredi - Université de Lausanne*

Recently, new developments of the Primitive Ontology (PO) programme has been proposed in order to defeat Laudan's Pessimistic Meta-Induction (PMI) on the one hand, and to provide a theory-independent fundamental atomistic ontology on the other. Against this background, this essay aims to achieve two main results. Firstly, it will be shown that the PO programme is unable to overcome the classical anti-realist arguments, i.e. underdetermination of theories by empirical evidence and the PMI. In the second place, I will argue that the PO approach should be interpreted as an internal realist perspective. It will be explained that the proposed internal realist interpretation is more apt to faithfully represent the ontological commitment and its limits implied by the endorsement of a given PO theory - being closer to the original scope of the PO programme with respect to its new advancements, and able to avoid their weaknesses.





**Computing and Modelling: Analog vs. Analogue**
*Philippos Papayannopoulos - Hebrew University of Jerusalem*

The talk examines aspects of the interplay between computing and scientific practice, with particular focus on analog computing. Although mainly neglected today, analog computing has been the main computing paradigm used in science up until the 1980s, when only replaced completely by digital computing. The motivation for this study is that investigating what people have been doing in scientific practice for centuries and calling it "computation" can give us new perspectives on the nature of computing per se, as well as on properties of analogical reasoning; perspectives that are missed insofar as computing is solely considered in its modern classical (silicon-based) form. In this talk, we are primarily concerned with the following matters: (a) the nature of computation as an epistemic process and the role of representation in it (b) the analog/digital dichotomy, (c) the interrelationships between analog computational modelling, analogue (physical) modelling, and analogical reasoning.

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**New Theories of Probability**
*Matthew Parker - London School of Economics*
*Davide Rizza - University of East Anglia*
*Leon Horsten - University of Bristol*
*Nicholas DiBella - Bilkent University*

Recent years have seen increased interest in theories of chance and credence that differ from the standard Kolmogorov theory, often motivated by the example of a fair infinite lottery. These include qualitative and non-Archimedean theories and Norton's infinite lottery logic. The virtues and limitations of these theories are hotly debated. We advance these debates and extend formal results on the theories. Rizza draws from the debate general criteria for a satisfactory probability theory, and develops a solution based on the idea of a measuring stick or numerical scale. Horsten, with Brickhill, constructs a Non-Archimedean Probability (NAP) over the entire universe of sets. DiBella shows how qualitative conditional probability addresses many of the concerns that motivated hyperreal probabilities. Parker extends Norton's infinite lottery logic by relating chances across outcome spaces.

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**Unusual Cooperation**
*Paternotte Cedric - Sorbonne Université*
*Jaffro Eva - Sorbonne Université*

Evolutionary explanations for cooperative traits abound nowadays. However and surprinsingly, there exists a high number of cases of unusual cooperation, many of which challenge traditional explanations. So why does the theory of cooperation not appear to be in crisis or at least threatened? We first gather and describe a varied set of fifteen cases of unusual, non-human cooperative entities, factors or traits, and highlight the explanatory challenges they pose. We then argue that they do not in fact constitue anomalies for the theory of cooperation. This is due, first to a peculiarity of this theory, namely the multiple realisability of its explanatory processes, factors and strategies; second, to the high quantity, and limited availability of data needed to eliminate or back up any one of the possible explanations on the market. As a consequence, the theory of cooperation, though falsifiable in principle, hasn't been yet challenged in practice.

**From the biological world to statistical theories: nineteenth-century**
*lessons for twenty-first-century philosophy of biology*
*Charles Pence - Université catholique de Louvain*

Philosophers of biology have expended a great deal of effort to understand the broad-scale causal structure of evolution. What kind of processes are selection, drift, mutation, and so on? What role do commonly studied properties like fitness, population size, etc. play within these processes? Often, the answers to these questions are taken to be peculiar to the biological context, and to result from contemporary philosophical reflection on probabilistic causation and statistical inference. It is my goal in this talk to offer the first half of an argument that this is mistaken. I will argue here that these kinds of questions are not a novel product of the philosophical literature, but rather have been with us since the introduction of statistics and chance into evolutionary theory in the last decades of the nineteenth century. Reconnecting with the history of this debate, I claim, will help us construct a clearer picture of the stakes both in the historical and the contemporary context.

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**Naturally, Moral Parametricism**
*João Pinheiro - University of Lisbon*

This presentation explores the consequences of moral parametricism, a corollary of evolutionary moral realism.
We begin by introducing the received view about the function of morality, that it evolved by maximizing the benefits of living in cooperative societies, and explain how some metaethicians and evolutionary anthropologists used this adaptationist hypothesis to further suggest that moral facts are grounded in facts about cooperation. Having done this, we argue that this latter view – call it evolutionary moral realism –, must take into account that cooperation's evolution is dependent on environmental conditions. Thus, moral facts, and the truth of moral propositions they allow to evaluate, must be parametrized – we call this moral parametricism, as suggested by Scanlon [1998:329]. With the help of evolutionary game theory, this presentation explores some of the natural consequences of moral parametricism, such as epistemic moral relativism and ethical pluralism.

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**Extended heredity in biomedicine : perspectives and challenges**
*Gaëlle Pontarotti - Université Paris-Diderot*

During the last few years, many studies have suggested that the gene-centered theory of heredity should be extended so as to include epigenetic marks, social behaviors, microorganisms and parts of the environment in biological legacies. While a great number of authors have discussed the potential effects of this extension in evolutionary biology, very few have questioned the theoretical and practical perspectives linked with the integration of a widened theory of heredity in biomedicine. The aim of this talk is to provide an overview of these perspectives.
After insisting on the challenges associated with the construction of an operational extended notion of hereditary disease that could find its place in the medical theory, I will show that such notion would be related to a complex etiology that has to be carefully outlined. I will then explore some effects of this revised etiology on the medical classification. Finally, I will question the practices that could be derived from it.





**Measurement and Identity:**
**On the History of the Electron's Charge-to-Mass Ratio**
*Jan Potters - University of Antwerp*

The electron is a paradigmatic entity within the realism-debate, since its history has been one of incompatible theories, which problematizes whether science is on the way towards a correct description. Recently some have argued that its identity can be characterized as a stable accumulation of experimental measurements. Here, I will argue that regarding its charge-to-mass ratio, its early history was also one of dispute, since many experiments were carried out within the debate between the electromagnetic view and relativity theory, and measurements and procedures were also disputed as theory-biased. There was no issue regarding its existence or identification, but its identity was at stake. I will then develop this identity-notion as a link between a realization, i.e. an interaction between entity and experimental set-up, and a conceptualization, which not only concerns the entity's behavior, but also its 'history' (interpretation of earlier results) and 'future' (further inquiry).

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**Philosophy in Science:**
*Can Philosophers Contribute to Science, and If so, How?*
*Thomas Pradeu - CNRS - Immunoconcept Bordeaux*
*Maël Lemoine - Université de Bordeaux - Immunoconcept*
*Lucie Laplane - IHPST, University Paris I & Gustave Roussy*
*Tim Lewens - University of Cambridge*
*Ralph Adolphs - California Institute of Technology*

While the question of what philosophy can bring to science is an old topic, the vast majority of current philosophy of science (PoS) is a meta-discourse on science, taking science as its object of study, rather than an attempt to intervene on science itself. In this symposium, we discuss a particular interventionist approach, which we call "philosophy in science (PinS)", and whose main aim is to make a significant contribution to science. This approach remains statistically rare, but has been very successful in a number of cases, especially (but not uniquely) among philosophers of biology, physics, and the social sciences. Our goal is to provide an explanation of what PinS is, how it differs from mainstream PoS, and how PinS manages to contribute to science, as well as to illustrate the usefulness of PinS to both science and philosophy of science through concrete examples.

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**Phylogenetic Competition: Defining the Selective Environment**
*Grant Ramsey - KU Leuven*
*Hugh Desmond - KU Leuven*

Even though natural selection is often said to be simply a difference in fitness between individuals, this is strictly speaking inaccurate: the individuals must also share a selective environment. However, under what conditions do two individuals share a selective environment? Previous accounts have answered this question by considering a range of factors, including the similarity of the physical environments of the organisms in question, their behavioral similarity, and their developmental similarity. The question at hand is which of these, if any, should be used to individuate selective environments. Our proposal in this paper is that two organisms share a selective environment if and only if they are in phylogenetic competition. Informally, phylogenetic competition occurs when two organisms compete to have their descendants represented in descendant populations. This occurs when branches from one descendant lineage displace branches from another descendant lineage.

**Counterfactuals and Mathematical Explanations of Empirical Phenomena**
*Navia Rivas de Castro - University of Santiago de Compostela*

In recent literature, there has been an increasing interest in mathematics and its role in explanations of empirical phenomena. The counterfactual theory of explanation is used by Knowles and Saatsi (Forthcoming) in order to defend a non-platonist approach to mathematical entities by basing their theory about mathematical explanation on a well-established general theory of explanation.
This paper examines how counterfactuals can be applied to mathematical explanations – and the cicada case in particular –its consequences in the ontological level, and the difficulties that can come up with this framework. It concludes that the counterfactual theory of explanation can shed some light to the way in which mathematics are used to explain empirical phenomena and clarify what makes an explanation a good or explanatory one. However, it is not conclusive as to which ontological commitments should be accepted and does not set the metaphysical case of abstract and mathematical entities.

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**Black Hole Thermodynamics**
*Katie Robertson - University of Birmingham*
*Erik Curiel - MCMP (LMU Munich)/BHI (Harvard)*
*John Dougherty - Munich Center for Mathematical Philosophy*
*Patricia Palacios - University of Salzburg*
*Carina Prunkl - University of Oxford*

This symposium tackles a topic at the crossroads of physics and philosophy: black hole thermodynamics. Whilst a formal analogy between black hole mechanics and thermodynamics was noticed in the early 1970s, Hawking's famous result that black holes radiate has led to the orthodoxy that black holes are bona fide thermodynamic objects.
This has led to much foundational controversy. Derivations of Hawking radiation face the 'trans-Planckian problem', which both Palacios and Curiel tackle in this symposium. Black hole thermodynamics is taken to guide the search for a theory of quantum gravity, a claim that Dougherty critically analyses. Robertson analyses the claim that the Bekenstein entropy of a black hole is identical to its thermodynamic entropy by drawing on work in the inter-theoretic relations literature. Prunkl defends derivations of the Bekenstein entropy, arguing that they do not rely on information-theoretic notions in a problematic way.

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**Inductive inference and machine learning: old and new**
*Jan-Willem Romeijn - University of Groningen*
*Simon Huttegger - Department of Logic and Philosophy of Science, UC Irvine*

This symposium is concerned with formal approaches to inductive inference. It connects new inductive methods from the sciences, roughly falling under the header of machine learning, to a long-running discussion on induction in philosophy. The symposium covers four topics: convergence results in formal learning theory and Bayesian inference, feature learning and inductive logic, PAC learning and simplicity, and cluster analysis and model selection. The common thread among the contributions is that these methods can be illuminated by focusing on the inductive assumptions that they rely on. The contributions reveal different ways in which these assumptions are made, but all of them point to the indispensability of the assumptions, and the unfeasibility of a theory-free and fully data-driven scientific method.





**Making Confident Decisions with Model Ensembles**
*Joe Roussos - London School of Economics*
*Roman Frigg and Richard Bradley*

Increasingly many policy decisions take input from collections of scientific models. Such decisions face significant and often poorly understood uncertainty. We rework a recently developed theory of decision-making under severe uncertainty—called the "confidence approach"—to tackle decision-making with multiple models, showing how it can be used to construct nested sets of predictions of increasing specificity. We discuss the conditions under which particular sets are available to decision-makers. We illustrate the approach with a case study: an insurance pricing decision using hurricane models. The confidence approach has important consequences for this case, and offers a powerful framework for a wide class of problems. We end with a consideration of different methods for nested set construction, appropriate to different collections of models.

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**The Constructivist's Programme and the Problem of Pregeometry**
*Kian Salimkhani - University of Bonn*
*Niels Linnemann - Université de Genève*

Prominently, Norton argues against constructivism about spacetime theories, the doctrine that spatiotemporal structure in the dynamics only has derivative status. Particularly, he accuses Brown's dynamical approach to SR of being merely half-way constructivist: setting up relativistic fields already requires spatiotemporal background structure (i.e., pregeometry). In response, Menon and Stevens recently defended constructivism.
In this paper, we investigate to what extent a constructivist aiming at reconstructing spacetime from fields and their dynamical laws is able to do without any presupposed spatiotemporal structure. First, we present a reformulation of the challenge for the constructivist. We then argue that previous attempts to address the challenge are either tied to a certain account of natural laws or ill-directed. Finally, we offer a solution based on Stevens' proposal and reevaluate the problem of pregeometry in light of it.

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**Mind-Independence as the Metaphysical Core Thesis of Scientific and Moral Realism**
*Leon-Philip Schäfer - Leibniz University Hannover*

Scientific and moral realism are parallel views that include, to the same extent, a semantic, an epistemological, and a metaphysical thesis, committing proponents to a literal interpretation of their respective statements, to an epistemic optimism concerning the success of our attempts to gain scientific or ethical knowledge, and to an idea about the mind-independence of scientific or moral truths. Although it seems natural to vindicate both views from a common perspective, previous proposals in the literature face serious difficulties. In order to preserve the opportunity to exchange insights from philosophy of science and metaethics regarding these debates, I explore an alternative connection between both views focusing on the metaphysical component about mind-independence. As a result, philosophers od science are recommended not to exaggerate the epistemic optimism that is widely associated with scientific realism.

**Two ways to think about (implicit) structure**
*Georg Schiemer - University of Vienna*

In this talk, I will compare two ways to think about the structural content of pure mathematics. According to the first approach, the implicit structure or the structural properties of mathematical objects are specified with reference to formal languages, usually based on some notion of definability. According to the second approach, structures are determined in terms of invariance criteria. For instance, the structural properties of a given system or its objects are often said to be those properties invariant under certain transformations of the system or under mappings between similar systems. In the talk, I will further investigate these two approaches to think about implicit structure in terms of invariance and definability conditions by drawing to several examples from finite geometry. Based on this, I will give a philosophical analysis of the conceptual differences between these methods and discuss their relevance for our present understanding of mathematical structuralism.

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**Conjunctive Explanations**
*Jonah N. Schupbach - University of Utah*
*David H. Glass*

Sometimes two explanations are better than one. An object's existence can be explained by referring to its causes or its function. One hypothesis may explain an event by telling us a causal story, while another may explain the same event by referring to a nomic regularity the event instantiates. In such cases, accepting multiple explanations provides us with a richer understanding of the explanandum. And, in general, several explanations are better than one just when the explanatory benefits of accepting them all outweigh the costs (in complexity and otherwise). We call this the phenomenon of "conjunctive explanation." This talk explores the logic and epistemology of conjunctive explanations, as they occur in scientific practice. We attempt a formal investigation into the precise conditions under which conjunctive explanations arise, and we apply our results to actual episodes from the history of scientific thought.

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**Feyerabend's Well-Ordered Science: How an Anarchist Distributes Funds**
*Jamie Shaw - Ryerson University*

I argue that Feyerabend's pluralism, once suitably modified, provides a plausible account of how to prioritize funds which is superior to contemporary accounts.
Kitcher argues for a 'well-ordered science' where democratic deliberations should determine which theories are funded and how they are prioritized. Others have introduced more fine-grained models that unwittingly make use of the notion of a well-ordered science. However, these models conflate the goals of research and the means of attaining those goals. This conflation comes from assuming that the goals, plus current scientific knowledge, determine the means of attaining these goals. Against this, I argue that Feyerabend was correct in arguing that we should fund theories that contradict currently accepted knowledge with no initial practical value. In my talk, I will reconstruct the methodological argument Feyerabend provides for this view and show how it supported by the social scientific literature on theory pursuit.





**Empirically calibrated models of group structures in contemporary experimental biology**
*Vlasta Sikimic - University of Belgrade*
*Kaja Damnjanovic*

Team structures in science are field-dependent. In biology, laboratories are typically structured hierarchically. We developed empirically calibrated models simulating three different management styles: from groups with one leader controlling everybody to groups with two levels of hierarchy. These structures and their effects on group performance were brought up and discussed during qualitative interviews we performed with biologists. When we consider that professors have a limited time for communication, the results after 1000 simulations show that groups with additional levels of hierarchy perform much better than centralized groups. The performance further improves when group leaders communicate with each other. The results also highlight that group leaders should not have too many students. Finally, large groups should be decentralized, which all agrees with the assumptions interviewees brought up.

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**New Perspectives on Scientific Objectivity**
*Michał Sikorski - University of Turin*
*Jan Sprenger - University of Turin*
*Noah van Dongen - University of Turin*
*Mattia Andreoletti - University of Turin*

This symposium discusses scientific objectivity in the context of present-day science: think of the replication crisis, dwindling expert authority and the development of new disciplines with their own epistemic problems (e.g., machine learning). To what extent can philosophical analysis of the notion of objectivity help to develop solutions to problems like experimenter's bias or questionable research practices? The symposium presents conceptualizations of objectivity which are of practical use for scientific practitioners, discusses which specific activities of a scientist reduce objectivity and identifies challenges for achieving objectivity in different disciplines. Finally, we will propose concrete advice on how to promote objectivity in scientific research.

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**Disconnecting commensurability of fitness from natural selection Short abstract**
*Adrian Stencel - Jagiellonian University*

I will argue for a distinction between groups made of units that have commensurable fitness (such that we can measure their fitness and decide which one is fitter) and groups that can undergo evolution by natural selection (ENS). I will argue that sometimes we can have a group of units whose fitness is commensurable but does not undergo ENS, and sometimes a group which undergoes ENS but is made up of units whose fitness is incommensurable. Firstly, I will argue which conditions are necessary for a group to undergo natural selection. Then I will set the conditions that are necessary to evaluate fitness differences between individuals. Finally, I will argue that sometimes a group fulfils the conditions to undergo natural selection, but fails to fulfil the conditions to have commensurable fitness, and vice versa.

**Model-independence in High-Energy Physics and Beyond. Methodological promises and scientific challenges.**
*Michael Stoeltzner - University of South Carolina*
*Michela Massimi - University of Edinburgh*

After the discovery of the Higgs boson in 2012, searches for physics Beyond the SM (BSM) have become the centrepiece of today's particle physics and the Large Hadron Collider (LHC). To date, however, none of the particles and features predicted by the many available BSM models have been observed. In their daily work, particle physicists apply various 'model-independent' strategies: from studying 'simplified models' to developing SM effective field theories. This symposium aims to foster an ongoing fruitful cross-disciplinary dialogue among philosophers and physicists interested in these broad methodological questions about the nature of models and the exciting new prospects opened up by high energy physics. What is model-independence? And how is it changing the contemporary face of experimenting and theorizing? The symposium consists of four papers: two papers by particle physicists Krämer and Bechtle, and two papers by philosophers Stöltzner and Massimi.

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**Explanation in Molecular Biology: The Explanatory Force of the Details**
*Predrag Šustar - University of Rijeka*
*Vito Balorda - University of Rijeka*

In this paper, we address the question of abstraction and specification in recent mechanistic debate. Namely, the role these procedures play in explaining biological phenomena, in particular, at the interface between molecular and evolutionary biology. Relatedly, we also address the issue of explanatory relevance, a key feature of the mechanistic accounts of explanation. We asses scientific abstraction, a procedure of ascending to a more general level in understanding target biological phenomena and having its main merits in providing a theoretical framework that allows us to filter and, then, fit into it explanatory relevant data. We argue that the explanatory power or force of a scientific explanation most usually consists in delineating the details. Furthermore, we address the related issue of the criterion for singling out explanatory relevant data and argue for a non-contextual, monistic approach.

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**Some issues in the prediction vs accommodation debate**
*Pekka Syrjänen - University of Helsinki*

Most theories on the prediction vs accommodation problem in the philosophy of science argue that predicted evidence doesn't provide an intrinsic epistemic advantage over accommodated evidence, but that sometimes it does have more value than accommodated evidence in an indirect way because it is symptomatic of some other feature that is epistemically relevant. Theories on what this other, relevant feature is include both agent-centered and content-centered approaches. The agent-centered approaches identify the feature in the agent making the predictions whereas the content-centered approaches find it in the logical properties of the contents of the theory itself. I argue that both the agent-centered and content-centered theories face problems that show that as formulated, they alone are incapable of accounting for the epistemic role that prediction plays in science.





**Schurz' Meta-Inductive Approach to Hume's Problem**
*Paul Thorn - HHU Duesseldorf*
*Gerhard Schurz - Heinrich Heine University Duesseldorf*
*Stathis Psillos - University of Athens*
*Tomoji Shogenji - Rhode Island College*
*Igor Douven - CNRS*

In his recent book "Hume's Problem Solved: The Optimality of Meta-Induction", Gerhard Schurz defends a new approach to Hume's problem of induction. Schurz acknowledges the impossibility of providing a noncircular justification for the reliability of induction, and argues for a noncircular justification of the optimality of meta-induction. Drawing on work in computational learning theory, Schurz demonstrates that a prediction method, that he calls "attractivity-weighted meta-induction", is optimal in all possible worlds, in comparison to any prediction method to which it has access. Schurz argues that this optimality result provides an a priori justification for the rationality of meta-induction, and that the justification of meta-induction generates a noncircular a posteriori justification of object induction. In this symposium, three experts (Douven, Psillos, and Shogenji) present critical responses to Schurz' book. The symposium will conclude with a response by Schurz.

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**Why the Stone-von Neumann theorem is not a categoricity result**
*Iulian Toader - University of Bucharest*

The Stone-von Neumann theorem states that any irreducible faithful representation of the Weyl algebra describing a quantum system with a finite number of degrees of freedom is uniquely determined up to an isometric isomorphism. This entails the physical indiscernibility of representations and it is the sense in which one speaks of the physical equivalence of the Schroedinger and the Heisenberg representations of a quantum mechanical system. The theorem has been intuitively interpreted as a categoricity result. We argue that this intuitive reading is incorrect. An isometric isomorphism is not a model-theoretical isomorphism, nor are representations of the Weyl algebra interpretations in the model-theoretical sense. We show that the formula expressing the isometric isomorphism is not a definable set and thus cannot axiomatize an isomorphism class in continuous first-order model theory. We also consider several possible replies to this argument.

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**Novel prediction, genuine realist success, and historical counterexamples**
*Dana Tulodziecki - Purdue University*

The pessimistic induction (PI) seeks to undercut the realist connection between success and truth by arguing that successful but false theories are typical of the history of science. Responses to the PI try to rehabilitate this connection by stressing continuity between earlier and later theories. Recently, several authors have argued that these responses are inadequate. They have pointed to examples that show that there are cases of theories that made successful novel predictions, but that also turned out to be completely false. Vickers (2015) has proposed a new response by arguing that they target not the realists' success-to-truth-inference but the idea that novel predictions are sufficient to support this inference: he argues that once realists have a better notion of genuinely realism-warranting success these counterexamples lose their force. In this paper, I will show that realists need to either reject Vickers' strategy or else be realists only with respect to physics.

**How could citizen engagement help in dealing with values in science?**
*Discussing the case of GDP and citizen economics.*
*Jeroen Van Bouwel - Ghent University, Belgium*

It is now commonly held that values influence the scientific process. Under what conditions is this influence justifiable? Elliott lists 3 conditions, i.e. value influences should be (1) made transparent, (2) representative of our major social and ethical priorities, (3) scrutinized through engagement between different stakeholders. I zero in on (3), focusing on citizen engagement (CE). How could citizens legitimately contest scientific claims by way of CE (cf. Douglas) and how could it help in dealing with values in science? To answer this, I also analyse debates in economics about the use of GDP as well as findings of the Citizens' Economic Council (RSA) – a rich example of CE in economics. I aim to (1) broaden Douglas' account; (2) elaborate Elliott's account on forms of engagement; (3) provide a detailed philosophical framework for discussing CE in economics, making the idea of CE more precise and identifying the epistemic benefits and possible drawbacks of citizen economics.

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**Black Hole Philosophy and String Theory**
*Jeroen van Dongen - University of Turin*
*Sebastian De Haro - University of Amsterdam*
*Manus Visser - University of Amsterdam*
*David Wallace - University of Pittsburgh*
*Nick Huggett - University of Illinois at Chicago*

Recent developments in the philosophy of physics reveal that quantum gravity has arrived as one of its main themes. Within this novel subject, philosophy of black holes will be one of the main concerns. Black holes pose a number of central problems: their singularity poses problems for spacetime philosophy, while the information paradox challenges the laws of quantum mechanics and raises a host of interpretative problems. Both issues, as some of the speakers in this symposium will argue, are also closely related to issues of ontology: what states are black hole states? And what is matter in the case of a classical or quantum black hole? Central to answering these questions in the context of modern physics will be to study the string theory account of black holes as 'D-branes'.

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**On the Structure and Espistemic Value of Function Ascriptions in Biology and Engineering Sciences**
*Dingmar van Eck - Ghent University*
*Erik Weber and Julie Mennes*

In this contribution we chart epistemological similarities between shared function talk in biology and the engineering sciences, focusing on the notions of biological advantage function and technical advantage function. We start by showing that biological advantage function ascriptions are common in biology and that technical advantage function ascriptions are common in engineering science. We then proceed to show that these ascriptions have a very similar structure and that their epistemic value also is similar: both biological advantage function and technical advantage function ascriptions provide the means to answer what-would-happen-if questions. We develop and illustrate our claims with case studies from biology and engineering design research. Our results offer new insights into a relatively neglected (but very important) issue in both philosophy of biology and technology, viz. assessing the explanatory and predictive utility of function ascriptions.





**The Revolutionary Rhetoric of Debates on Bohm's Interpretation of Quantum Mechanics and Kuhnian Philosophy of Science, 1950s-1960s**
*Marij Van Strien - Bergische Universität Wuppertal*

In 1952, the American physicist David Bohm published an alternative interpretation of quantum mechanics, with which he offered a deterministic, realist account of quantum phenomena. In this talk, I look at the rhetoric used in debates surrounding Bohm's theory. I argue that proponents and opponents of Bohm's interpretation accused each other of being conservative, dogmatic and unwilling to accept revolutionary change, and examine how this rhetoric affected the reception of Bohm's ideas. Furthermore, I argue that during the 1950s and 1960s, there was a broad group of physicists who shared revolutionary ideals in physics; however, there was disagreement on whether the time was ripe for a new quantum revolution. These discussions played a role in debates among philosophers of science, notably Kuhn, Feyerabend and Hanson, on whether new theoretical frameworks should actively be pursued.

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**Inferentialism and representation: chasing factivity**
*Philippe Verreault-Julien - London School of Economics*

In this paper, I argue that two brands of inferentialism (Suárez 2004; Suárez 2015) and what I call the factive inferentialist account of representation (Kuorikoski and Ylikoski 2015) do not provide satisfactory criteria with respect to what makes a scientific representation explanatory in the context of modelling. First, I show that Suárez's brand of inferentialism is silent with respect to how models can offer factive explanations. I then argue that because of an ambiguous notion of inferential 'correctness', FInfR can't distinguish merely phenomenological from explanatory representation. I conclude by presenting a dilemma the inferentialist faces: either they double down on deflationism or they substantiate their position. I believe the latter is the best course of action.

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**Has classical genetics been practically reduced?**
*Oriol Vidal - UNED, Madrid*
*David Teira - UNED, Madrid*

The reduction of classical genetics to molecular genetics has been a source of controversies for almost half a century in the philosophy of biology. In this presentation, we will discuss the reducibility of one of the fundamental traits of the classical gene: position, which marks a locus in the genome, with no fundamental role in the molecular gene. Following Wimsatt (2006), we will first defend that position was more a laboratory heuristic than a fundamental trait with an explanatory role in both classical and molecular genetics. On the one hand, it is dubious that chromosomic loci played any causal role in the explanation of phenotypical traits. On the other hand, the use of molecular markers in association studies allow geneticists to conduct association studies in which classical positions play no role. In our view, this constitutes what we call a practical reduction of the classical gene position.

**Developmental Channeling and the Causal Structure of Evolutionary Theory**

*Cristina Villegas - University of Madrid*
*Grant Ramsey - KU Leuven*

In this paper, our aim is to identify what appears to be a lacuna in the causalist picture of evolutionary theory: the causal role of development. We provide a framework for understanding how development—particularly in the sense of developmental channeling and evolvability—fits within the causal structure of evolutionary theory. We first give an overview of the role of development in evolutionary changes, and propose the term developmental channeling for referring to this role. We then introduce the causal account of evolutionary theory given by Ramsey (2016), and we argue for the inclusion of developmental channeling into this picture. This way, we defend channeling as a structuring cause of evolution grounded in the developmental plasticity of individuals.

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**Science, Abstraction and the Quest for Lost Reality**

*Bobby Vos - University of Cambridge*

In this paper, I take up the problem of lost reality plaguing structuralist philosophy of science. In brief, the problem asks if and how concrete, physical reality enters into the structuralist construal of the science-world relation as a mapping between mathematical structures. Following a brief introduction to the problem against the general backdrop of structuralism, I consider two proposals for dealing with it: Bas van Fraassen's pragmatic dissolution argument and F.A. Muller's KS-view of scientific theories. Arguing that neither succeeds in adequately dismantling the problem, I propose that a solution may be found by examining more closely the notion of abstraction. Drawing on several existent accounts of abstraction both within and outside the philosophy of science, I present a revised framework for the science-world relation that I believe successfully solves the problem of lost reality.

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**Gibbs' solution of Gibbs' paradox**

*James Wills - London School of Economics*

This paper concerns Gibbs' paradox in thermodynamics. It aims to 1) demonstrate that there are three distinct versions of the paradox in the literature, 2) solve them and 3) demonstrate that this solution reconstructs Gibbs' reasoning. Thus, this argument is not `yet another' solution to the paradox; it is Gibbs'. Of the three versions, only one was stated by Gibbs and, oddly, it is the other two that have concerned physicists and philosophers writing about the paradox since. I show that Gibbs solved the one that concerned him and that the other two can be solved by providing a precise definition of distinguishability. I show that this definition emerges naturally out of thermodynamic reasoning by deriving the equation for entropy changes from first principles and emphasising aspects of the derivation which are often brushed over in physics textbooks. I then argue that Gibbs can be read as giving an identical definition and thus, in this sense, Gibbs' reasoning is reconstructed.





**Setting Limits to Chang's Pluralism**

*K. Brad Wray - Aarhus University*

Hasok Chang has raised some serious questions about the extent to which there needs to be consensus in science. At its core, Chang's project is normative. He argues that there are significant benefits to pluralism.
I argue that Chang overlooks the importance of a certain type of consensus in science. I advance an account of consensus in science that will aid us in better understanding the constructive roles as well as the limitations of pluralism in science. For a research community to be able to effectively address anomalies, there must be a plurality of interpretations of the accepted exemplars, and a plurality of interpretations of the values of theory choice. But there is a limit to how much pluralism can be tolerated in a research community. To be a community at all, to have the sort identity that would constitute a specialty community, scientists must employ the same lexicon. Otherwise, they are not even describing the world the same way.

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**Hierarchy in research communities: the case of economics**

*Jack Wright - University of Cambridge*

What affect do hierarchical structures within research communities have on the output of those communities? In this paper I address this question from the perspective of the social epistemic practices within economics. The outsize role five journals play in determining success within economics has become a hot topic of discussion. In this paper I argue that the reification of five journals is just one of a number of features of how economists interact that reveals a steep hierarchy within the discipline. Although most academic disciplines are hierarchical in certain ways, the degree of asymmetry between the power, status, and influence of those at different rungs of economics' hierarchy is greater than in other disciplines. In this paper I collect empirical evidence from a variety of studies of economics to describe the ways that the discipline is hierarchical and then use ideas from social epistemology to discuss the epistemic and political implications of economics' hierarchy.

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**Revisiting abstraction and idealization in molecular biology**

*Martin Zach - Charles University & Czech Academy of Sciences*

Abstraction and idealization are two notions that are most often discussed in the context of assumptions employed in the process of model-building. However, closer inspection shows that the standard construal of these notions turns out to be problematic. I further argue against a recent attempt to pick a fight with the mechanistic account of explanation. As the objection goes, the mechanistic view of explanation cannot account for the practices of idealization. Using an example from molecular biology that the critics themselves rely on, I argue that the objection is misguided because the critics fail to adequately characterize both abstraction and idealization. Finally, I caution others to pay more attention when speaking of abstraction and idealization in a context where these concepts play a significant role, such as the one on mechanistic explanation. Arguably, this is important as some have embraced the criticism without realizing the fundamental issues with such criticism.

# POSTERS

**Niche Construction: Lewontin, Niche Construction Theory and Biological Constructionism**

*Bendik Hellem Aaby - KU Leuven*
*Grant Ramsey - KU Leuven*

In this paper we argue that niche construction theory (NCT), the theory that accounts for the evolutionary effects of organisms' manipulation of the physical environment, or their spatiotemporal relation to it, does not go far enough. While NCT was inspired by Lewontin's metaphor describing the origin and change in biological form as construction—as opposed to adaptation—NCT only includes one aspect of Lewontin's picture. One of the most important components of the construction metaphor is its emphasis on interaction. While NCT gives its due diligence to reciprocal effects of organismal interaction with the physical environment, there is still an array of interactions (i.e., ecological relationships) that are left out. We argue for the broader conception in which all organism-environment interactions are included in the construction of an organism's niche. Further, we argue that these interactions can be grouped into three fundamental kinds: constitutive, relational, and external.

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**How the "Extended Evolutionary Synthesis" Transforms Our Understanding of Cultural Evolution**

*Karim Baraghith - DCLPS - Heinrich-Heine University, Duesseldorf*

The aim of this paper is to show how a theory of cultural evolution (CE) could be integrated into the "Extended Evolutionary Synthesis" (EES).We think that there are basically two strategies available in this context: The first is simply to identify cultural transmission as one out of several kinds of inheritance within the scope of what is called "inclusive inheritance" by the EES. While such an integrative approach may be valid, it fails to tell us much about the specific mechanisms of CE.We suggest a second option, which is to compare core aspects of the EES (facilitated variation or developmental bias) with those characteristics that have been identified as exceptions of CE (conformist bias or guided variation).Three exemplary cases vividly show that if relevant aspects identified by the EES strongly resemble those features which have hitherto been taken to be exclusively relevant for CE, then biological and cultural evolution could have much more in common than presumed so far.





**Communicating scientific evidence in doctor-patient interactions: an ethnographic study**

*Monica Consolandi - Università Vita-Salute San Raffaele*

The effectiveness of medical evidence is largely dependent on the ability to communicate that evidence to the science-users, mostly patients. Like in many fields of science, also in medicine trust is one of the most important components of doctor-patient interaction (Chalmers, 2002). Cultivation of patient trust is, in turn, primarily a linguistic activity, subject to linguistic norms and conventions. The problem we highlight in this paper is that, as in most interactions between experts and laypeople, there are asymmetries in communication of evidence in doctor-patient interactions. The goal of this paper is to explore these asymmetries using ethnographic studies of doctor-patient interaction, with a focus on the communication of scientific evidence to the patients.

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**Defending non-explanatory understanding**

*Richard David-Rus - Romanian Academy & University Munich*

The aim of this contribution is twofold: to discuss and reject some recent critique against non-explanatory understanding as articulated by Khalifa (Khalifa 2017) and to highlight some specific characteristics of understanding through possible explanations. I'll argue first that Khalifa's reconstruction of Lipton's basic assumption and argument (Lipton 2009) is biased and misses the point of the author's intention. I'll address secondly his critique on understanding through possible explanations and argue that the Right Track Objection fails to achieve its goal. This objection involves a narrow view on understanding gained through possible explanation so I'll further suggest some characteristic that needs to be considered.

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**The Demarcation Problem in philosophy of science: the scientific predicate, a socio-political status or an epistemic assessment?**

*Stéphanie Debray - AHP-PReST*

What do we say when we affirm that a theory, discipline or decision is scientific? When we use the scientific predicate, do we learn something about the epistemic nature of the object we are describing, or do we just say something about its social and political status? If using the scientific predicate leads to a properly epistemic valorization, the question of the demarcation is the responsibility of the philosopher. If the predicate is simply the mark of a social decision, then it is no longer within the domain of philosophy (Laudan, 1983). Adopting a new model of science (value-laden ideal), rather than value-free one, we will understand that it's actually more complex than this, that we must distinguish the values at work, their role and the moment when they intervene in decision-making (Douglas, 2009). The scientific predicate is both a socio-political status and an epistemic finding, and the demarcation question remains the responsibility of the philosopher and the scientist.

**The Value of Mathematical Rigor in Physics**
*Foad Dizadji-Bahmani - California State University Los Angeles*

Physics is couched in mathematics, but the use of mathematics in physics is not always uncontroversial. In particular, there are several well-known cases of physical theories (or parts thereof) that were not, at least from a contemporary mathematical perspective, mathematically rigorous. These include Newton's use of calculus in his mechanics, and the Dirac delta function in quantum mechanics. Weierstrass' work, following on from Cauchy, is usually credited as making rigorous the former. The latter was made rigorous by Schwartz in terms of distribution theory.
One thing which is uncontroversial is that mathematical rigor is, ceteris paribus, a good thing when it comes to physical theories. It is surprising therefore that the question of what exactly is the value of mathematical rigor in physics has not been posed, let alone answered. In this paper I pose this question and try to make some headway in answering it.

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**Reconstructing the Last Common Ancestor:**
**epistemological and empirical challenges**
*Amadeo Estrada - Universidad Nacional Autónoma de México*

Modern evolutionary biology works with tree representations of life since Darwin. Latest data suggest that lateral gene transfer results rather in network representations. Based primarily on this, Ford Doolittle has challenged the idea of tree representations and has argued against the precise reconstructions of early life stages, such as the last common ancestor. These ideas have appealed more to philosophers than to scientist, which maintain that very precise reconstructions are possible. The goal of my work is to assess the relevance of Doolittle's arguments, contrast them with recent developments and empirical results concerning reconstructions of the tree of life and of ancestral stages, and finally suggest some conditions (epistemic, technical and empirical) that, in principle, could offer a way out of Doolittle's paradigm. The most important suggestion is the revision of negative natural selection as a powerful tool in the reconstruction of early life stages.

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**Reductive explanation and the construction of quantum theories**
*Benjamin Feintzeig - University of Washington*

I will argue that one can use the constraint that a quantum theory explain the success of its classical predecessor to substantively constrain the construction of quantum theories through quantization procedures. I will argue for a specific form of this constraint when there is a possibility that a quantum theory contains "unphysical" states. I will present a number of theorems establishing that the constraint leads to a previously accepted quantization procedure in the context of two models: regular states for a finite collection of free particles and gauge invariant states for a particle moving in an external Yang-Mills field.





**Group epistemology and scientific change:**
**Financial supervisors in the Bank for International Settlements and their conception of financial market risk**
*Helena Hachmann - Institut Jean Nicod (ENS/EHESS/CNRS)*

The importance of the social context for scientific work and how it directs research has been broadly discussed in social epistemology, philosophy of science and in sociology of science literature (see for example Goldman 1991, 2011; Kitcher 1990, 1993; Knorr -Cetina 1999; Strevens 2003, also Sosa 2010). In the present paper I will look more specifically on the institutional context and how it governs epistemic and methodological approaches of research. This question will be explored by examining the work of financial supervisors in intergovernmental institutions, especially in the Bank for International Settlements, and the specific conception of financial market risk they developed. In this context I will ask if their risk conception is due to their institutional context and their specific (policy) objectives.

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**Mapping vs. Representational accounts of models and simulations**
*Michal Hladky - University of Geneva / MCMP Munich (visiting)*

Philosophers of science often analyse scientific models and simulations as representational tools (Frigg and Nguyen 2017, 2016; Weisberg 2013; Giere 2010; Suárez 2010; Goodman 1976). The representational accounts clarify how scientists use models, how they think about them and how they draw inferences based on them. This however does not mean that scientific models have to be defined in terms of representation. In a recent attack on representationalism, Oliveira (2018) shows that ontological and epistemic dimensions of this approach are in irreconcilable tension. His solution is to adopt a pragmatic approach to modelling and analyse them in terms of surrogate reasoning and practical engagement. The pragmatic approach to representational semantic conception of theories is also stressed by Suárez and Pero (2018). However, we should not be so quick in dismissing the standard conception of theories and models, as they provide several advantages and capture some of the scientific practices.

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**"But it's the truth, even if it didn't happen."**
**Constructed expressions as idealizations in linguistics**
*Hubert Kowalewski - Maria Curie-Skłodowska University in Lublin*

One important debate in modern linguistics concerns the sources of legitimate data for analyses. The enthusiasts of authentic data emphasize the importance of real-life attested expressions produced in natural circumstances. Proponents of constructed examples claim that expressions constructed for the purposes of the analysis at hand offer may be more useful. I defend the latter approach by arguing that constructed expressions in linguistics may function like idealizations in natural sciences. While both constructed expressions and scientific idealizations are counterfactual, the former are counterfactual in a modally weaker way (they are non-occurrent rather than impossible). Similarly to scientific idealizations, constructed expressions help us to investigate linguistic phenomena in what Cartwright terms "nomological machine," i.e. an environment in which phenomena under investigation can be isolated from interfering factors.

**The meta-level of experience:**
**the case of string theoretical research. Poster.**
*Milla Lifke - Bielefeld University*

Drawing from the history of theoretical physics I will sketch what I call the meta-level of experience to elucidate the current status of string theory. This discussion differs from others in that it does not focus on what string theory should have been but aims at a recognition of string theory's role and contribution as a research at the physical frontiers.

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**Causal supervenience and mental exclusion**
*Thomas Lodewyckx - University of Antwerp*
*Bert Leuridan*

In philosophy of mind and in philosophy of the cognitive sciences, it is common to assume that mental states supervene on physical states. Because of the modern predilection towards a materialist metaphysics, which holds that the physical domain is causally complete, there is an abundance of arguments supporting the causal inefficacy of mental properties. The best-known are those espoused by Jaegwon Kim (1998/2003), notably his attack on downward causation and his causal exclusion argument. This narrative of causal impotence on behalf of mental properties seems to be the dominant stance in the literature, even though it runs counter to the intuition, present in both the psychological sciences and in everyday practice, that the mental is causally efficacious. It is our intention to argue against said narrative, by entertaining the possibility of a causal interpretation of the supervenience relation itself.

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**Deception as Cooperation**
*Manolo Martínez - Universitat de Barcelona*

I develop a rate-distortion analysis of signaling games with imperfect common interest. Sender and receiver should be seen as jointly managing a communication channel with the objective of minimizing two pendent distortion measures. I use this analysis to identify a problem with 'functional' theories of deception, and in particular Brian Skyrms's: there are perfectly cooperative, non-exploitative instances of channel management that come out as manipulative and deceptive according to those theories.





**Where evidence for archaic introgression has brought us so far:**
**a case-study for an epistemology of palaeoanthropology**
*Andra - Shirin Meneganzin Abwini - Università degli Studi di Padova*
*Telmo Pievani*

The study of the relationships of anatomically modern humans with archaic hominin species has revealed in the last years a rich history of admixture for Neanderthals, Denisovans and modern humans, with important consequences for models of modern human origins and geographic dispersal.
We want to show how the data on the encounters with other hominin forms is now posing a fundamental scientific and epistemological problem, rephrasing questions in paleoanthropological research. We intend to evaluate strategies of evidence integration by exploiting the lens of interbreeding data, to see if previous models can be maintained and updated in slightly different variants, or if new ones need to be formulated. We argue that a programmatic triangulation of multiple lines of evidence is key in reducing single-method biases. Finally, we intend to rephrase the species problem in human evolution in light of archaic admixture evidence.

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**Chances and propensities in evo-devo: variability,**
**evolvability and random variation**
*Laura Nuño de la Rosa*
*Cristina Villegas - Complutense University of Madrid*

In the context of the Modern Evolutionary Synthesis, the notion of variational chance (VC) has been defined in a restrictive fashion that cannot deal with current challenges to the concept coming from evo-devo. We argue that variability and evolvability research crucially question the underlying assumptions of the VC concept. Firstly, the notion loses its explanatory force when variation is defined at the phenotypic level and variational properties of developmental systems are considered. Secondly, evolvability research challenges the received idea that variation is random with respect to fitness. We suggest that a propensity frame casts some light into this discussion.

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**Comparative analysis of structural representation methods.**
**Case study: Ontic Structural Realism.**
*Agnieszka Proszewska - Jagiellonian University*

The aim of this paper is a comparative analysis of the philosophical foundations for applications of different structural frameworks discussed in the context of Ontic Structural Realism, with particular emphasis on set theory and category theory. I will discuss the strengths and weaknesses of both concepts, especially in the context of their explanatory value in formulating answers to the questions about the structure of scientific theories, application of mathematics to scientific theories and the complex problem of Structural Realist's appeal to the structural continuity between successive theories and following ontological commitments. These considerations will then be confronted with a hypothesis stating that we should make use of some kind of trade-off between the comparative and relevant powers of different representational methods, proposing a pluralistic (in opposition to standard, unificatory) view on the role of structural representation within OSR.

**Modeling collaborative division of cognitive labor**
*Samuli Reijula - University of Helsinki*
*Jaakko Kuorikoski - Tampere University*

The modeling tradition in the social epistemology of science has had little to say about epistemic collaboration in research. The models typically depict a competitive situation in which the actions of individual agents, as if by an invisible hand, lead to good collective outcomes. We employ a model template from organizational economics, the bitstring model, to study collaborative problem solving in science (Marengo & Dosi 2005; Hong & Page 2001). We use the model to examine a three-way interaction between individual-level problem-solving heuristics (diversity), problem decomposition schemes (division of labor), and different levels of problem modularity.

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**Science and Illusions**
*Luigi Scorzato - Accenture AI / Geneva*

Popper's criterion of falsifiability fails to provide a useful demarcation between science and non-science, because ad-hoc assumptions (which lack a definition) are always able to save any theory that conflicts with the data; and, adding some testable predictions is easy. This argument does not simply make the demarcation approximate: it makes it totally useless. Currently, no philosophical criterion is able to rule out even some of the most blatant cases of pseudo-science, not even approximatively (in any well defined sense of approximation). This conflicts with our firm belief that some theories are clearly not scientific. In this paper I argue that it is necessary and possible to recognise the notion of syntactic simplicity that is able to tell the difference between empirically equivalent scientific and non-scientific theories, with a precision that is adequate to many important practical purposes, and it fully agrees with the judgments generally held in the scientific community.

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**Objectivity for the Research Worker**
*Michał Sikorski - University of Turin*
*Noah van Dongen - University of Turin*

In the last few years, many problematic cases of scientific conduct were diagnosed; some of which involve outright fraud (e.g., Stapel, 2012) others are more subtle (e.g., supposed evidence of extrasensory perception; Bem, 2011). We assume that these and similar problems are caused by a lack in scientific objectivity. The current theories of objectivity do not provide scientist with conceptualizations that can be effectively put into practice in remedying these issues. We propose a novel way of thinking about objectivity; a negative and dynamic approach. It is our intention to take the first steps in providing an empirically and methodologically informed inventory of factors (e.g., Simmons, Nelson & Simonsohn, 2011) that impair the scientific practice of researchers. The inventory will be compiled into a negative definition (i.e., what is not objective), which can be used as an instrument (e.g., check-list) to assess deviations from objectivity in scientific practice.





**Inheritance Inference from an Ecological Perspective**
*Paul Thorn - HHU Duesseldorf*

We present results from a study that aims to ascertain which kinds of inheritance inferences are reliable, with attention to variations in reliability that depend upon environmental conditions: The study addresses whether inheritance inference is reliable in the case of 'exceptional subclasses', and attends to variations in reliability that result from variations in the entropy level of the environment. A further goal was to show that the reliability of inheritance inference depends upon the criteria that are used in selecting the classes used in inheritance inference. One approach proceeds by treating any atomic property as an admissible class.
A second approach identifies classes with the cells of a partition of the domain of objects that maximizes the similarity of objects that are assigned to the same class. Our study shows that the second approach results in inheritance inferences that are far more reliable, both for exceptional and unexceptional subclasses.

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**Biotechnology regulation as a case for applied philosophy of science**
*Martin Wasmer - Leibniz University Hannover*

Genome editing is a new biotechnology that challenges the current regulatory framework for breeding plants and animals, as alterations can be indistinguishable from natural mutations. In European law, the legal definition of GMO depends on the interpretation of the vaguely formulated phrase "altered in a way that does not occur naturally" (Dir. 2001/18/EC). How can this caveat be interpreted in the case of genome edited organisms?
I provide a framework for answering this question that draws on considerations from philosophy of science: Three contradicting concepts of naturalness can be distinguished (cf. Siipi, 2008; Siipi & Ahteensuu, 2016). However, the decision between those is necessarily based on ontological choices and thus – in part – on values (cf. Ludwig, 2016). Once these issues solved, the GMO definition can be operationalized for regulatory practice. This clarification of concepts is an illustrative case for the role philosophy of science can play in applied contexts.

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**Solving the Black Box Problem: From Machine Learning to Marr**
*Carlos Zednik - University of Magdeburg*

The Black Box Problem arises due to the 'opacity' of some computing systems--especially those that are developed using methods from Machine Learning. Explanainable AI is a nascent research program that is dedicated to solving this problem by rendering such systems 'transparent'. Unfortunately, the explanatory norms and practices of Explainable AI remain ill-defined. This talk aims to develop a normative framework for Explainable AI that is modeled after Marr's levels of analysis framework for explanation in cognitive science. Using this framework, it is possible to evaluate the explanatory import of recent techniques for e.g. visualizing the activity of deep neural networks, or for highlighting salient properties of a system's input. Accordingly, this framework can be used to determine whether and to what extent the Black Box Problem can be solved.