Contents

Review 2012 and Structure of the KLI

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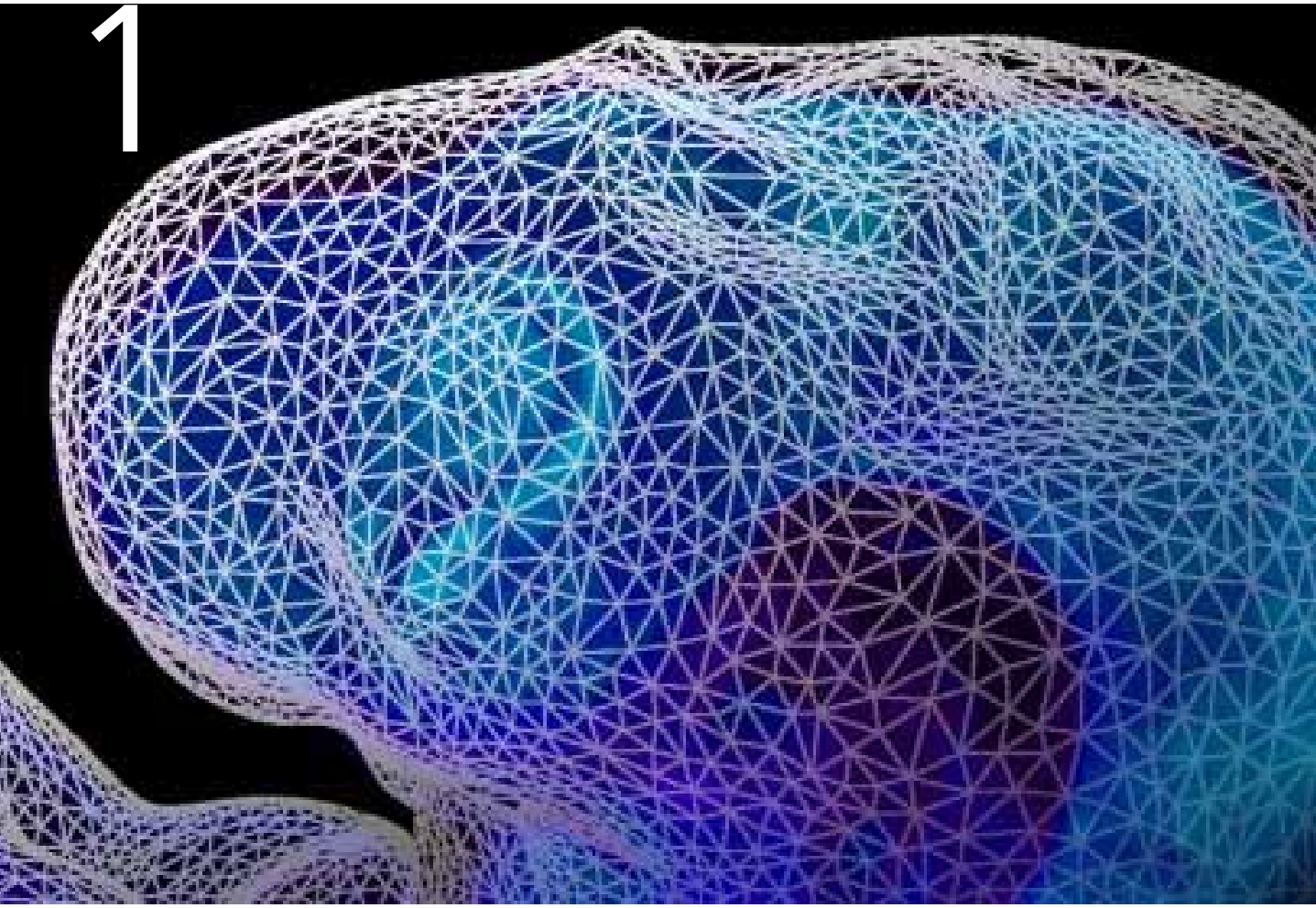

The KLI is not just an institute constituted in a formal way, it is an "emergent phenomenon" in its own right.

Steve Lewis,

University of Chester

1.1 The Year in Review

The year 2012 was in many respects a year of new visions, endeavors, and targeting of objectives. The KLI started a number of activities that are expected to peak out in subsequent years.

The KLI journal *Biological Theory* migrated from The MIT Press to Springer. This strategic decision was based on the idea to increase the outreach of the journal by taking advantage of Springer´s market leader position. The transition was accompanied by a new submission system that allows a substantial speeding-up of the reviewing process. By 2014 it is planned to have *Biological Theory* evaluated by Thomson Reuters in order to obtain an impact factor.

The KLI also launched a Call for Fellowship Applications, to be submitted by a given deadline. This call allowed the institute to recruit the most excellent applicants from a highly competitive pool and contributed to an increase in the international visibility of the KLI, reflected in a further augmentation of visitors of the KLI homepage in October/November 2012. The call found broad approval by young scientists and international collaboration partners of the KLI.

The KLI strengthened its ties with the Office of the State Government of Lower Austria, initiating joint activities, such as participation in their annual science report, appearance in an illustrated book featuring research in Lower Austria, and presentations of the KLI in events organized by the State Government.

In September 2012, the KLI successfully negotiated with the organizing committee of the European Advanced Seminar in the Philosophy of Life Sciences (EASPLS) for choosing the KLI as the new venue for its biannual Summer Schools, starting in September 2014. In addition, the KLI will be a partner in the local organization of the international Euro-Evo-Devo Meeting 2014, held by the European Society for Evolutionary Developmental Biology at the University of Vienna.

The KLI continued to pursue its successful formats: 17 fellows were hosted, 33 original papers as well as 7 issues of *Biological Theory* were published, and 43 presentations at national or international conferences and meetings were financially supported. The KLI hosted an internationally acclaimed workshop on the "Origins of Communication and Language" and organized a timely symposium on "Data-intensive Biology: Why Google Won´t Replace Science." Furthermore, the KLI co-organized the EASPLS Summer School in Hermance (Geneva).

The past year´s activities are described in more detail on the following pages. I would like to express my gratitude to the members of the KLI Trust, the Board of Directors, the Scientific Advisory Board, as well as the staff and fellows of the KLI for their continued support.

Gerd B. Müller
Chairman

1.2 The KLI

The KLI is an international center for Theoretical Biology. The institute commits itself to the formulation, analysis, and integration of biological theories as well as the investigation of their scientific and cultural consequences. The thematic focus is on evolutionary biology, developmental biology, and cognition. The KLI supports interdisciplinary research projects in these areas that aim at generating models of living systems or meta-theoretical constructions of historical, philosophical, or cultural aspects of biological theories. Research at the KLI is supported by fellowships in seven different categories; granting decisions are based on international peer review.

The KLI also pursues its objectives by organizing international workshops, symposia, and lecture series, and by publishing a scientific journal and a book series. Moreover, the KLI runs an open access Internet database that covers bibliographic information related to the most important foci of its research, and hosts the Konrad Lorenz archive that comprises correspondence, photographs, manuscripts, diaries, and awards of Konrad Lorenz.

1.3 Organization of the KLI

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School of Audiology and Speech-Language Pathology, University of Memphis, TN

Scientific Projects

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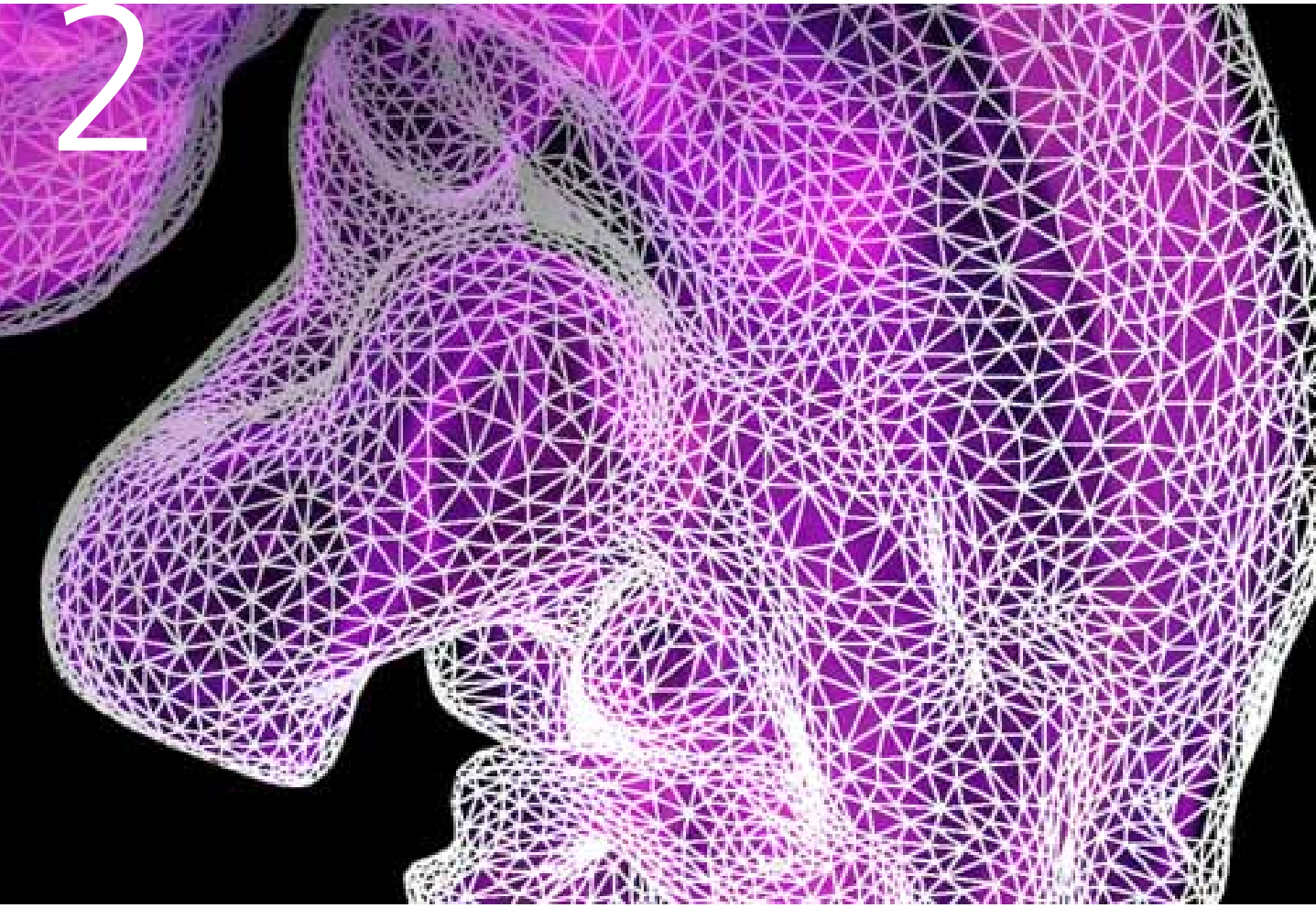


The KLI offers seven different types of fellowships for students, post-docs, and visiting scientists or scholars in the area of theoretical biology for a period of a few weeks up to two years. All project applications are subjected to an international review process.

2.1 Applications

In 2012, the KLI received a total of 86 applications for fellowships, 9 of these were granted for either 2012 or 2013.

	applied	granted
Writing-up Fellowships	5	3
Postdoctoral Fellowships	32	1
Senior Fellowships	3	0
Visiting Fellowships	8	3
Others	37	0
Visitors (self supported)	1	1

2.2 Writing-Up Fellowships

Borja ESTEVE-ALTAVA
(July 2012 – January 2013)

Borja Esteve-Altava obtained his Bachelor´s degree in Biology from the University of Valencia, and subsequently specialized in biodiversity, conservation, and evolution. He obtained his Master´s degree in 2008, and is currently a PhD student in the Theoretical Biology research group at the University of Valencia, Spain.

Network Models of the Skull

The purpose of my fellowship application at the KLI is to write-up my PhD thesis entitled "*Network Models of Tetrapod Skull Morphology: Implications for the Analysis of Morphological Integration, Modularity, and Phenotypic Stability,*" which has been developed under the supervision of Diego Rasskin-Gutman at the Theoretical Biology Research Group, Institute Cavanilles for Biodiversity and Evolutionary Biology, University of Valencia.

The main goal of my thesis project is to use a network theory framework to study morphological problems related to

form at the connectivity level. Specifically, I have built anatomical network models for a sample of tetrapod skulls, on which I performed a comparative analysis of morphological integration and modularity. For this purpose, prior to any empirical study I offer a conceptual anatomical interpretation of those parameters specific to the network theory, in order to properly discuss all possible findings.

The analysis of evolutionary trends in the morphological complexity of the skull is the second goal of my project. The classical trend toward reduction of skull bone number in vertebrates is studied from the perspective of the skull as a network. Here, I discuss a trend toward increasing complexity and integration in skull network, as well as an evolutionary pattern in symmetry acquisition due to emergence of new unpaired bones. Finally, I use the information obtained from different network null models to build the theoretical morphospace (i.e., 'connectospace') of the tetrapod skull.

The results of four years work led me to propose several hypotheses about tetrapod skull organization as an integrative and modular system, and to offer some clues about how the particular network organization of skull bones affects the morphology of the skull during development and evolution; e.g., the key role of highly connected bones in the maintenance of skull robustness to bone loss and fusion events during evolution, the changes in skull module symmetry due to unpaired bones, and the whole network pattern as a correlation map underlying shape covariations.

Katinka QUINTELIER
(March 2012 – June 2012)

Katinka Quintelier obtained her PhD in Philosophy from Ghent University in 2011. Her work was on individual differences in moral cognition and their relevance for ethics. She studies how findings about human nature, cognition, and evolution are relevant to ethics. In some of her research she conducts empirical studies on moral psychology, specifically folk moral relativism and the

moral-conventional distinction. In other work she investigates the theoretical relationship between ethics and human evolution and cognition. She is a member of the interdisciplinary research group 'The Moral Brain.'

The Bridges between 'Is' and 'Ought'

The main goal of my stay at the Konrad Lorenz Institute is to inform normative ethics by using empirical findings. I focus on three topics.

1. *Religion and morality*. Previously, I explained the structure of naturalistic ethics and how it relates to the naturalistic fallacy. In this project, I apply this notion of naturalistic ethics to the creationism-evolution debate.
2. *Child-care and human nature*. I also apply the notion of naturalistic ethics to the question of who should be encouraged to care for children. Evolutionary theories suggest that women evolved to assist each other in child care duties. In light of these biological data, should we really urge only fathers to stay home and care for their children, should we focus on the promotion of child care facilities, or should we include still other options?
3. *Moral relativism*. In previous work, I argued that lay people have consistent agent relativist notions of morality. This is a subset of moderate moral relativism that has been ignored in the literature. I will further ask if this kind of folk moral relativism is normatively appealing.

Joeri WITTEVEEN
(November 2011 – April 2012)

Joeri Witteveen obtained his liberal arts undergraduate degree from University College Maastricht in 2006. He took courses towards his degree at the University of California, Berkeley. In September 2007 he finished his work on theories of cultural evolution for the MSc in Philosophy of the Social Sciences at the London School

of Economics and Political Science. He is currently pursuing a PhD in History and Philosophy of Science from the University of Cambridge.

Rethinking Typological versus Population Thinking: A Philosophical Examination of a Disputed Dichotomy

The problem my doctoral research focuses on is the discord between communities of historians of biology, philosophers of biology, and practicing biologists in interpretation, use, and evaluation of the distinction between 'typological thinking' and 'population thinking.'

In the years since biologist Ernst Mayr introduced this dichotomous distinction, it has spread through textbooks, articles, and anthologies in different disciplines. Some take the distinction to be no more than a rhetorical device, others think it brings out fundamental metaphysical and/or epistemological differences that are relevant from a historical perspective or in contemporary scientific practice.

The widely divergent interpretations of the meaning and relevance of the distinction come together in the philosophy of biology. There the distinction is invoked in a variety of discussions on conceptual issues in evolutionary biology, without there being much uniformity in its interpretation and deployment. To mitigate polysemy within the philosophy of biology and to promote communication between historians, philosophers, and evolutionary biologists it is important to put the distinction on a firm footing.

Reassessing and continuing recent work in the history and philosophy of biology will help us to acquire a better understanding of what the distinction between typological and population thinking is a distinction between, what its relation is to other long-standing conceptual issues, and what its relevance is to topical issues in evolutionary developmental biology and systematics.

2.3 Postdoctoral Fellowships

Tudor BAETU
(March 2012 – February 2014)

*Tudor Baetu holds degrees in Biology and Philosophy of Biology. He obtained a MSc degree in Molecular Biology from McGill University (*Expression of Cytokine and Apoptotic Genes: a role for NF-kB in the regulation of TNF-a Related Apoptosis Inducing Ligand (TRAIL) expression, 2001*), where he worked on a project concerning the regulation of immune responses in cancer and HIV infection. He finished his PhD in Philosophy at the Université de Montréal, under the supervision of Prof. Yvon Gauthier. In his dissertation (*Strategies of Empirical Justification in Experimental Science, 2009*), he investigated the experimental constraints on the formulation and confirmation of hypotheses, using genetics as a study case. From 2008 to 2011 he worked at the University of Maryland on a project concerning the evolution of the concept of the gene from classical genetics to molecular biology to present-day genomics.*

Molecular Mechanisms in the Context of Systems Biology

The main objective of my research program is to elucidate the complex epistemic relationships between mechanistic explanations in molecular biology and associated wet-lab experimental practices, and newly developed systems biology models and associated bioinformatics approaches. More specifically, I aim to gain a better understanding of how complex systems of molecular mechanisms can be modeled in a computationally efficient way in order to make possible novel predictions about the overall behavior of cells and organisms over extended periods of time, as well as predictions about disease progression and other dynamic aspects of biological phenomena; and how mathematical models of disease and other biological

phenomena can provide new insights about the causal processes responsible for producing these diseases and phenomena. In addition to providing better predictions about disease progression and unwanted side-effects of treatments, the integration of mathematical modeling in molecular biology may also reveal thus far unsuspected causal factors, the investigation of which will eventually lead to the development of new treatments, new experimental techniques, and practical applications. I am particularly interested in elucidating the connection between novel, quantitative models of genomic contributions to phenotypes, such as gene regulatory networks (GRNs) and abstract/schematic representations of mechanisms of genome expression. Using gene molecular networks as study cases, I aim to investigate how knowledge of molecular mechanisms contributes to the models devised by systems biologists, and vice versa: what kind of knowledge about molecular mechanisms can be extracted from quantitative models derived from the analysis of large bodies of genomic, transcriptomic, and proteomic data. Several GRNs have been elucidated in great detail, and, at least in some cases, there is substantial knowledge available about the biochemical details of the molecular mechanisms underlying them. At the same time, several GRN modeling strategies as well as quantitative models of actual GRNs are available in the scientific literature. Thus, GRNs constitute a suitable study case for investigating the relationship between molecular mechanisms and more mathematical models associated with systems biology.

Elisa FRASNELLI
(January 2011 – January 2013)

Elisa Frasnelli has participated in a PhD program in Cognitive and Brain Sciences at the University of Trento from 2007 to 2010. Before starting her PhD work she spent several months at the Laboratory of Fluorescence Dynamics, Biomedical Engineering Department, University of California Irvine in 2006

and 2007. In 2009 she worked at the Centre for Neuroscience and Animal Behaviour, University of New England, Armidale, NSW, Australia, and in 2010 at Coffs Harbour, NSW, Australia, where she performed studies on Australian native bees in the field.

The Evolution of Brain and Behavioral Asymmetries: Theoretical Models and Empirical Tests

Recent studies have revealed a variety of left-right asymmetries among vertebrates and invertebrates. In many species, left- and right-lateralized individuals coexist but in unequal numbers ('population-level' lateralization). Using mathematical game theory, it has been shown that in the context of predator-prey interactions, population-level lateralization can arise as an evolutionarily stable strategy when individually asymmetrical organisms must coordinate their behavior with that of other asymmetrical organisms (Ghirlanda and Vallortigara 2004). Recently, I took part in further modeling (Ghirlanda et al. 2009) showing that populations consisting of left- and right-lateralized individuals in unequal numbers can be evolutionarily stable, based solely on strategic factors arising from the balance between antagonistic (competitive) and synergistic (cooperative) interactions. Empirical evidence supporting the model have been provided by comparative studies in insects of the Hymenoptera Apoidea family, showing social and non-social organization (Anfora et al. 2010), suggesting that stable polymorphism with an uneven distribution of left- and right-forms can be expected to emerge spontaneously in species in which left-right biases have behavioral consequences during everyday interactions between individuals.

The aim of my research project is to consider how strategic factors interact with other potential determinants of lateralization, in particular genetic mechanisms, integrating our game-theoretical approach with more traditional genetic models based on research on human handedness. As to the empirical part of the project, I would be interested to investigate other species of insects displaying different degrees of sociality. Comparative research with several species of

Hymenoptera both in the field and laboratory may provide important insights in the evolution of left-right asymmetries in behavior and in the nervous system.

Aida GÓMEZ ROBLES
(March 2011 – February 2012)

Aida Gómez-Robles completed her PhD in Paleo-Anthropology (Biological Sciences) at the National Research Centre for Human Evolution (Burgos) and at the University of Granada in May 2010. Her research consists mainly in the analysis of morphological variation and evolution of human dentition using geometric morphometric techniques. Her current research interests include the use of quantitative methods to better understand the evolution and development — and the interaction between both processes — of teeth and other serially homologous systems.

In Silico Evolution of Hominin Dental Morphology

Geometric morphometric analyses of skeletal remains are becoming more and more common in paleo-anthropological research. These methods provide not only a complete description of morphological variation, but also new datasets that can be used to examine the dynamic processes underlying morphological variation. The evolution of teeth, from which many evolutionary inferences are drawn, is constrained by different factors, including phylogenetic, developmental, and functional ones. Quantifying and characterizing these factors is fundamental to test the accuracy of evolutionary scenarios inferred from cranial and dental traits. The analysis of hominin dentition can also help us to understand the evolution and development of serially homologous structures, which appear when a developmental program is multiplied and expressed in a new location. Morphological analyses of teeth can shed some light onto the developmental mechanisms constraining diversification and the functional pressures causing differentiation within homologous series. Previous research on

human evolution has assumed a neutral mode of change for the dental system without testing this hypothesis, thus biasing many results derived from dental features. This assumption is based on an expected similarity between dental and cranial characters, which show a pattern of neutral evolution. However, these different features may be subject to different selective pressures, being effectively located in different evolutionary scenarios. In this light, *in silico* studies based on computer simulations provide an experimental framework to test hypotheses about evolution on a paleontological time scale and with an illustrative visual output. This approach is useful for delineating theoretical possibilities and eliminating some specific simulation models, with all the parameters assumed by it, by comparing model results with actual paleontological data. Theoretical possibilities observed as a result of the simulations but not explored by evolution can clarify the mechanisms underlying biological variation.

Daniel NICHOLSON
(January 2011 – October 2012)

Daniel Nicholson holds Masters degrees in Molecular and Cellular Biology (University of Bath) and in History and Philosophy of Science (University of Leeds). In 2010 he obtained his PhD in Philosophy (University of Exeter). His doctoral thesis presented a critical examination of mechanistic thinking in biology. He is particularly interested in the role of machine models in biological explanations, in the task of providing a naturalistic account of organismic purposiveness, and in philosophical arguments for the autonomy of biology. He also has a longstanding interest in the history of theoretical biology.

The Organicist Conception of Life: Rethinking the Nature of Organism

This project is concerned with the theoretical foundations of our biological understanding of the nature of organisms. Since Descartes, the dominant school of biological thought regard-

ing the nature of life has been mechanicism, which conceives organisms in analogy with machines. Guided by this conception, mechanicism understands biological wholes in terms of the activities of their component parts; it characterizes the properties of living systems from the bottom up in increasing levels of complexity; it emphasizes the causal and material attributes of organisms over their organizational and teleological features; and it vindicates the appeal to explanatory reductionism in the study of organisms. Although mechanicism has played a fundamental role in the historical development of biology, and indeed still underlies many areas of biological inquiry today, there is a growing awareness in the biological community that it no longer provides an adequate theoretical framework in which to make sense of the most recent advances in our understanding of organisms.

The project attempts to lay the philosophical groundwork for the articulation of a biologically compelling theoretical alternative to the mechanistic conception of life. To do so, it draws on the rich, yet largely neglected anti-mechanistic tradition in biology. In the early twentieth century, a number of theoretical biologists, including J. B. S. Haldane, J. H. Woodger, and L. von Bertalanffy, used the classic vitalistic critiques of mechanicism to develop a new naturalistic theory of the organism called organicism. Organicism takes the teleological self-organizing nature of living systems as the hallmark of their ontological distinctiveness, and by implication regards biology as an autonomous science possessing its own theoretical principles distinct from those of physics and chemistry. Although organicism flourished for a brief period, it was eclipsed by the molecular revolution that swept biology in the 1950s, and consolidated mechanicism for the rest of the century.

The main contention of the project is that organicism possesses the necessary intellectual resources to supplant mechanicism as a general theory of living systems. Thus, the project aims to use the pioneering ideas of several early twentieth-century theoretical biologists as a springboard to formulate an organicist philosophy of the organism capable of coming to terms with the latest empirical findings of biology. The project is not only concerned with biological ontology, as the organi-

cist conception of life also has important implications for the study of living systems and our understanding of biology as a science.

Laura NUÑO DE LA ROSA GARCÍA
(April 2012 – April 2013)

Laura Nuño de la Rosa García graduated in Humanities from the University of Alicante, and joined the doctoral program in Philosophy of Science at Complutense University, Madrid, where she defended her DEA thesis, Philosophical History of the Idea of Organismal Form: From Aristotelian Hylemorphism to Cellular Microanatomy, *in 2005. She subsequently studied Biophysics at the Autonomous University of Madrid, and obtained a Master´s degree in Biophysics in 2010. She finished her PhD thesis in Philosophy of Biology at the Complutense University of Madrid and the IHPST (Paris) in 2012. Her thesis dealt with the concept of form in contemporary biology, especially in EvoDevo.*

The Problem of Organismal Form: from Description to Explanation. The Case of Vertebrate Limbs

The problem of organismal form played a privileged role throughout the history of biology. However, since the end of the 19th century, the significance of morphology progressively weakened until its practical disappearance in the context of the triumph of the Modern Evolutionary Synthesis and the genetic theory of development. However, since the late 1970s, morphology has experienced a renaissance in almost every domain of biology, which has brought the spatial dimension of biological entities back to the fore. The return of form in the biosciences has awakened interest in the history of morphology, and drawn increasing philosophical attention to the Aristotelian notion of 'formal causation' as well as to morphological concepts such as 'type,' 'homology,' and 'novelty.' However, many historical and philosophical challenges related to the morphological approach to development and evolution

remain to be explored. My post-doc project aims at addressing some of these challenges: (1) to explore the historical roots and to analyze the epistemological and ontological implications of the taxonomical and the morphological approach to the problem of form; (2) to examine the interweaving of modeling practices and explanations in developmental biology and EvoDevo; (3) to distinguish the conceptions of causality underlying different explanatory strategies of form in developmental biology and EvoDevo; (4) and to investigate the relationship between form and organization in developmental and evolutionary biology. In line with my philosophical project, I aim at (5) developing an epigenetic hypothesis on one of the most classic and still unsolved problems in the history of evolutionary theory: the origin of vertebrate limbs. According to my hypothesis, the number and position of the paired appendages along the A-P and D-V axes of vertebrates are due to a commonality of tissue environments determined by the global interactions that relate the two types (somatic and visceral) of lateral plate mesoderm.

Eran SHIFFERMAN
(March 2011 – February 2012)

Eran Shifferman studied Biology at the University of British Columbia. He obtained his Bachelor´s degree in Biology from Tel Aviv University in 2003. He studied at the Cohn Institute for the History and Philosophy of Science and Ideas (2004-2005) and in 2006 joined a PhD program at the Philosophy Graduate School, Tel Aviv University, which he completed in 2011. Shifferman was awarded the Rotenstreich Scholarship for Outstanding PhD Students (2006-2011).

A Theoretical Eco-evolutionary Account of the Complexification of the Quantity Estimation Aptitudes in the Animal Kingdom

My project is a theoretical eco-evolutionary account of the complexification of the quantity estimation (QE) aptitudes

in the animal kingdom. I wish to bring together all the sub-disciplines that deal with any aspect of QE in order to create a combined body of knowledge that can be used as bedrock for the implementation of a new kind of evolutionary analysis, which constitutes a full-bodied, rich, and coherent tale of complexification.

My basic premise is that quantity is omnipresent, highly useful information for survival and, as such, mechanisms that allow for its perception and processing have emerged, persisted, and complexified during evolutionary history. By complexification I assume that in order to shift from one aptitude to the next, more cognitive elements need to be integrated. This process had shaped a continuum of different cognitive manifestations of QE ranging from quorum sensing at its origin and culminating in mathematics. I also argue that QE is a composite behavior utilizing independent cognitive pathways, which in turn serve as its foundation while simultaneously possessing contextually antagonistic and competitive functions. By 'composite' I mean that in order to be able to relate to quantity, an organism already relies on other available perceptual and/or cognitive traits operating on the same stimulus. I consider these other traits to be the building blocks of QE. 'Competition' means that the sheer utilization of these building blocks automatically offers them concurrently as a viable alternative solution to the task. This interweaving is the source of both the emergence of QE complexification (phylogenetically) and of its hindrance (ontogenetically). I also suggest a plausible mechanism behind the evolution of QE and claim it is guided by exaptation and neurological redeployment: old and new cognitive pathways vie for 'processing rights' and exert selection pressure on each other.

I will offer a new eco-evolutionary narrative, complete with ontogenetic and phylogenetic mechanisms that utilize neurological models and evolutionary theory. Then I will demonstrate how the proposed framework brings to the surface a new perspective of the evolution of cognition by using selected examples.

2.4 Senior Fellowships

Wayne CHRISTENSEN
(February 2010 – January 2012)

Wayne Christensen studied Philosophy at the University of Newcastle, Australia (PhD, 2000), and worked as a post-doctoral research associate with the Complex Adaptive Systems Group there in 2000-2001. He was a post-doctoral fellow at the KLI (2002-2004) and in the Philosophy Department at the University of Kwazulu-Natal, South Africa (2004-2006). More recently (2007-2009) he has been a research fellow in Philosophy and Cognitive Science at Macquarie University, Australia. W. Christensen is currently working on a book that investigates the cognitive and biological foundations of personal agency. The objective is to promote a broad-based engagement between philosophical agency theory and empirical cognitive research. Within this larger project he is currently developing an account of the respective roles of automatic and higher cognitive processes in skilled action, and a naturalist approach to the foundations of normativity. In recent work he has proposed a theory of the role of hierarchically structured control and model-based representation in the evolution of cognition.

A Naturalist Theory of Agency: Biological and Cognitive Groundings

The goal of this project is to complete a book project that will be submitted to the Cognition, Brain, and Behavior series of MIT Press. The book will develop a theory of the cognitive and biological grounding of personal agency. Agency is a central topic of research in philosophy with fundamental and wide-ranging significance. Reflective agency is commonly regarded as central to personhood, autonomy, and moral normativity. As such it has great practical significance. Most philosophers take the cognitive basis for reflective agency to be more or less self-evident and unproblematic. However, some influential strands of empirical and philosophical research have chal-

lenged the causal role of introspective awareness in cognition. In philosophy of cognitive science Dennett (1991) has influentially criticized 'Cartesian theater' views that posit a central locus for conscious awareness and control. There have been numerous philosophical responses to the more influential challenges. But given the breadth of the empirical and conceptual issues, what is needed is not a piecemeal response to specific experiments, but rather a broad-based engagement between agency theory and empirical cognitive research. The book will develop such an engagement, and will have four main theoretical components: (1) an account of the integrated operation of automatic and controlled processes in voluntary action control, (2) a theory positing a common basis in hierarchical control for goal-directed and reflective agency, (3) a theory of agent individuation that takes biological individuality as a template, and (4) a theory of the naturalist grounding of agency norms.

Mihaela PAVLICEV
(March 2012 – June 2013)

Mihaela Pavlicev is a Lecturer in the Department of Theoretical Biology at the University of Vienna. She studied ecology at the University of Vienna (MA, 1998; PhD, 2003), and subsequently trained in molecular phylogenetics at the Natural History Museum in Vienna. She was a post-doc (as a Schrödinger Fellow) in quantitative genetics with Jim Cheverud at Washington University in St. Louis (2006-2008), and in theoretical population genetics with Thomas Hansen at Oslo University (2008-2011).

Evolution of Development by Natural Selection

One of the most enduring problems of evolutionary theory and biology in general is how complex organisms can arise from random genetic change. This is also the ultimate question guiding the proposed research on developmental evolution in response to natural selection. Because of the com-

plexity of the developmental process, most mutations have a variety of effects, but only a few of them are likely to be adaptive. Hence any adaptive evolutionary change is a complex mix of adaptive, fitness-increasing effects, deleterious side effects and compensatory changes ameliorating these deleterious side effects. This is the likely reason why evolution at the genomic and developmental level is exceedingly complex. Now, for the first time in history, with systems biology combined with novel methods from quantitative genetics we have the tools to probe and eventually understand the complexities of evolutionary change at the genetic and developmental level. In this project, I propose to explore the idea of developmental evolution by evolving pleiotropic genes, accompanied with the compensation of side effects. I will apply this model to a specific question: differentiation between fore- and hindlimb in mice. Specifically, the idea is that homologous parts share the crucial developmental program while its expression becomes modified by local factors. The developmental program and its modifying background maintain functionality by coadaptation, in this case allowing the two limb pairs to diverge in function. Using existing population variation in this mechanism, I will draw on a novel quantitative genetic approach to map the factors underlying differentiated development of the two limb pairs. The data used for this project stem from mouse intercross of two inbred lines. I attempt to complement a computational approach with the experimental validation of expression patterns. The model provides a unifying mechanism for evolutionary differentiation of parts at different levels. Within the population this model may underlie differentiation of traits in sexual dimorphism, above the population level it may underlie speciation by divergence of coadapted interacting gene complexes. This project provides a direct link between developmental and population genetics. Combined computational and empirical results will contribute towards more realistic theoretical models.

2.5 Exchange Fellowship

Stephan HANDSCHUH
(September 2010 – January 2012)

Stephan Handschuh studied Zoology at the University of Vienna, focusing on theoretical evolutionary biology, morphology, and imaging methods. In 2012, he finished his Doctoral thesis at the University of Vienna, where he also lectures on 3D imaging and visualization methods, and histology.

Sexual Selection and Assortative Mating: Key Factors in the Evolution of Crustacean Bodyplans?

Population and developmental genetics represent two prominent approaches of modern evolutionary research. Within the field of evolutionary developmental biology (EvoDevo), the evolutionary developmental genetics approach gained importance due to progress in cloning and visualization techniques. Today a fusion of classical population genetics and developmental genetic data seems both challenging and necessary. On the way towards synthetic interpretations and evaluations of evolutionary scenarios there is a need for model systems that are well investigated in both regards. The bodyplans of higher Crustacea (Malacostraca) may present such a model system.

I introduce a number of hypotheses that implicate complex mating systems and their population genetic consequences as key factors in the evolution of Malacostracan bodyplans. Sexual selection in particular is assumed to act directly on the expression patterns of developmental regulatory genes underlying the morphology of structures that are crucial for mating behavior. The main part of this work is the detailed investigation of the complex mating system of *Dikerogammarus villosus* (Amphipoda), using modern and innovative techniques like x-ray microCT for acquiring morphometric data. Based on the combination of morphometric and regulatory gene expression data, this study may yield new insights into the mechanisms of Malacostracan bodyplan and appendage evolution.

2.6 Visiting Scientists

Sabine BRAUCKMANN
(December 2012 – February 2013)

Sabine Brauckmann studied Philosophy, Mathematics, and Slavic Literature and Languages at the University of Münster. She finished her PhD work in 1997 with a thesis on the organismic systems theory of Ludwig von Bertalanffy. Until 2000 she was a research associate of the Institute of Philosophy, University of Münster. Meanwhile she also conducted projects on the history of theoretical morphogenesis and the scientific life of Paul A. Weiss as a visiting scholar of the MPI for Neurobiology, the Rockefeller Archive Center, and the Department of Medical Genetics, University of Utah. The German Research Foundation awarded her a Research Fellowship to continue her biographical project on Paul A. Weiss at Dartmouth College and Johns Hopkins University until early 2003. She was a post-doctoral fellow at the KLI in 2003-2005 and a senior fellow in 2008 as well as in 2010-2011.

A Laboratory in the Prater: The Biologische Versuchsanstalt in Vienna

The book project 'Vivarium' will be a detailed study of the research program of the Biologische Versuchsanstalt in Vienna (1902-1945). The objective is to locate the Vivarium inside the context of experimental and theoretical biology from 1900 to 1940, to map the networking grid that connected it to other Austrian and international research institutes, and to trace its diverse tie-ins to fin-de-siècle Vienna. The first part of the edited volume will introduce the Vivarium as a new research institution in Austria, delineate the Jewish topography of the families of Przibram, Portheim, and Figdor (among some others), positioning them inside the Viennese culture and bourgeoisie, and trace how the scientific community of the university and the academy acted towards them. The following main part, elaborating the Vivarium's research program of

experimental and theoretical biology, will display the experimental work of the departments dealing with developmental physiology, classical genetics/heredity, botany and plant physiology, and medical physiology/endocrinology, without neglecting the role of the women scientists, and also including a chapter on the impact theoretical biology had on the experimental research at the Vivarium. The third part presents the architecture of the building and its equipment, followed by a chapter discussing the collections, library, and museum. The final part will discuss the international exchange programs, and will compare the Vivarium with international research institutes (e.g., Cambridge, Agram, Lunz, Monaco, Moscow, Philadelphia, Rome), and university institutes working on similar problems.

Russell POWELL
(May 2012 – June 2012)

Russell Powell is Assistant Professor in the Department of Philosophy at Boston University. Prior to his appointment at BU, Dr. Powell was an Arts and Humanities Research Council Fellow in the Faculty of Philosophy, and a James Martin Research Fellow in the Institute for Science and Ethics at Oxford University. Before his time at Oxford, R. Powell was a Greenwall Postdoctoral Research Fellow at Johns Hopkins University, and a Visiting Assistant Professor of Philosophy and Senior Research Scholar in the Kennedy Institute of Ethics at Georgetown University. R. Powell holds advanced degrees in philosophy, biology, and law, and prior to his academic work in philosophy he worked as an attorney in complex pharmaceutical liability litigations. His research interests range from the philosophy of biology and bioethics to political and legal philosophy, with a special interest in the epistemological and metaphysical dimensions of emerging biotechnologies. In the philosophy of biology he works on macroevolutionary theory (especially convergent evolution and its implications for evolutionary contingency), philosophical problems in connection with human evolution and

the evolution of religion, and the relationship between evolution and ethics. He is currently serving as Associate Editor for the Journal of Medical Ethics*, which is part of the British Medical Journal Group.*

Human Evolution: Past, Present, and Future

This project explores conceptual and methodological problems in the study of human evolution. There is a tendency in both scientific and humanistic disciplines to think of biological evolution in humans as significantly impeded if not completely overwhelmed by the robust cultural and technological capabilities of the species. The central aim of this research is to make sense of and evaluate this claim. Doing so will require fleshing out the argument that humans are 'insulated' from ordinary evolutionary mechanisms in terms of our contemporary biological understandings of phenotypic plasticity, niche construction, and cultural transmission. In addition, I will consider some obvious objections to the above argument based on the growing literatures related to gene-culture coevolution and recent positive selection on the human genome, in addition to some less common objections relating to the connection between plasticity, population size, and evolvability. I contend, however, that the case for continued biological evolution in humans is significantly more persuasive than it is usually taken to be. This is because both the 'human evolutionary stasis argument' (as I call it) and its various detractor theories are premised on a fundamental conceptual flaw: they take evolutionary stasis for granted, since they fail to conceive of stabilizing selection as a type of evolution and drift as a universal tendency that dominates in the absence of selection (or other evolutionary forces). Without the continued operation of natural selection, the very properties that are purported to reduce the evolutionary response to selection in humans would themselves drift into non-functionality. My conclusion will be that properly conceived, biological evolution is a permanent and ineradicable fixture of any species, including *Homo sapiens*. I will then apply this conclusion and the various lines of reasoning on which it is predicated to contemporary problems in biomedical science. In particular, I will consider the implications

of human evolutionary history for medicine, and medicine for the future of human evolution. Evolutionary perspectives have rarely been integrated in medical practice and education, in part due to the strong connection between proximate causation and clinical outcomes, and in part due to the sordid history of Darwinian perspectives in bioethics and social policy. I will develop and defend the counterintuitive claim that the greater the effectiveness of classical medicine, the greater the need for human genetic modification, given the former's predictable population-genetic effects. This conclusion will follow on the heels of the above conceptual and empirical analysis of the relation between selection, drift, and evolutionary buffering mechanisms.

María José FRÁPOLLI SANZ
(September 2012)

María-José Frápolli Sanz is Professor of Logic and Philosophy of Science at the Department of Philosophy I, University of Granada, Spain. She has been the former President of the Spanish Society of Logic, Methodology, and Philosophy of Science. Her work is focused on the study of higher-order concepts: truth, quantifiers, logical constants, and epistemic notions.

A Priori and Logical Constants

Logic is an essential part of our rational behavior, and its significance and the meanings of its concepts cannot be understood when the kinds of actions speakers use logical terms for are ignored. Logic poses no special problelm to the project of naturalism. Inferential practices are just one kind of linguistic actions. If the latter are naturalistically explainable, so are the former.
We will focus on logical connectives and quantifiers as higher-order expressions. Some traditional treatments of logical constants only point, dimly, to their higher-order status.

- the Medieval characterization as syncategorematic terms;

- Invariantist positions that stress that logical constants don't discriminate among individuals;
- Inferential accounts to the extent that logical constants exhaust their meaning in their introduction and elimination rules.

Applying to them the understanding of higher-order concepts reached by contemporary philosophy of language might offer a healthy change of perspective towards this traditionally troublesome issue.

The particular aspect of this general research on which I will search some illumination during my stay at the KLI has to do with the cognitive human abilities that can account for human trading with higher-order concepts. A further, related topic I will be concerned with is the kind of a priori proper of logic, once logical constants have been understood as higher-order concepts.

Jan-Willem STOELHORST
(April – May 2012)

Jan-Willem Stoelhorst is Associate Professor of Strategy and Organization and head of the Strategy and Marketing section at the Amsterdam Business School, University of Amsterdam. He received his PhD degree in management studies (cum laude) from the University of Twente, the Netherlands. His research interests include the application of evolutionary theory in the social sciences (in particular economics) and the application of evolutionary and economic theory in management (in particular the field of strategy). His work on these and related issues has been published in California Management Review, Journal of Business Research, Journal of Economic Methodology, and Journal of Management Studies*, among others. He is coordinator (with Jack Vromen) of the research area 'The Ontological Foundations of Evolutionary Economics' for EAEPE (the European Association of Evolutionary Political Economy).*

Generalized Darwinism and Institutional Change

There have been many attempts to develop evolutionary theories in the social sciences. A recent attempt in economics is the work on 'generalized Darwinism' (e.g. Aldrich et al. 2008; Hodgson 2002; Hodgson and Knudsen 2006, 2010; Stoelhorst 2005, 2008). This work assumes that, at a sufficiently high level of generality, biological and cultural evolution are not just analogous, but similar. In light of this premise, the purpose of the work on generalized Darwinism is twofold. The first purpose is to specify a meta-theory of evolution by generalizing the explanation of evolution developed in biology. The second purpose is to use the resulting meta-theory to develop middle-range theories of socio-economic phenomena. The work on generalized Darwinism has been under way for some ten years. While progress has been made on specifying a meta-theory of evolution, progress on applying the resulting meta-theory to specific socio-economic phenomena has been very limited. This project is motivated by this lack of progress on applying generalized evolutionary principles in economic theory. The premise of the project is that this lack of progress is largely due to the specific way in which proponents of generalized Darwinism have formulated their meta-theoretical framework. In particular, the adoption of the replicator-interactor distinction as the centrepiece of the framework by its most prominent advocates (Hodgson & Knudsen 2010) seems to hold back the development of fruitful middle-range theories. In light of this premise, the aim of the project is twofold: to specify a meta-theory of evolution that takes its starting point in evolutionary epistemology (e.g., Campbell 1974; Plotkin 1994), rather than the replicator-interactor distinction, and to apply this framework to the development of a theory of institutional change.

2.7 Junior Visiting Scientist

Richard GAWNE
(July – August 2012)

Richard Gawne is a PhD student in Philosophy at Duke University. He holds a Master´s degree in Biology from Duke University, a Master of Philosophy in History and Philosophy of Science from the University of Cambridge, and a Master of Arts in Philosophy from Western Michigan University. Richard worked as an instructor and graduate teaching assistant at the Department of Philosophy at Western Michigan University.

Rethinking the Lagacy of J. H. Woodger and the History of Twentieth-Century Philosophy of Biology

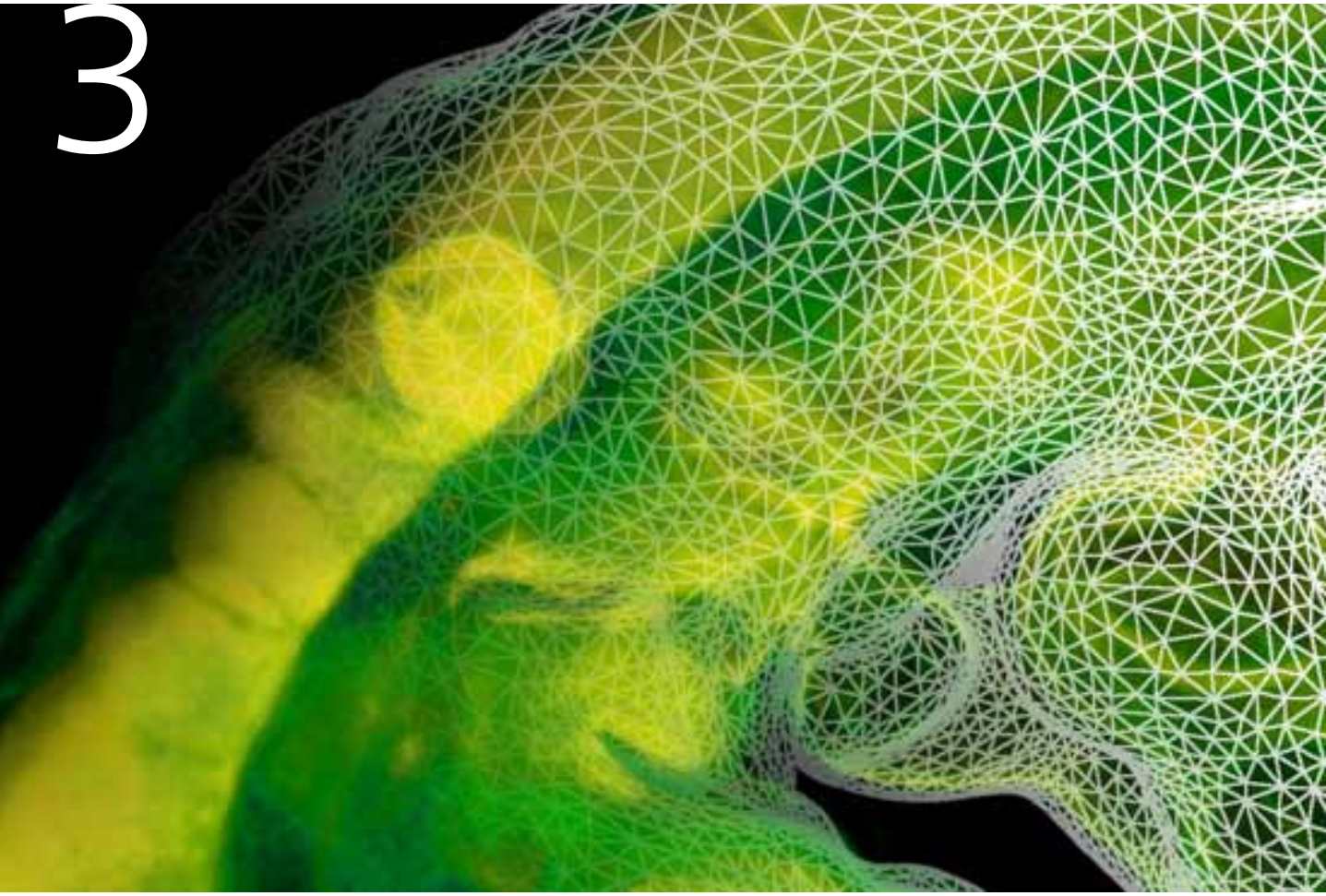
Today, the philosophy of biology is a thriving sub-field of the philosophy of science, but according to most accounts, the discipline modern analytic history stretches back no further than the last third of the 20th century. Works such as Kenneth Schaffner´s *Antireductionism and Molecular Biology* (1967), William Wimsatt´s 'Teleology and the Logical Structure of Function Statements' (1972), Michael Ruse´s *The Philosophy of Biology* (1973), and *The Philosophy of Biological Sciences* by David Hull (1974) are generally credited as being among the field´s pioneering efforts. By the time these pieces made it to print, however, the philosophy of science, and related sub-fields such as the philosophy of physics, had long become recognized areas of specialization. Many contemporary philosphers of biology have suggested that the discipline´s belated development is attributable to the erstwhile prominence of logical positivism, and its accompanying deification of the physical sciences. The positivistic leanings of the practitioners who plied their trade during the early part of the 20th century are said to have discouraged careful analysis of biological issues, and corrupted the few scattered attempts at the philosophy of biology that were undertaken. After the collapse of logical positivism, philosophers were able to see the organic world in

an unbiased light, and the seeds which spawned the contemporary literature could finally be sown, or so says the sanctioned account of the field´s developmental history.

To highlight the alleged futility of the biophilosophy undertaken prior to the late 1960s, proponents of the 'received view' outlined above have often cited the work of Joseph Hentry Woodger, which is said to exemplify all that was misguided about positivistic excursions into the life sciences. 'First-generation' philosophers of biology who began publishing in the 60s and 70s were quick to attack Woodger in order to distance themselves from his method and theories, but the criticism leveled by these individuals was anything but even-handed. Later thinkers accepted the analyses put forth by the first-generation practitioners without taking the time to consult the relevant primary sources, and as a result of this ahistoricism, a number of myths about Woodger have become canonized as official dogma of the discipline. The aim of this project is to lay the foundations for a new narrative history of 20th-century philosophy of biology by redressing these errors, and reestablishing Woodger as a figure of historical and contemporary importance.

Meetings and Lectures

3



The KLI supports international workshops, symposia, lecture series, and individual talks that are organized either by the KLI or in cooperation with other institutions.

3.1 Altenberg Workshops in Theoretical Biology

The 'Altenberg Workshops' address key questions of biological theories. Each workshop is organized by leading experts of a certain field who invite a group of international specialists to the KLI. The resulting books are published by The MIT Press in the Vienna Series in Theoretical Biology. The Altenberg Workshops aim to make conceptual progress and to generate initiatives of a distinctly interdisciplinary nature. Further information concerning the participants and their presentations can be found on the KLI website.

28th Altenberg Workshop in Theoretical Biology 5 – 8 July 2012

Origins of Complex Communication and Language: Epigenetic Modeling and Ethological Observation

Organization: D. Kimbrough Oller, Ulrike Griebel, and Rick Dale

Topic and aims

Modeling of communication/language evolution and learning has shown an extraordinarily accelerating publication rate in the last two decades. The work includes both the application of existing statistical methods and the development of new tools, including options utilizing neural networks of varying architecture and implementations in epigenetic robotics. There have been some remarkable successes in this process, with new 'existence proofs' illustrating, for example, that associative learning and interactive patterns among simple agents can account for the acquisition and/or evolution of a variety of structures that appear to be related to language. Yet it remains uncertain how much such modeling has to say about the real processes of language evolution and development. A key factor here concerns the particular 'units' of communication to posit as inputs to models, and how to interpret outputs as units of the system being modeled. This is a fundamentally theoretical problem of external validation. One cannot know what models illustrate about the real processes of development or evolution if the models are not grounded in external evidence from the empirical study of language change. Of course the units of communication that were relevant at each stage in the evolution of language can only be inferred. On the other hand, the units of communication in the development of language in individual infants

and children can be observed in longitudinal research. Thus at least in the short run the success of modeling of language change can best be judged by its success in simulating the observed steps of development in real human infants and children.

The problem of 'units' in development is not at all trivial for modeling because the units of communication themselves change dramatically in both forms (the transmission units) and functions in the process of early development. Consider first the forms of natural language: Mature units such as well-formed (or 'canonical') syllables, phonemes, or phrases are not produced systematically in the early months of life. Yet infants do 'communicate' with precanonical vocalizations including both cries and laughter as well as with a notable set of infant precursor forms that appear to have infrastructural significance for speech. Infants engage in vocal turn taking, vocal play, and in expressive acts. These human infant vocalizations of the first months of life can be shown to differ in form, variety, and flexibility of use from vocal forms of other primates at any age. So realistic modeling of early vocal development cannot begin with alphabetical units such as phonemes as the units of transmission, because real infants simply do not possess them. Yet most modeling that has been conducted on language evolution or development to date has utilized phonemic level units such as vowels or syllables. Clearly it will be necessary to model development such that forms change from stage to stage, and where in the earliest stages precanonical forms become the focus.

Consider also the functions of natural language: The earliest vocal communications are clearly not symbolic, and thus they do not make explicit reference to objects or events. Instead, early vocal communications systematically express states and can solicit attention or assistance, but the functions that are served by the vocalizations are at best 'illocutionary' rather than 'semantic.' Again however, the range of vocal expressions that is possible in the human infant and the flexibility with which those communications can be presented clearly exceeds that of non-human primates at any age. Thus realistic modeling of the earliest stages of vocal communication cannot begin with semantic (that is, referential) lexical units as the functions that are transmitted. It will be necessary to model development such that functions of communication change from stage to stage and where in the earliest stages illocutionary functions become the focus.

ULRIKE GRIEBEL
University of Memphis
"My Dog Understands Every Word I Say": Cognitive Underpinnings of Language and Evidence from the Animal Kingdom

D. KIMBROUGH OLLER
University of Memphis
Vocal Development as a Guide to Modeling the Evolution of Language

RICK DALE
University of California Merced
Language Evolution by Multimodal Synergy

LINDA B. SMITH
Indiana University, Bloomington
Senorimotor Origins of Reference

MORTEN H. CHRISTIANSEN
Cornell University & Santa Fe Institute
The Importance of Chunking in Language Learning and Evolution

GERT WESTERMANN
Lancaster University
Experience-dependent Brain Development as a Key to Understand the Language Faculty

DAN DEDIU
Max Planck Institute for Psycholinguistics, Nijmegen
Language Acquisition, Change and Evolution: Genetic Influences and Phylogenetic Approaches

CYNTHIA BREAZEAL
Massachusetts Institute of Technology, Cambridge, MA
Human-Robot Communication and Coordination through Non-verbal Behavior

PIERRE-YVES OUDEYER
Inria
Bootstrapping Language Development out of Multimodal Curiosity and Socially Driven Development of Sensorimotor Skills in Robots

CARLOS GUSSENHOVEN
Radboud University Nijmegen
Functions of Intonation: Complex Language Structures versus Physiologically Based Paralinguistic Communication

36 ANDREW WEDEL
University of Arizona, Tucson
Context-specific Pronunciation and the Creation of Regular Sound Change: Effects of Short versus Long-term Predictability on the Pronunciation of Individual Words

BOB McMURRAY
University of Iowa, Iowa City
EvoDevo in the Third Dimension: The Role of Real-time Processes in Language Development and Evolution

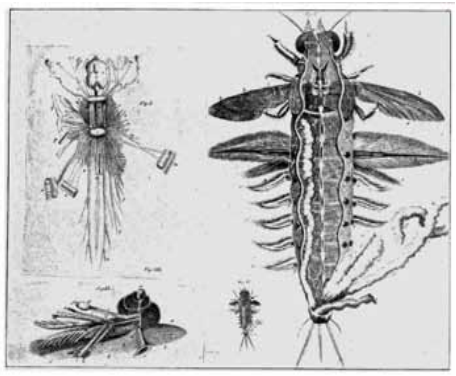
BENJAMIN K. BERGEN
University of California San Diego
How did Grammar come to Modulate Embodied Simulation?

GARY LUPYAN
University of Wisconsin, Madison
Cognitive Functions of Language and their Implications for Language Evolution

VITTORIO LORETO
Sapienza University of Rome
A Cultural Route to the Emergence of Duality of Patterning

BART DE BOER
Vrije Universiteit Brussel
Interaction of Biological and Cultural Evolution of Speech: The Case of Combinatorial Structure

3.2 Summer School



2nd European Advanced Seminar in the Philosophy of the Life Sciences
10 – 14 September 2012

***In Vivo, ex Vivo, in Vitro, in Silico*: Models in the Life Sciences**

Brocher Fondation, Hermance (Geneva)

Organization: ESRC (Exeter), IHPST (Paris), KLI (Altenberg), SEMM (Milan), Universität Bielefeld, Université de Genève

MARCEL WEBER
Geneva
Experimental Modelling: Exemplification and Representation as Theorizing Strategies
NINA ATANASOVA
Cincinnati
Comment

JEAN GAYON
Paris
Model Organisms in Biology and Medicine
Tarquin HOLMES
Exeter
Comment

ALESSANDRO MINELLI
Padua
Model Organisms in Evo-Devo. Promises and Pitfalls of the Comparative Approach
Jan BAEDKE
Bochum
Comment

38 JOSEPHINE DONAGHY
Exeter
Models and Theory in Metabolic Control Analysis.

Andrea ESANU
Bucharest
Modeling Open-ended Evolution

Sebastien DUTREUIL
Paris
How/Why Should One Model the Organisms/Environment Interactions?
Marie KAISER
Geneva
Comment

Giovanni BONIOLO
Milan
Modeling Molecular Biology Complexity
Dan NICHOLSON
Altenberg
Comment

Philippe HUNEMAN
Paris
Computer Simulations in Evolutionary Theory
Fridolin GROSS
Milan
Comment

Silvia DE MONTE
Paris
Differential Attachment and the Evolution of Social Groups
Maximilian HUBER
Geneva
Comment

Rebecca MERTENS
Bielefeld
Flexible Tools: The Lock and Key Model Across Biochemical Boundaries
Tudor BAETU
Altenberg
Quantitative Mechanistic Explanations

Ann-Sophie BARWICH
Exeter
Making Sense of Smell: Models in Olfaction Theory
Pierre-Olivier MÉTHOT
Geneva
Comment

Adam TOON
Bielefeld
Molecular Models in Vitro and in Historico
Guillaume SCHLAEPFER
Geneva
Comment

Daniel BROOKS
Bielefeld
Problem Agendas in Neuroscience

Arnon LEVY
Jerusalem
Model Organisms Aren't Models
Pierre-Alain BRAILLARD
Paris
Comment

Michael DIETRICH
Dartmouth
Model Choice and Method Selection in Molecular Evolution
Jean HARRINGTON
Exeter
Comment

Amir TEICHER
Tel-Aviv
"In Stemma": Mendel's Model and Human Heredity in Germany, 1900-1933

Cecilia NARDINI
Milan
Generalizing Randomized Control Trials

40 Pierre-Luc GERMAIN
Milan
Disease Models Between Replica and Instruments
Thomas REYDON
Bielefeld
Comment

Sabina LEONELLI
Exeter
Model Organisms *in Vivo* and *in Silico*: Data, Speciments and Models
Gladys KOSTYRKA
Paris
Comment

Werner CALLEBAUT
Altenberg
Multiscale Modeling
Stephan KOPSIEKER
Bielefeld
Comment

Bruno STRASSER
Geneva
The End of Model Organism?

3.3 Focal Symposium

Focal Symposia in Theoretical Biology
14 – 15 June 2012

Data Intensive Biology: Why Google Won´t Replace Science

University of Vienna and KLI

Organization: Werner Callebaut and Isabella Sarto-Jackson

According to science critic James Le Fanu, ours is the "best and worst of times" for science. The best because funding has never been so lavish, publication output never so great, and data generation never more impressive in quantitative terms. Why the worst of times? Critics reprehend that despite the dramatic push of financial investment and deluge of data few new scientific landmarks were set. While until recently, biology raised high expectations by employing high-throughput technologies such as in the Human Genome Project (HGP), the 'rational' design of drugs, or personalized medicine, now disillusion takes over more and more. The genome project led to the disappointing finding that humans harbor less genes than weed and that human genes can be functionally replaced by mouse genes. *In silico* drug designers or scientists exploiting experimental model organisms for drug development increasingly exercise an attitude of humility in view of the creativity and richness of three and a half billion years of evolution.

Bioinformatics, computational biology, systems biology (here taken to include genomics, proteomics, and other 'omics'), and synthetic biology have become data-intensive scientific undertakings. High-throughput technologies as first deployed on a massive scale in biology in the HGP raise great expectations within the scientific community and beyond, which range from 'rational' drug design or a better understanding of meteorology to "an improved ability to examine history and culture" (Borgman 2010). The explosion of data in 'big sciences' such as astronomy, high energy physics, and more recently also in subdisciplines of biology and biomedicine has led to a reinterpretation of what science is and does as well as to the emergence of new fields of study such as astro-informatics and computational biology.

The "Fourth Paradigm" envisioned by Jim Gray (1944-2007), a software designer for Microsoft, calls for a new scientific methodology based on the power of data-intensive science, understood as the capturing, curation, and analysis of

large data (Hey et al. 2009). Its proponents intend this methodology to complement rather than to displace the first (empirical/experimental), second (analytical/theoretical), and third (large-scale computer simulation) scientific 'paradigms.' This sounds more plausible than Chris Anderson's (2008) claim that "with enough data, the numbers speak for themselves," and that we "can analyze the data without hypotheses about what it might show." Google, then, is not on its way to displace science.

The big data challenge concerns the scale, breadth, and complexity of the new data sets, whose combined effect is taken to require revolutionary measures for data management, analysis, and accessibility now that "biology is changing fast into a science of information management" (US National Institutes of Health). Although skepticism about the prospect of finding ways to extract useful information from this 'morass' is voiced occasionally (e.g., Valencia 2002; Brent 2004), most biologists and computer scientists put their hopes in data-driven modeling approaches such as clustering, principal components analysis, and partial least squares analysis, tools for the automated extraction of meaningful pathways from 'omics' data, new visualization techniques, and other technical advances. Some authors (e.g., Hanahan & Weinberg 2000; Woese 2004; Callebaut 2012) count on conceptual and theoretical breakthroughs.

The data torrent poses ethical and political challenges to society, which include big issues about who in democratic societies is to govern bioengineering with its promises of better drugs and even an "elixir of eternal youth" (Antoine Danchin), and more modest questions about the de/regulation of practices of data sharing within scientific communities and between the scientific community and other stakeholders (Strasser 2006; Leonelli 2009; Borgman 2010). Advocates of the "Fourth Paradigm" like to portray it as a means to enhance citizens' participation in science; it is probably too early to judge if such optimism is warranted.

Data intensive biology also raises a number of philosophical issues. This symposium can only focus on some of those:

- Is big data biology a new kind of science, presumably post-reductionistic or even holistic? To what extent is big data biology data-driven? Can data 'speak for themselves?' In her talk, Sabina Leonelli ponders whether we are witnessing "the rise of a new scientific epistemology" from her practice oriented philosophical perspective, which is informed by empirical studies of data curation.

- What is 'systemic' about 'systems biology'? Big data biology turns out to be pretty near-sighted when it comes to reflecting on its own conceptual founda-

tions. In an introduction to an issue of *Science* magazine on systems biology, Chong & Ray (2002), referring to Ludwig von Bertalanffy's General System Theory (1969), claim that Bertalanffy's "remains an effective definition of systems biology as practiced today with the integration and application of mathematics, engineering, physics, and computer science to understanding a range of complex biological regulatory systems." They go on to argue that the "delay" between Bertalanffy's "early pronouncement" of systems theory and the work presently assembled by systems biologists "was necessary, primarily to accumulate sufficient descriptions of the parts to enable a reasonable reassembly of the whole." Yet, as Athel Cornish-Bowden will argue in his contribution, present day systems biology often seems to be little more than old-fashioned experimental biology practiced on a vast scale and generating mountains of data, but with no real concept of a system as an entity in itself. As a consequence, he feels, it cannot lead to an understanding of life, because living systems can never be understood simply as the accumulation of vast amounts of data.

- *The role of theory*. A century and a half ago, Charles Darwin found it odd that "any-one should not see that all observation must be for or against some view if it is to be of any service!" Latter day believers in "let the data speak for itself" are but repeating a mistake that is as old as modern science itself: "About thirty years ago there was much talk that geologists ought only to observe and not theorize; and I well remember someone saying that at this rate a man might as well go into a gravel-pit and count the pebbles and describe the colours" (Darwin 1861). Current modeling practices in systems biology have been described as "Data without models merging with models without data" (Krohs & Callebaut 2007). In his contribution focusing on developmental control theory, Eric Werner will discuss the challenge of relating lower levels of molecular implementation with abstract theories of developmental control networks, and argue that data gains meaning and relevance only in the light of a theoretical perspective.

- Knowing through making? Microbiologist Carl Woese (2004) warned that "a society that permits biology to become an engineering discipline, that allows that science to slip into the role of changing the living world without trying to understand it, is a danger to itself." In the final contribution to this symposium, Joachim Schummer will scrutinize various epistemic claims that revive Giambattista Vico's *verum factum* principle—in a radical form, "What I cannot build, I cannot understand") and argue that synthetic biology's epistemic ambition is questionable (see also Schummer 2011).

SABINA LEONELLI
ESRC Centre for Genomics in Society (Egenis), University of Exeter
Promise and Danger of Data-intensive Research

ATHEL CORNISH-BOWDEN
CNRS Marseille
Systems Biology: What Became of Systemic Thinking?

ERIC WERNER
University of Oxford
Local and Global Control in Development and Evolution

JOACHIM SCHUMMER
Hyle, International Journal for Philosophy of Chemistry, Berlin
Knowing through Making: From Synthetic Chemistry to Synthetic Biology

3.4 Brown Bag Discussions

'Brown bag' refers to the informal format of these public talks: bring your lunch, sit back, enjoy the talk, and join in the discussion! The 'Brown Bag Discussions' take place at lunch time in the library of the KLI in Altenberg. Abstracts of the presentations and information about the lecturers can be found at the website of the institute.

BENCE NANAY
University of Antwerp
Type-selection versus Token-selection

LAURA NUÑO DE LA ROSA GARCÍA
KLI
The Concept of Organismal Form in Contemporary Biology

TUDOR BAETU
KLI
From Mechanisms to Mathematical Models and Back to Mechanisms: The Integration of Mathematical Modeling in Molecular Biology

KATINKA QUINTELIER
KLI
The Bridges between 'Is' and 'Ought'. Towards an Empirically Informed Normative Ethics

JAN-WILLEM STOELHORST
University of Amsterdam & KLI
Generalized Darwinism: On Evolutionary Theorizing in Economics

BORJA ESTEVE-ALTAVA
KLI
Network Analysis of Skull Morphology Evolution

JOERI WITTEVEEN
KLI
Four Kinds of Population Thinking

DANIEL NICHOLSON
KLI
Is the Cell Really a Machine?

MICHAEL TRESTMAN
University of California Davis
Space, Body, and Mind in Animal Evolution

RUSSELL POWELL
Boston University & KLI
Biological Evolution in a Technological Species

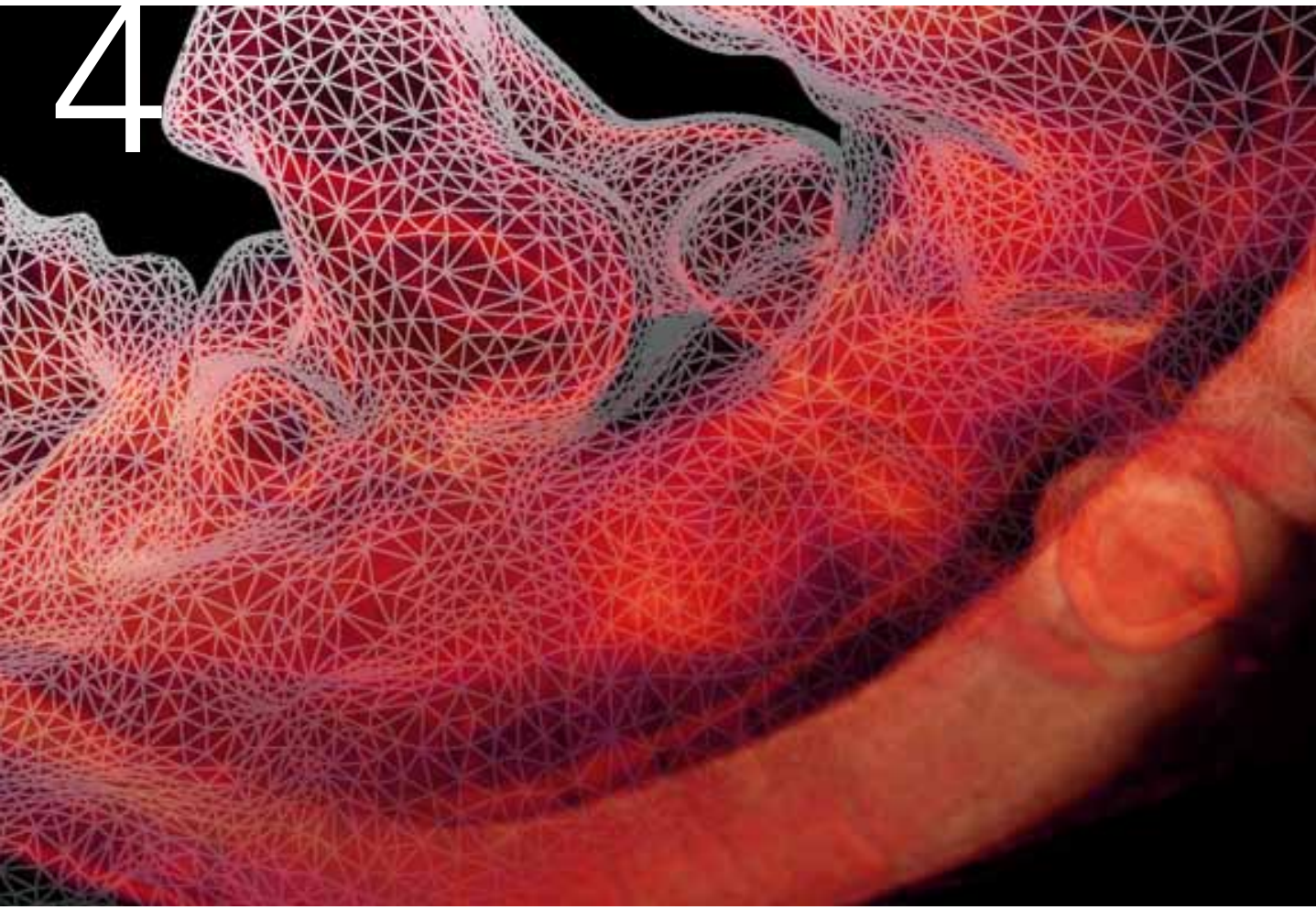
MARÍA-JOSÉ FRAPOLLI
University of Granada & KLI
Is Logical Knowledge Compatible with Naturalism?

MARKUS BÖCKLE
University of Vienna
Intentional Behavior in Ethology, Law, and Psychology

Pierra FILIIPPI
University of Vienna
The Role of Syntax and Prosody in the Emergence of Language

Publications

4



Scientific publications and presentations of fellows and staff members of the KLI in 2012.

4.1 Professional Papers and Books

BAETU T.
Mechanistic Constraints on Evolutionary Outcomes
Philosophy of Science 79: 276-294

BRENTARI C.
Jakob von Uexküll: Alle origini dell'antropologia filosofica
Brescia: Morcelliana

CALLEBAUT W.
Scientific Perspectivism: A Philosopher of Science's Response to the Challenge of Big Data Biology
Studies in History and Philosophy of Biological and Biomedical Sciences 43: 69-80

CALLEBAUT W.
De toekomst van de wetenschappelijke vrijheid.
In: De onvoorspelbaarheid van het determinisme (Van Isacker P, ed), 153-154
Hasselt: Hasselt University Press

CALLEBAUT W.
Peering Up Above the Malthusian Abyss [Editorial]
Biological Theory 6: 103-105

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Weak Genetic Relationship Between Trabecular Bone Morphology, and Obesity
Bone 51: 46-53

CLARKE E.
Plant Individuality: A Solution to the Demographer's Dilemma
Biology and Philosophy 27: 321–361

48 ESTEVE-ALTAVA B, MARUGAN-LOBON J, BOTELLA H, RASSKIN-GUTMAN D.
Structural Constraints in the Evolution of the Tetrapod Skull Complexity: Williston's Law Revisited Using Network Models
Evolutionary Biology: 1-11

FRASNELLI E, IAKOVLEV I, REZNIKOVA Z.
Asymmetry in Antennal Contacts during Trophallaxis in Ants
Behavioural Brain Research 232: 7-12

FRASNELLI E, VALLORTIGARA G, ROGERS LJ.
Left-right Asymmetries of Behaviour and Nervous System in Invertebrates
Neuroscience and Biobehavioral Reviews 36: 1273-1291

GÓMEZ-ROBLES A, POLLY PD.
Morphological Integration in the Hominin Dentition: Evolutionary, Developmental, and Functional Factors
Evolution 66: 512-526

GÓMEZ-ROBLES A, BERMÚDEZ DE CASTRO JM, MARTINÓN-TORRES M, PRADO-SIMÓN L, ARSUAGA JL.
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Journal of Human Evolution 63: 512-526

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Three-dimensional Evaluation of Root Canal Morphology in Lower Second Premolars of Early and Middle Pleistocene Human Populations from Atapuerca (Burgos, Spain)
American Journal of Physical Anthropology 147: 452-461

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Molecular Biology and Evolution 29: 1695-701

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Evolution - The Extended Synthesis. A Research Proposal Persuasive Enough for the Majority of Evolutionary Biologists?
Human Ethology Bulletin 27: 18-21

MACLEOD M.
How to Compare Homology Concepts: Class Reasoning about Evolution and Morphology in Phylogenetics and Developmental Biology
Biological Theory 6: 141-153

MACLEOD M.
Rethinking Scientific Concepts for Research Contexts: The Case of the Classical Gene
In: Scientific Concepts and Investigative Practice (Steinle F, Feest U, eds) as part of the 'Berlin studies in Knowledge Research' (Abel G, Conant J, eds)
Berlin: De Gruyter

MITTEROECKER P, GUNZ P.
Human EvoDevo
Evolutionary Biology 39: 443-446

MITTEROECKER P, GUNZ P, NEUBAUER S, MÜLLER GB.
How to Explore Morphological Integration in Human Evolution and Development?
Evolutionary Biology 39: 536-553

MOSS L, NICHOLSON DJ.
On Nature and Normativity: Normativity, Teleology, and Mechanisms in Biological Explanations
Studies in History and Philosophy of Biological and Biomedical Sciences 43: 88-91

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In: A More Developed Sign (Favereau D., Cobley P., Kull K, eds)
Tartu, Estonia: Tartu University Press

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The Concept of Mechanism in Biology
Studies in History and Philosophy of Biological and Biomedical Sciences 43: 152-163

NICHOLSON DJ.
Book Review of 'Knowledge of Life' by Georges Canguilhem (2008)
Annals of Science: 1-4

50 NUÑO DE LA ROSA L.
El Concepto De Forma En La Biología Contemporánea. Examen Filosófico/ Le concept de forme dans la biologie contemporaine. Examen philosophique.
Madrid: Universidad Complutense de Madrid, Université Paris 1-Sorbonne
Supervised by José Luis González Recio (UCM) and Jean Gayon (IHPST-Paris 1-Sorbonne)

PAVLICEV M, WAGNER GP.
Coming to Grips with Evolvability
Evolution: Education and Outreach 5: 231-244

PAVLICEV M, WAGNER GP.
A Model of Developmental Evolution: Selection, Pleiotropy, Compensation
Trends in Ecology and Evolution 27: 316-322

POWELL R.
Human Nature and Respect for the Evolutionarily Given
Philosophy & Technology 25: 485-493

QUINTELIER K.
Women are Confronted with Sticky Floors, Leaky Pipes, Delayed Trains, and a Glass Ceiling
Book review of: De promotiekloof. Carrières van vrouwen en mannen op de Belgische arbeidsmarkt (Deschacht N)
Tijdschrift voor genderstudies 15: 58-60

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Its all in your Head: The Role of Quantity Estimation in Sperm Competition
Proceedings of the Royal Society Biological 279: 833-840

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PLoS ONE 7: e34922

VERPOOTEN J.
Brian Boyd's Evolutionary Account of Art: Fiction or Future?
Biological Theory 6: 176-183

VERPOOTEN J, NELISSEN M.
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In: Philosophy of Behavioral Biology (Plaisance KS, Reydon TAC, eds)
Boston Studies in the Philosophy of Science 282: 189-216

4.2 Forthcoming Publications

BAETU T.
From Mechanisms to Mathematical Models and Back to Mechanisms: Quantitative Mechanistic Explanations
In: Explanation in Biology (Malaterre C, Braillard P-A, eds)
Dordrecht: Springer

BAETU T.
Models as Local Frameworks for Integrating Knowledge about Phenomena
Philosophy & Theory in Biology

BIRNER J.
Una Europa federal como garantía para la paz. El "estado mínimo" como un modelo para la Unión Europea
www.catalactica.com.at

BIRNER J.
F.A. Hayek's The Sensory Order. An evolutionary perspective
STOREPapers 1: 1

52 BROWN RL.
What Evolvability Really Is
British Journal for the Philosophy of Science

CALCOTT B.
Why the Proximate–Ultimate Distinction is Misleading, and Why it Matters For Understanding the Evolution of Cooperation
In: Cooperation and its Evolution (Sterelny K, Joyce R, Calcott B, Fraser B, eds)
Cambridge, MA: MIT Press

ESTEVE-ALTAVA B, MARUGAN-LOBON J, BASTIR M, BOTELLA H, RASSKIN-GUTMAN D.
Grist for Riedl's Mill: a Network Model Perspective on the Integration and Modularity of the Human Skull
Journal of Experimental Zoology Part B: Molecular and Developmental Evolution

JOYE Y, VERPOOTEN J.
An Exploration of the Functions of Religious Monumental Architecture from a Darwinian Perspective
Review of General Psychology

MACLEOD M.
Limitations of Natural-kind Talk in the Life Sciences: Homology and other Cases
In: Natural kinds in philosophy and in the life sciences: scholastic twilight or new dawn? (MacLeod M, Reydon T, eds)
Biological Theory

MACLEOD M, REYDON T.
Natural Kinds in Philosophy and in the Life Sciences: Scholastic Twilight or New Dawn?
In: Natural kinds in philosophy and in the life sciences: scholastic twilight or new dawn? (MacLeod M, Reydon T, eds)
Biological Theory

MESOUDI A, BLANCHET S, CHARMANTIER A, DANCHIN E, FOGARTY L, JABLONKA E, LALAND KN, MORGAN T, MÜLLER GB, ODLING-SMEE FJ, PUJOL B.
A Corroboration of the Extended Evolutionary Synthesis: Non-genetic Inheritance Cannot be Ignored
Biological Theory

MITTEROECKER P, GUNZ P, WINDHAGER S, SCHAEFER K.
Shape, Form, and Allometry in Geometric Morphometrics, with Applications to Human Facial Morphology
Hystrix

MICHAEL J, MACLEOD M.
Applying the Causal Theory of Reference to Intentional Concepts
Philosophy of Science

MÜLLER GB.
Evolutionary Theory Today: Three Myths Rejected
In: Evolutionstheorie und Schöpfungsglaube (Weber HP, Langthaler R, eds)
Göttingen: Vienna University Press

MÜLLER GB.
Beyond Spandrels: EvoDevo, S.J. Gould, and the Extended Synthesis
In: Stephen Jay Gould's Legacy (Minelli A, Pievani T, eds)
Berlin: Springer

NICHOLSON DJ.
Organisms ≠ Machines
British Journal for the Philosophy of Science

NICHOLSON DJ, GAWNE R.
Rethinking Woodger's Legacy in the Philosophy of Biology
Studies in History and Philosophy of Biological and Biomedical Sciences

NICHOLSON DJ.
Life Itself as a Basis for Philosophy of Biology
Essay review of The Nature of Life: Classical and Contemporary Perspectives from Philosophy and Science (2010), (Bedau M, Cleland C, eds)
Biology & Philosophy

NICHOLSON DJ.
The Machine Conception of the Organism in Evolutionary Biology: A Critical Analysis
Studies in History and Philosophy of Biological and Biomedical Sciences

54 NICHOLSON DJ.
The Return of the Organism in the Philosophy of Biology
Philosophy Compass

NUÑO DE LA ROSA L.
El Problema De La Función En EvoDevo
In: Actas del I Congreso de la Asociación de Filosofia de la Biologia (AIFBI) (Diéguez A, Claramonte V, Alcolea J, Caponi G, Etxeberría A, Lorenzano P, Marcos A, Martínez-Contreras J, Rosas A, eds)
Valencia: Universitat de València

NUÑO DE LA ROSA L.
Book review on Richard Owen. 2012 [1848]
Boletín de la SLMFC

NUÑO DE LA ROSA L.
Book review on Richard Owen. 2012 [1848] El retorno de Owen
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PÉLABON C, BOLSTAD GH, EGSET CK, CHEVERUD JM, PAVLICEV M, ROSENQVIST G.
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American Naturalist

PETERSON T, MÜLLER GB.
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Journal of Experimental Zoology (Molecular and Developmental Evolution)

POWELL R, SHEA N.
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Philosophy of Science

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Anthropological Science

QUINTELIER KJP, ISHII K, WEEDEN J, KURZBAN R, BRAECKMAN J.
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Human Nature.

4.3 Journal *Biological Theory*

Volume 6, Issue 1:

PRADEU T, LAPLANE L, MORANGE M, NICOGLOU A, VERVOORT M.
The Boundaries of Development

MINELLI A.
Animal Development, an Open-ended Segment of Life

THÉRY F.
Characterizing Animal Development with Genetic Regulatory Mechanisms

VERVOORT M.
Regeneration and Development in Animals

NICOGLOU A.
Defining the Boundaries of Development with Plasticity

LAPLANE L.
Stem Cells and the Temporal Boundaries of Development: Toward a Species-dependent View

MORANGE M.
Development and Aging

GILBERT SF.
Expanding the Temporal Dimensions of Developmental Biology: the Role of Environmental Agents in Establishing Adult-Onset Phenotypes

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"Organization" as Setting Boundaries of Individual Development

PRADEU T.
A Mixed Self: The Role of Symbiosis in Development

DEPEW DJ, WEBER BH.
The Fate of Darwinism: Evolution After the Modern Synthesis

Volume 6, Issue 2:

CALLEBAUT W.
Peering Up Above the Malthusian Abyss

BRENNAN G.
Keeping Company with Seabright

FRASER B.
Explaining Strong Reciprocity: Cooperation, Competition, and Partner Choices

STERELNY K.
Civilizing Cooperation: Paul Seabright and the Company of Strangers

SEABRIGHT P.
The Three Musketeers: What do We Still Need to Know About Our Passage Through Prehistory?

KELLER EF.
Genes, Genomes, and Genomics

MACLEOD M.
How to Compare Homology Concepts: Class Reasoning About Evolution and Morphology in Phylogenetics and Developmental Biology

SHRADER-FRECHETTE K.
Randomization and Rules for Causal Inferences in Biology: When the Biological Emperor (Significance Testing) Has No Clothes

RIEPPEL O.
Hugo Dingler (1881-1954) and the Philosophical Foundation of the German Evolutionary Synthesis

ROSAS A.
Disentangling Social Preferences from Group Selection

VERPOOTEN J.
Brian Boyd´s Evolutionary Account of Art: Fiction or Future?

JENNINGS S.
Learning to Dance with Maxine Sheets-Johnstone

BARWICH A-S, AMILBURU A.
Bridging Disciplines? An Inquiry on the Future of Natural Kinds in Philosophy and the Life Sciences

Volume 6, Issue 3:

LALAND KN, O´BRIEN MJ.
Cultural Niche Construction: An Introduction

CUDDINGTON K.
Legacy Effects: The Persistent Impact of Ecological Interactions

SCHIELKE EG, PLAKOVACS EP, POST DM.
Eco-Evolutionary Feedbacks Drive Niche Differentiation in the Alewife

ODLING-SMEE J, LALAND KN.
Ecological Inheritance and Cultural Inheritance: What Are They and How Do They Differ?

FRAGASZY DM.
Community Ressources for Learning: How Capuchin Monkeys Construct Technical Traditions

58 KENDAL JR.
Cultural Niche Construction and Human Learning Environments: Investigating Sociocultural Perspectives

COLLARD M, BUCHANAN B, RUTTLE A, O´BRIEN MJ.
Niche Construction and the Toolkits of Hunter-Gatherers and Food Producers

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FOGARTY L, FELDMAN MW.
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Volume 6, Issue 4:

HEINTZ C, CALLEBAUT W, MARENGO L.
How Evolutionary is Evolutionary Economics?

NELSON RR.
Human Behavior and Cognition in Evolutionary Economics

EARNSHAW E.
Evolution Beyond Biology: Examining the Evolutionary Economics of Nelson and Winter

WALLISER B.
Learning Versus Evolution: From Biology to Game Theory

GAYON J.
Economic Natural Selection: What Concept of Selection?

HODGSON GM, KNUDSEN T.
Generalized Darwinism and Evolutionary Economics: From Ontology to Theory

CALLEBAUT W.
Beyond Generalized Darwinism. I. Evolutionary Economics from the Perspective of Naturalistic Philosophy of Biology

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MARTENS B.
Economic Exchange as an Evolutionary Transmission Channel in Human Societies

NELSON K.
The Human Nature of the Economic Mind

WITT U.
Economic Behavior - Evoutionary Versus Behavioral Perspectives

NICHOLSON N.
The Evolved Self, Self-regulation, and the Co-evolution of Leadership

BECK N.
Be Fruitful and Multiply: Growth, Reason, and Cultural Group Selection in Hayek and Darwin

Volume 7, Issue 1:

CALLEBAUT W.
The Evolution of Chicago

BLUTE M.
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BOOKSTEIN FL.
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SALAZAR-CIUDAD I.
Evolution in Biological and Non-biological Systems: The Origins of Life

SCHULZ AW.
Selection, Drift, and Independent Contrasts: Defending the Methodological Foundations of the FIC

TRESTMAN W.
Which Comes First in Major Transitions: The Behavioral Chicken, or the Evolutionary Egg?

TREMBLAY F.
Nicolai Hartmann and the Metaphysical Foundation of Phylogenetic Systematics

WORTMANN H.
Re-Reading Robert E. Park on Social Evolution: An Early Darwinian Conception of Society

VECCHI D.
The Trouble with Natural Genetic Engineering

Volume 7, Issue 2:

MACLEOD M, REYDON TAC.
Natural Kinds in Philosophy and in the Life Sciences: Scholastic Twilight or New Dawn?

BARWICH A-S.
A Pluralistic Approach to Extension: The Role of Materiality in Scientific Practice for the Reference of Natural Kind Terms

MACLEOD M.
Limitations of Natural Kind Talk in the Life Sciences: Homology and Other Cases

BOLKER J.
The Use of Natural Kinds in Evolutionary Developmental Biology

GANNETT L.
Projectibility and Group Concepts in Population Genetics and Genomics

GODMAN M.
Psychiatric Disorders qua Natural Kinds: The Case of the "Apathetic Children"

ACERO FERNÁNDEZ JJ, PALMA MUÑOZ JM.
Emotion, Perception, and Natural Kinds

RIEPPEL O.
Biological Individuals and Natural Kinds

SLATER MH.
Cell Types as Natural Kinds

DIÉGUEZ A.
Life as a Homeostatic Property Cluster

Volume 7, Issue 3:

CALLEBAUT W.
The Tension Between Tradition and Innovation

MESOUDI A, BLANCHET S, CHARMANTIER A, DANCHIN É, FOGARTY L, JABLONKA E, LALAND KN, MORGAN TJH, MÜLLER GB, ODLING-SMEE FJ, PUJOL B.
Is Non-Genetic Inheritance Just Proximate Mechanism? A Corroboration of the Extended Evolutionary Synthesis

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STIEFEL KM.
Why Are There No Eusocial Fishes?

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Evolutionary Moral Realism

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The Evolutionary Rationale for Consciousness

HODGSON D.
Cognitive Evolution, Population, Transmission, and Material Culture

SMIT H.
Effects of Imprinted Genes on the Development of Communicative Behavior: A Hypothesis

BONIOLO G.
On Molecular Mechanisms and Contexts of Physical Explanation

PERBAL L.
GxE Interaction and Pluralism in the Postgenomic Era

MATSUNO K.
In the Eyes of the Beholder

SURMAN J.
ABC of Biological Concepts

BARCELÓ-COBLIJN L.
Biology: A Newcomer in Linguistics

Volume 7, Issue 4:

PIGLIUCCI M, STERELNY S, CALLEBAUT W.
The Meaning of "Theory" in Biology

PIGLIUCCI M.
On the Different Ways of "Doing Theory" in Biology

GRIESEMER J.
Formalization and the Meaning of "Theory" in the Inexact Biological Sciences

LOVE AC.
Theory is as Theory does: Scientific Practice and Theory Structure in Biology

VORMS M.
Theorizing and Representational Practices in Classical Genetics

LEONELLI S.
Classificatory Theory in Biology

MILLSTEIN RM.
Exploring the Status of Population Genetics: The Role of Ecology

STERELNY K.
Cooperation in a Complex World: The Role of Proximate Factors in Ultimate Explanations

DEPEW DJ.
The Rhetoric of Evolutionary Theory

CLELAND CE.
Is a General Theory of Life Possible? Seeking the Nature of Life in the Context of a Single Example

LONGINO HE.
The Social Life of Scientific Theories: A Case Study from Behavioral Sciences

KAPLAN JM, WINTHER RG.
Prisoners of Abstraction? The Theory and Measure of Genetic Variation and the Very Concept of "Race"

CALLEBAUT W.
Naturalizing Theorizing—Beyond a Theory of Biological Theories

4.4 Scientific Presentations

ALVARGONZÁLEZ D, NUÑO DE LA ROSA L, ONGAY DE FELIPE I.
Round table: **El debate sobre el aborto a la luz de la idea de teleología (The Debate on Abortion in the Light of the Idea of Teleology)**
XVII Encuentros de Filosofía: Finalidad & Teleología, Fundación Gustavo Bueno, Oviedo

BAETU T.
Quantitative Mechanistic Explanations
Second European Advanced Seminar in the Philosophy of the Life Sciences. Foundation Brocher, Hermance

BAETU T.
A Multi-Level Approach to Defining Species
Australasian Association of Philosophy, Wollongong

BAETU T.
Elucidating the Quantitative-Dynamic Aspects of Molecular Mechanisms
Models and Simulations 5, Helsinki.

BAETU T.
The Integration of Mathematical Modeling in Molecular Biology
21th European Meeting on Cybernetics and Systems Research (EMCSR), Vienna

CALLEBAUT W.
Multiscale Modeling: Disunities of the Sciences or Perspectivism?
Second European Advanced Seminar in the Philosophy of the Life Sciences
Fondation Brocher, Hermance

CALLEBAUT W.
Discussant of WITT U.
Cultural Evolution and Human Motivation: A Drift Process?
Biological Determinants and Contingencies of Economic Behavior
Max Planck Gesellschaft, Ringberg Castle, Tegernsee

CALLEBAUT W.
Toward a Philosophy for EvoDevo
21th European Meeting on Cybernetics and Systems Research (EMCSR), Vienna

CALLEBAUT W.
Phoenix Arisen? The Demise of Evolutionary Epistemology and the Advent of Bio-cognition
Groningen University

CAPEK D, METSCHER BD, MÜLLER GB.
A Molecular-morphogenetic Approach to Avian Digit Identity
4th Meeting of the European Society of Evolutionary Developmental Biology (EED), Lisbon

ESTEVE-ALTAVA B.
Network Models in Morphology: Past, Present, and Future
Department of Theoretical Biology, University of Vienna

ESTEVE-ALTAVA B.
Raiders of the Origin of Life
Department of Theoretical Biology, University of Vienna

FRASNELLI E.
Lateralization in the Invertebrate Nervous System
East European Conference of the International Society for Invertebrate Neurobiology, Moscow

FRASNELLI E, GHIRLANDA S, VALLORTIGARA G.
Understanding Lateralization Through Game Theory and Genetic Models
4th meeting of the European Society for Evolutionary Developmental Biology (EED), Lisbon

FRASNELLI E, IAKOVLEV I, REZNIKOVA Z.
Asymmetry in Antennal Contacts During Trophallaxis in Ants
3rd Workshop on Cognition and Evolution (CogEvo), Rovereto

FRASNELLI E, RIGOSI E, ANFORA G, TRONA F, VALLORTIGARA G.
Left-right Asymmetry of Olfaction in Apoidea Species
International Symposium on Olfaction and Taste (ISOT), Stockholm

HANDSCHUH S.
Animals as Developing Systems: On the Various Relationships of Individual Development and the Diversity of Organismal Form
21th European Meeting on Cybernetics and System Research (EMCSR), Vienna

66 HANDSCHUH S, NEMESCHKAL HL, METSCHER BD, MITTEROECKER P, MÜLLER GB.
The Role of Post-embryonic Growth and Sexual Selection in the Evolution of Sexually Dimorphic Appendages in Amphipods
4th meeting of the European Society for Evolutionary Developmental Biology (EED), Lisbon

LANGE A, NEMESCHKAL HL, MÜLLER GB.
Biased Polyphenism in Polydactylous Cats Carrying a Single Point Mutation
4th Meeting of the European Society of Evolutionary Developmental Biology (EED), Lisbon

MAYER C, METSCHER BD, MÜLLER GB, MITTEROECKER P.
Modeling Development, Combining Geometric Morphometrics and Image Analysis
4th Meeting of the European Society of Evolutionary Developmental Biology (EED), Lisbon

METSCHER BD, MÜLLER GB.
MicroCT for 3D EvoDevo: Imaging Micromorphology, Molecular Expression, and Developmental Variation
4th Meeting of the European Society of Evolutionary Developmental Biology (EED), Lisbon

MÜLLER GB.
Beyond Spandrels: S. J. Gould, EvoDevo, and the Extended Synthesis. Stephen J. Gould's Legacy
Istituto Veneto di Science, Lettere ed Arti and Università Ca' Foscari, Venezia

MÜLLER GB.
The EvoDevo Turn: Consequences for Evolutionary Theory
4th Meeting of the European Society of Evolutionary Developmental Biology (EED), Lisbon

MÜLLER GB.
Novelty in Limb Development
Department of Biotechnology and Biosciences, University of Milano Bicocca

NICHOLSON DJ.
Is the Cell Really a Machine?
All Souls College, University of Oxford

NICHOLSON DJ.
Is There a Logic of Molecular Biology?
Second European Advanced Seminar in the Philosophy of the Life Sciences
Fondation Brocher, Hermance

NICHOLSON DJ.
The Influence of Machine Metaphors on Biological Theory
The Sciences in Historical, Philosophical, and Cultural Contexts
Department of Theoretical Biology, University of Vienna

NICHOLSON DJ.
What is the Fundamental Unit of Life? Biological Atomism in Historical and Philosophical Perspectives, Autonomy and Individual Organisms in Biology
Centre for Research in Life, Mind, and Society, San Sebastián

NICHOLSON DJ.
Machine Models of Cellular Complexity
Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University

NÖDL MT, MÜLLER GB, SEAVER E, DE COUET G.
Wnt Signaling During Cephalopod Appendage Development
4th Meeting of the European Society of Evolutionary Developmental Biology (EED), Lisbon

NUÑO DE LA ROSA L.
El problema de la función en evo-devo (The Problem of Function in EvoDevo)
I Congreso de la Asociación Iberoamericana de Filosofía de la Biología (AIFBI).
University of Valencia

NUÑO DE LA ROSA L.
The Origin of Paired Fins: An Epigenetic Hypothesis
Department of Theoretical Biology, University of Vienna

68 NUÑO DE LA ROSA L.
Organization as Internal Functional Adaptation in EvoDevo
Symposium
IVe Congrès de la Société de Philosophie des Sciences (SPS), Montreal

NUÑO DE LA ROSA L.
The Development of Relational Autonomy
Autonomy and Individual Organisms in Biology – A Collaborative Perspective. Centre for Research on Life, Mind and Society, University of the Basque Country, San Sebastian

NUÑO DE LA ROSA L, MÜLLER GB, METSCHER B.
The Origin of Paired Fins: An Epigenetic Hypothesis
4th Meeting of the European Society of Evolutionary Developmental Biology (EED), Lisbon

NUÑO DE LA ROSA L.
Teoría de la evolución y teleología: del adaptacionismo darwinista a la investigación de lo posible en la evo-devo (Theory of Evolution and Teleology: From Darwinian Adaptationism to the Research of the Possible in Evo-Devo)
XVII Encuentros de Filosofía: Finalidad & Teleología, Fundación Gustavo Bueno, Oviedo

PAVLICEV M.
Genomic Correlates of Loci for Forelimb-hind Limb Differentiation in Mice
Joint conference of European and American Societies for the Study of Evolution, Ottawa

PAVLICEV M.
The Genetic Architecture of Variational Modularity, and its Evolution
Seminar on Canalisation, Modularity, Phenotypic Integration, and Adaptive Accuracy, Royal Society of London

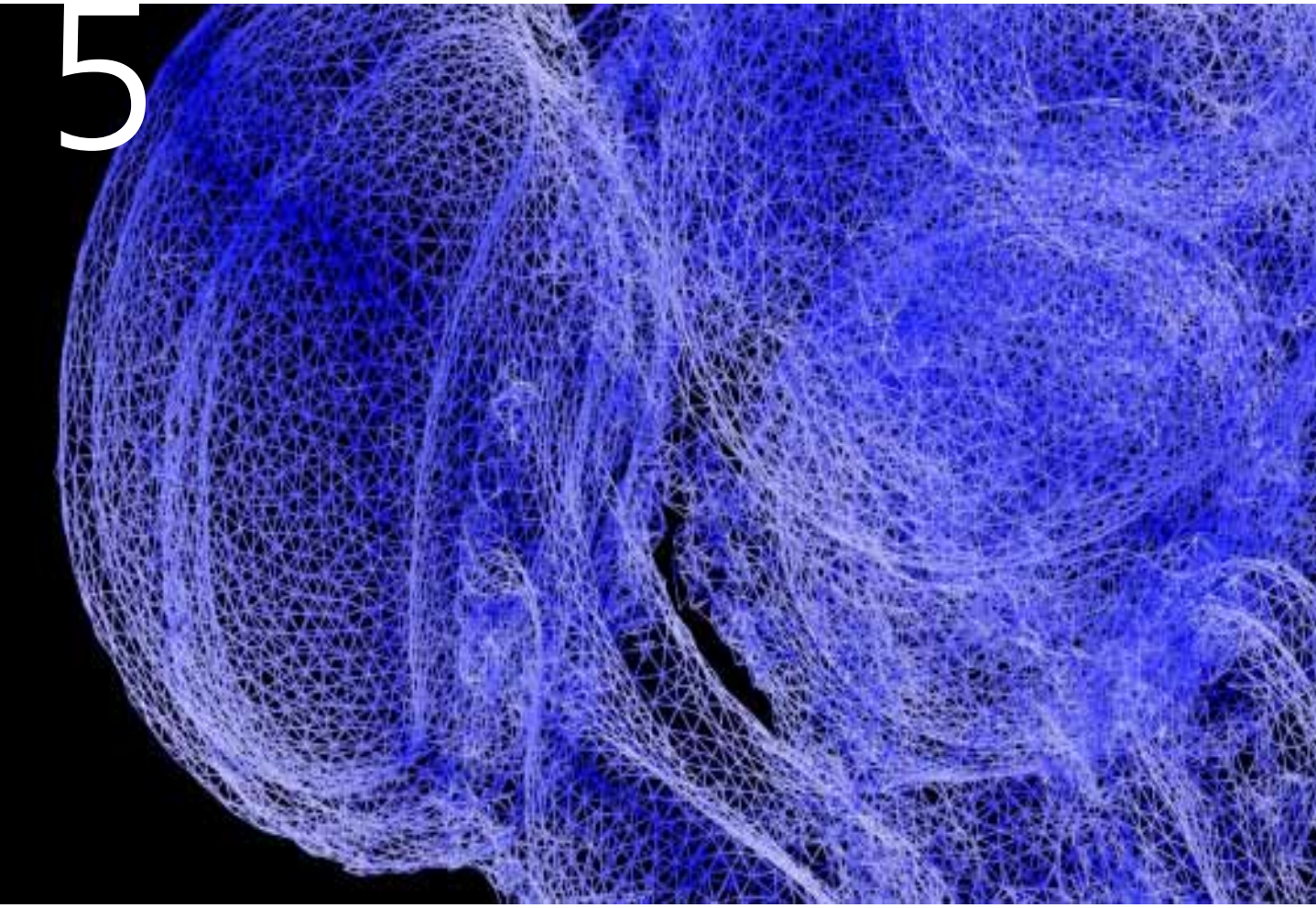
PAVLICEV M.
The Effect of Pleiotropy on the Response to Selection
Working group for Biomathematics, Vienna

PETERSON T, MÜLLER GB.
Novelty Through Development: Pharyngeal Jaws in Cichlidae and Labridae
4th Meeting of the European Society of Evolutionary Developmental Biology (EED), Lisbon

QUINTELIER K.
Universal Versus Relative Concepts of Ethics in Health Care
Wiener Dialoge der Medizinanthropologie, Medical University of Vienna

Further Activities

5



Many activities of the KLI transgress the scientific core area. Some representative activities are listed here.

5.1 KLI Homepage

www.kli.ac.at

The new KLI homepage launched in December 2011 is continuously internationally acknowledged. In 2012, almost 25.000 people visited the KLI homepage and looked at more than 86.000 pages (Fig. 1). KLI internet visitors come predominantly from Austria, the US, Germany, the UK, Spain, Italy, Canada, France, and Australia (Fig. 2).

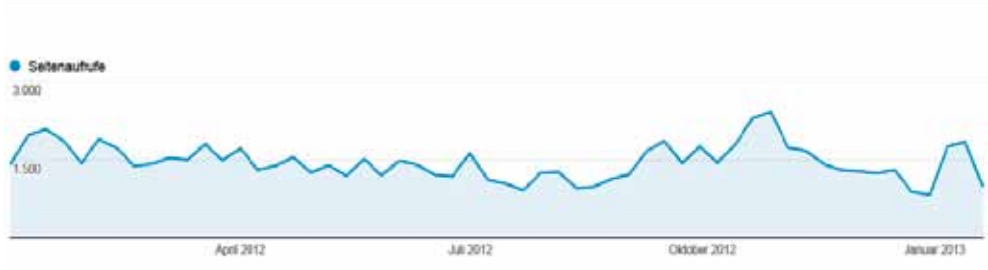


Fig. 1

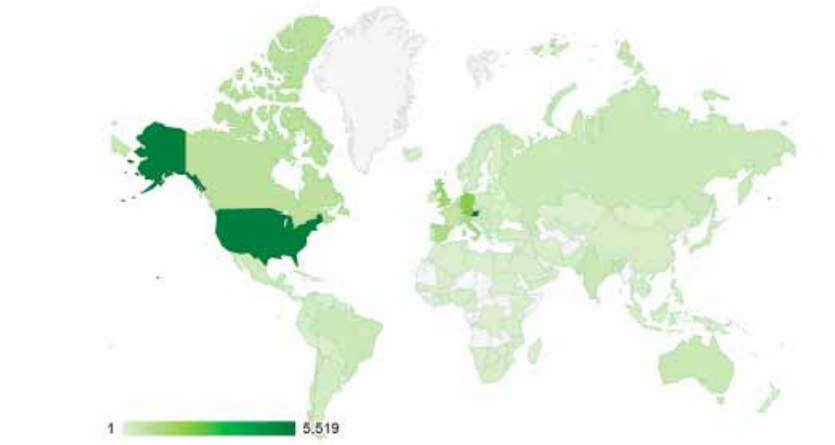


Fig. 2

5.2 Migration of the KLI Journal *Biological Theory*

Biological Theory has switched to Springer by the end of 2011. Seven issues were published since and there was an impressive download of more than 2,700 full-text articles (Fig. 3) of the KLI journal from the publisher´s homepage. The most frequent downloads were articles by D. Depew, T. Pradeu, and K. Laland (Fig. 4).

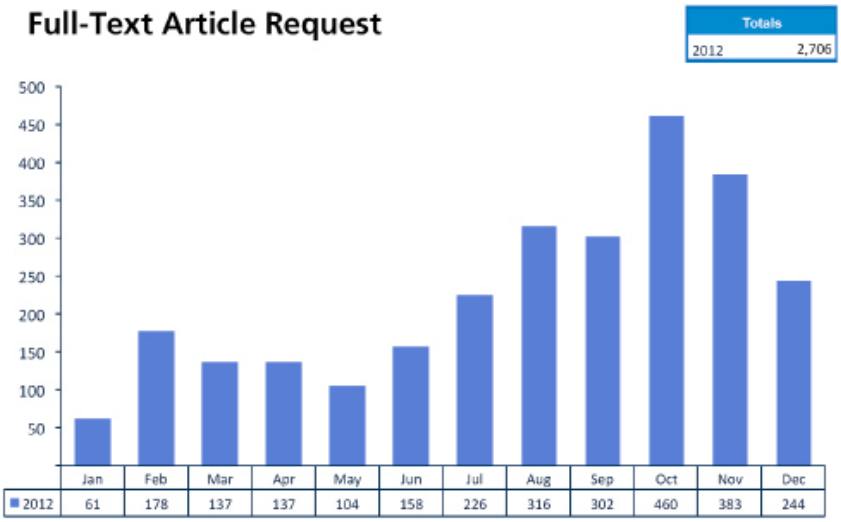


Fig. 3

Top 10 Article Downloads

Title	Author	Volume	Issue	Year	Article Requests 2012
The Fate Of Darwinism: Evolution After The Modern Synthesis	DAVID DEPEW	6	1	2011	210
The Boundaries Of Development	THOMAS PRADEU	6	1	2011	164
Cultural Niche Construction: An Introduction	KEVIN LALAND	6	3	2011	88
A Mixed Self: The Role Of Symbiosis In Development	THOMAS PRADEU	6	1	2011	78
Cultural Niche Construction And Human Learning Environments: Investigating Sociocultural Perspectives	JEREMY KENDAL	6	3	2011	65
Expanding The Temporal Dimensions Of Developmental Biology	SCOTT GILBERT	6	1	2011	64
Genes, Genomes, And Genomics	EVELYN KELLER	6	2	2011	64
Animal Development, An Open-Ended Segment Of Life	ALESSANDRO MINELLI	6	1	2011	55
Eco-Evolutionary Feedbacks Drive Niche Differentiation In The Alewife	ERIKA SCHIELKE	6	3	2011	54
Niche Construction And The Toolkits Of Huntergatherers And Food Producers	MARK COLLARD	6	3	2011	54

Fig. 4

The far-reaching international distribution of *Biological Theory* by Springer is demonstrated in Fig. 5 showing that more than 2,800 institutions have access to the journal as part of an online deal with Springer (**).

	2012
Region	Institutions with exposure via online deals
Americas	1,339
Asia Pacific	669
EMEA*	832
Grand Total **	**2,840**

Fig. 5

* EMEA: Europe, Middle East, Africa

5.3 New Members

The following new member was elected at the General Assembly 2012:
Ehab Abouheif, McGill University, Montréal, Québec, Canada.

5.4 Acknowledgment

The KLI is grateful to the Office of the State Government of Lower Austria, Division for Science and Research for additional financial support contributing to the conservation of the Lorenz mansion.