

## Contents

Page

2

### **1 Review 2013 and Structure of the KLI**

6

### **2 Scientific Projects**

- 2.1 Applications
- 2.2 Writing-Up Fellowships
- 2.3 Postdoctoral Fellowships
- 2.4 Senior Fellowship
- 2.5 Visiting Scientists
- 2.6 Junior Visiting Scientist
- 2.7 Scientists with own funding

34

### **3 Meetings and Lectures**

- 3.1 Altenberg Workshop in Theoretical Biology
- 3.2 Summer School
- 3.3 Rupert Riedl Lecture in Science and Society
- 3.4 Brown Bag Discussions

44

### **4 Publications**

- 4.1 Vienna Series in Theoretical Biology
- 4.2 Professional Papers and Book
- 4.3 Forthcoming Publications
- 4.4 Journal *Biological Theory*
- 4.5 Scientific Presentations

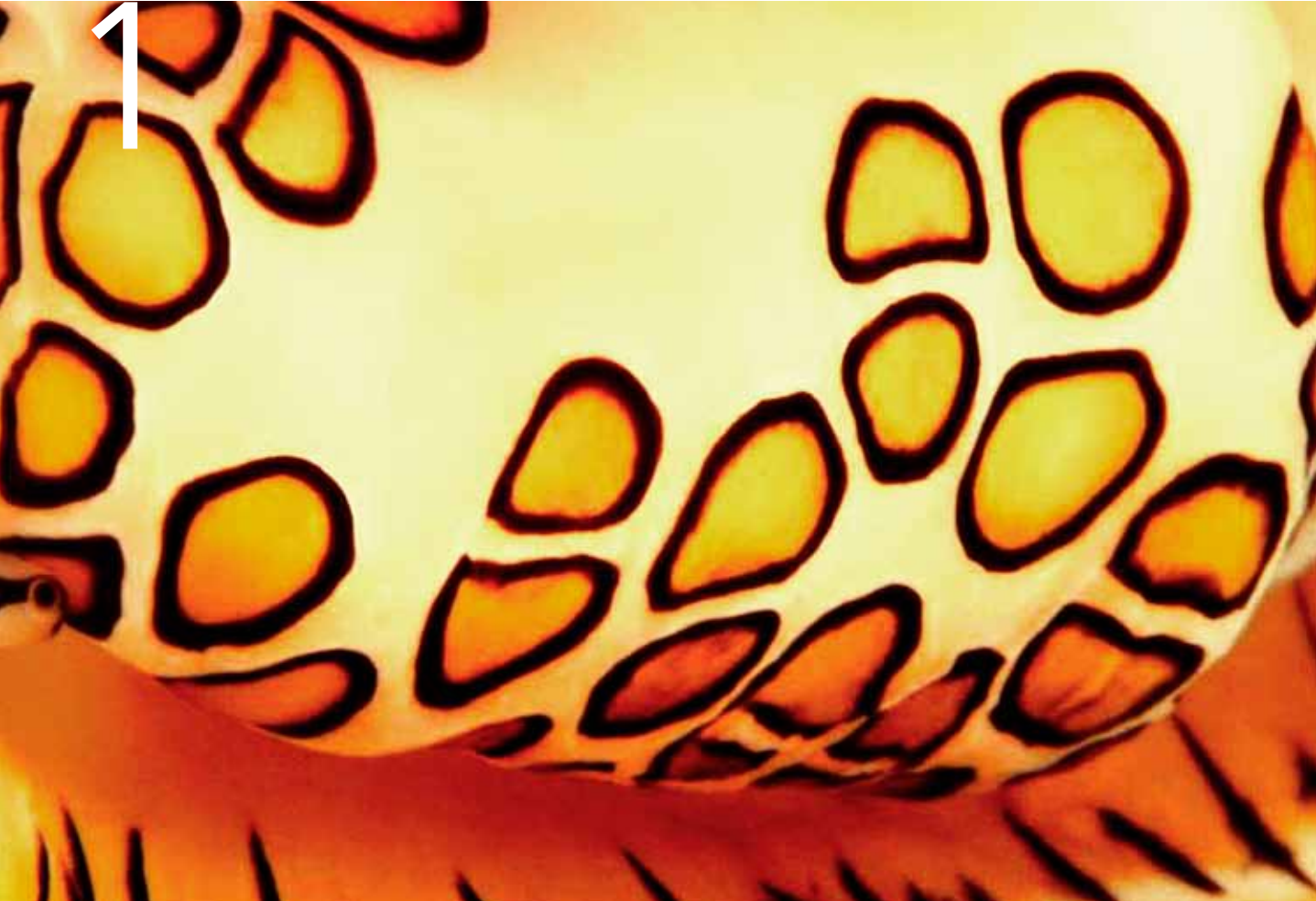
64

### **5 Further Activities**

- 5.1 The New KLI
- 5.2 *Biological Theory* at Springer
- 5.3 Public Outreach
- 5.4 New Member
- 5.5 Acknowledgment

## Review 2013 and Structure of the KLI

1



*La realidad del presente  
construyendo las teorías del futuro.*

*The reality of the present constructs the  
theories of the future.*

Diego Rasskin-Gutman,  
Universitat de València

## 1.1 The Year in Review

Since its foundation, the KLI has been developing the vision of an “enabling space,” the kind of intellectual and physical environment stimulating creativity, innovation, and out-of-the-box thinking on the conceptual foundations of the life sciences that is driving the “biological century” pronounced by Bill Clinton. Over the years, the KLI has attracted young and accomplished scholars from all over the world who wanted to take advantage of the inspiring interdisciplinary atmosphere of the institute. In order to accommodate the growing number of fellows and scientific events, it was decided to take a major step forward and establish a novel and larger institute building that reflects the ambition of the KLI in its design.

The year 2013 was marked by the anticipation and preparation of the KLI’s relocation. The 29th Altenberg Workshop in Theoretical Biology on “Evolutionary Systems Biology” was the last workshop hosted at the Lorenz mansion, whose magical surroundings will always be remembered as the ignition locus of the KLI. The 2013 Rupert Riedl Lecture in Science and Society, given by the eminent systems biologist Denis Noble, was yet another occasion to promote the founding ideas of the institute. All other successful formats of the KLI were equally pursued, such as the third edition of the Summer School in Evolutionary Developmental Biology, co-organized together with the Istituto Veneto, the publication of two books in the Vienna Series of Theoretical Biology and of four issues of the journal *Biological Theory*. 18 fellows were hosted, 36 original papers published, and 48 scientific presentations were given at national or international meetings. On the following pages, the past year’s activities are described in more detail.

As always, I would like to express my gratitude to all those who made this success possible: the members of the KLI Trust, the Board of Directors, the Scientific Advisory Board, as well as the staff and fellows of the KLI. Last but not least, I would like to express our profound gratitude to Traudl Engelhorn for her most generous and unwavering support of the New KLI !

Gerd B. Müller  
Chairman

## 1.2 The KLI

- 4 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 colloquia, and by publishing a scientific journal and a book series.

## 1.3 Organization of the KLI

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PROF. DR. MANFRED LAUBICHLER

Department of Biology, Arizona State University, Tempe, AZ;  
Max Planck Institute for the History of Science, Berlin

PROF. DR. STUART NEWMAN

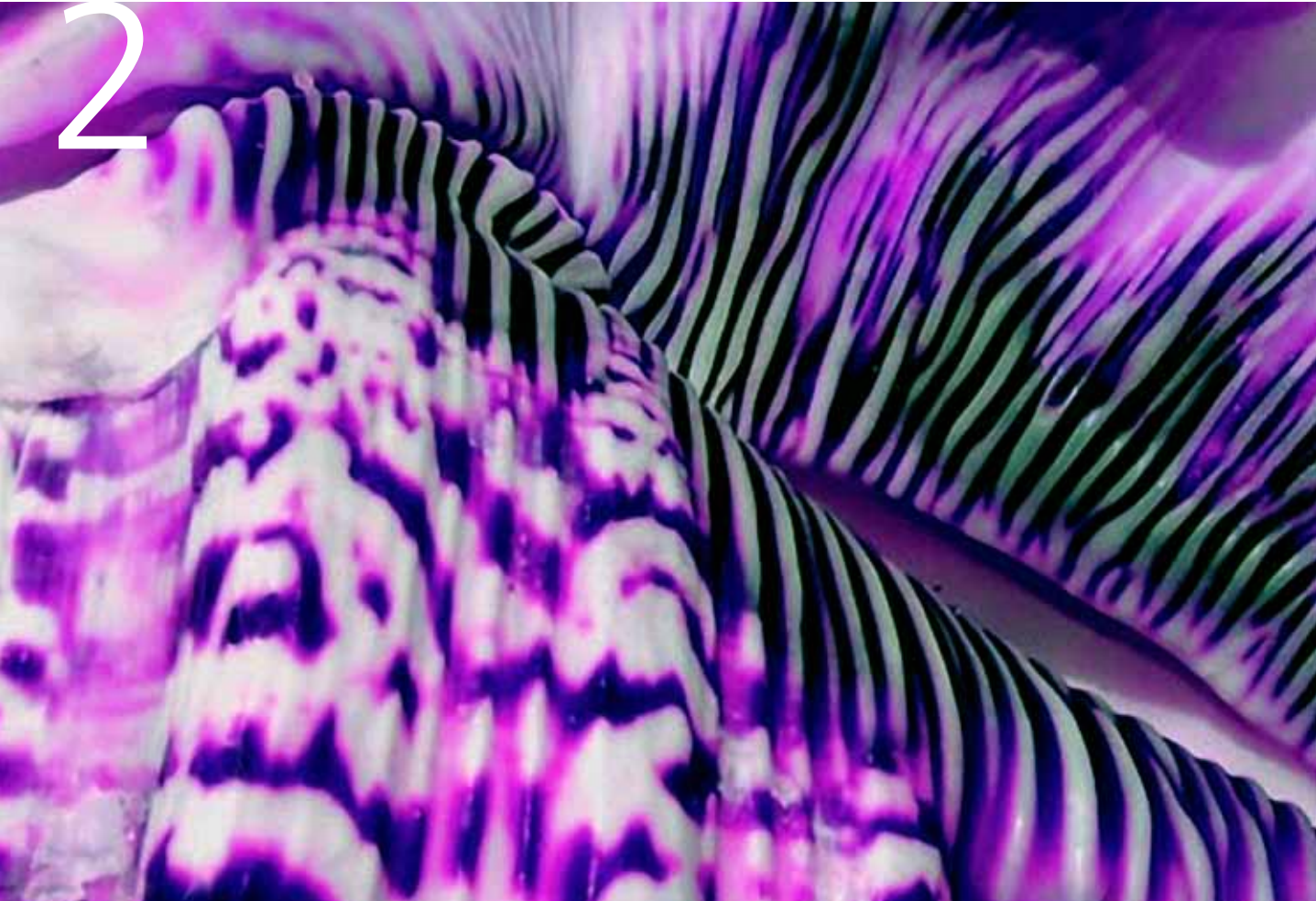
Department of Cell Biology and Anatomy, New York Medical College,  
Valhalla, NY

PROF. DR. D. KIMBROUGH OLLER

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

## Scientific Projects

2



*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 2013, the KLI received a total of 58 applications for fellowships, 5 of these were granted for 2013 or 2014.

	applied	granted
Writing-up Fellowships	8	0
Postdoctoral Fellowships	20	1
Senior Fellowships	2	1
Visiting Fellowships	11	3
Others	16	0
Visitors (self supported)	1	0

## 2.2 Writing-Up Fellowships

### Lynn Chien-Hui CHIU

(July 2013 – January 2014)



*Lynn Chien-Hui Chiu is a philosophy PhD student at the University of Missouri. Her dissertation project concerns the impact of organismal activities and cognitive abilities on natural selection explanations. She has a MA in philosophy from the University of Missouri and a MS in psychology from National Taiwan University, with a BS in Life Sciences from National Yang Ming University.*

### Niche Construction and Natural Selection

Organisms construct their ecological niches when they define, create, and alter their surrounds by their metabolism, behavior, and choices. Richard Lewontin (1983, 1985, 2000, 2001) argues from these phenomena that the metaphor of construction should replace the metaphor of adaptation in evolutionary theory. In this dissertation, I argue that the subsequent literature on “niche construction,” including modeling work, merely revises and extends the adaptationist explanatory schema. This literature fails to recognize how Lewontin’s con-

8



structuralist views undermine adaptationism as an explanatory framework and revolutionize interpretations of “fitness,” “niche,” and “natural selection.” The key difference between Lewontin and the mainstream view is how they interpret the adaptationist assumption that the internal mechanisms of variation are independent from the external, environmentally driven process of natural selection, with “one generating ‘problems’ at random with respect to the organism, the other generating ‘solutions’ at random with respect to the environment” (Lewontin, 2001, p. 47). John Odling-Smee, Kevin Laland, Michael O’Brien, Peter Godfrey-Smith, and others merely focus on how organism-induced environmental changes affect evolutionary dynamics. However, this is consistent with the problem-solution metaphor if the niche-constructing organisms merely create the problems they later solve. I argue that niche construction undermines adaptationism because it implies that there is no “problem” in the environment. When each individual creates its own niche, the environment of the population consists of a myriad of individual selective environments dependent on organismic variation, and no longer constitutes a single problem for the population to solve. After analyzing how the explanatory roles of these concepts are challenged by niche construction, I develop a theoretical model based on Lewontin’s original view, and apply it to different disciplines.



### **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 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 the 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, changes in skull module symmetry due to unpaired bones, and the whole network pattern as a correlation map underlying shape covariations.

10



### Sebastian MATUSZEWSKI

(December 2013 – May 2014)

10

*Sebastian Matuszewski is a doctoral candidate in the Mathematics and BioSciences Group at the University of Vienna. He studied Biomathematics at the University of Greifswald. The focus of his dissertation is on the genetics of adaptation in changing environments. The goal of his PhD project is to extend existing population-genetic models of adaptation to changing environments in multi-dimensional trait spaces, and to study the influence of various aspects (e.g. pleiotropy, genetic correlations, speed and direction of environmental change) on the adaptive process.*

### The Genetics of Adaptation in Changing Environments

Adaptation is central to Darwinian evolution, and it may be a key to the survival of species under the conditions of human-induced global change. Despite its importance, many basic questions about the genetic basis of adaptation are still unresolved. This is particularly true of adaptation to gradual change, such as the rise of global temperature and atmospheric CO<sub>2</sub>, or increase in UV radiation and the concentration of pollutants. To understand the consequences of gradual change it is important to develop a theory with increased ecological realism. The fundamental event during adaptation is the substitution of a resident allele (i.e., gene variant) by a beneficial mutation. An important goal of current research - both empirical and theoretical - is to learn more about the statistical properties of these substitutions. In particular, much effort is being devoted to understanding the distribution of the effects of new mutations and the distribution of the subset of those mutations that go to fixation and contribute to adaptation. Knowledge of these distributions is necessary to answer seemingly simple questions, such as how many substitutions occur during a typical bout of adaptation - a few with large effects, many with small effects, or a combination of both - and whether they do so in a particular order (e.g., large ones first).

One way of addressing these questions in the context of gradual environmental change is to model adaptation with the so-called moving-optimum model. For a single evolving trait, Kopp and Hermisson showed that selection for a moving optimum produces patterns that are fundamentally different from those predicted under constant selection (i.e., after a single, abrupt change in the environment). In the first part of my PhD project, I extended their model to include multiple characters. In other words, I studied a moving optimum of Fisher's classical geometric model of adaptation in high-dimensional trait spaces. In contrast to existing models, this model deals with more complex, yet realistic, biological assumptions on the underlying genetic architecture, in particular genetic correlations between traits. This means that with two or more traits, these can be correlated with respect to selection, mutation, or even both, allowing for a variety of different evolutionary outcomes. While it has been shown that more complex organisms pay a "cost of complexity" causing them to adapt more slowly to a single abrupt change in the environment, the generalization of the moving-optimum model to multiple traits likewise enables us to address how organismic complexity (and thereby pleiotropy) influences a population's ability to adapt to a sustained environmental change.

To analyze this model, we derived analytical approximations for the adaptive process and verified them by means of computer simulations. In particular, we characterized how the fitness of mutations changes over time and obtained approximations for the statistical properties of "adaptive walks" (e.g., the average time and size of adaptive "steps"). Furthermore, we generalized results from previous studies demonstrating that the influence of various genetic and environmental factors on the properties of adaptive walks can be summarized in a single parameter that describes the degree to which adaptation is either "genetically" or "environmentally limited." Addressing the question how the ability to adapt to changing environment depends on "organismic complexity," we obtained the unexpected result that, even though complexity makes adaptation more difficult, adaptation of complex organisms proceeds in large steps. In addition, we found that patterns of adaptation depend on correlation between traits, and found that the source of the correlations (mutation or selec-

12



tion) has a major effect and shapes the distribution of adaptive substitutions. The exact shape of this distribution, however, strongly depends on the speed of environmental change.



**Sonja WINDHAGER**

(January 2013 – December 2013)

*Sonja Windhager holds a Master of Science and a PhD from the University of Vienna. She wrote her PhD thesis in anthropology and was a lecturer in the Department of Anthropology at the University of Vienna.*

**Human Facial Sexual Dimorphism: Quantifying Morphology and its Perception**

Until now there has been no thorough approach to the puzzle of the degree of contemporary human sexual dimorphism in the face, which actually concerns not only the cranium as previously investigated but also the lower face, soft tissue, and, importantly, the perception of mate quality. This is of theoretical relevance for human evolutionary history because the degree of sexual dimorphism hints at the kind of social system and sexual selection patterns. Furthermore, it is not yet clear in how far body height—as represented by facial allometry—contributes to the interpersonal attribution of dominance, masculinity, and attractiveness. Novel morphometric methods, i.e., geometric morphometrics (GMM) including the concept of the psychomorphospace, for the first time allow the comparison of facial shape variation to attributions of attractiveness, maturity, dominance, and masculinity in the same data space. This way, this project will not only replicate, challenge, and extend prior findings, but test a new set of predictions that specifically combine these two data sources, morphology and perception.

## 2.3 Postdoctoral Fellowships

### **Argyris ARNELLOS**

(November 2013 – October 2014)

*Argyris Arnellos was a Marie Curie Postdoctoral Fellow at the IAS-Research Centre for Life, Mind and Society (Department of Logic and Philosophy of Science, University of the Basque Country). Previously, he was a researcher and lecturer in the department of Product and Systems Design Engineering at the University of the Aegean in Syros, Greece. His current line of research is centered on the role of the notion of autonomy in integrating constitutive and interactive aspects of multicellular organisms, with a focus on developmental regulatory mechanisms and their role in the self-construction of multicellular organizations, and in the formation of complex body plans and their resulting behaviors. His PhD was on The Emergence of Meaning in Autonomous Agents and in Artificial Environments. He has published in several scientific journals and participated in numerous international and national conferences in the areas of autonomous and complex systems, 2nd-order cybernetics, philosophy of biology, philosophy of mind, and interactivism, design theory, artificial intelligence, and human-computer Interaction.*



### **Organizational Requirements and Regulation for Organismal Development and Maintenance**

From an organizational perspective, organisms have the capacity to regulate and modify both their developmental processes and their interactions with the environment, while at the same time they are able to incorporate influences of the environment in their developmental and self-maintaining dynamics. They achieve this by exhibiting a developmental organization that fosters the endogenous construction of complex patterns of its own regulation, and which is brought about by the interplay between genetic, epigenetic, interac-

14



tive, and environmental factors at the cellular, tissue and organismal levels. Several difficulties appear when one tries to specify the organizational conditions and the terms in which the development and maintenance of such an organization and its evolutionary characteristics should be accounted for. The main objective of this research project is to elucidate and provide a feasible explanation of the overall relation between the developmental organization and its endogenously produced regulation in multicellular organisms. More specifically, this project aims at getting a better understanding of: (1) the nature, form, and pattern of different types of developmental regulatory mechanisms in an organism; (2) the ways developmental regulation shapes the relation between cells (parts), groups of cells (tissues), and the organisms (wholes) in which they participate; (3) whether the concept of regulation (and which specific regulatory patterns) can be theoretically established as a general principle underlying the exportation of 'organismality' from the unicellular to a meta-cellular level; (4) how the nervous system and the respective interactive and environmental regulatory factors contribute, influence, and transform the overall pattern for the regulation of development and maintenance; (5) the regulatory logic that allows for new forms of complex agency and flexible behavior.



### **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- $\kappa$ B in the Regulation of TNF- $\alpha$  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 into 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

16



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, substantial knowledge is 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.



### **Ann-Sophie BARWICH**

(October 2013 – September 2014)

*Ann-Sophie Barwich obtained her MA at the Humboldt-Universität zu Berlin in Philosophy and German Literature Studies. She currently finishes her PhD in philosophy at the ESRC Centre for Genomics in Society (University of Exeter). Her work addresses classifications and model thinking in olfaction theory and concerns pluralist arguments for scientific realism.*

### **Biology Scenes of Scientific Discovery: Modeling the Olfactory Mechanism at the Intersection of Experimental, Technological, and Conceptually Driven Analysis**

The project aims to breathe new life into questions about the nature of scientific discoveries by analyzing their epistemic, empirical, and methodological basis within a contemporary controversy in the life sciences. By questioning whether there are different kinds of discovery within recent developments in olfaction theory, this project analyzes different forms of empirical success in the application of theoretical frameworks. This inquiry is supposed to explore the diverging emphasis in scientific judgments of evidential support within the debate about two competing models that address the molecular basis



of odor perception.

Until recently, biologists were in fact unable to identify the specific processes of odor recognition, because the odorant receptors in our nose were so far unknown. In 1991 Linda Buck and Richard Axel eventually discovered a multigene family encoding odorant receptors in the mammalian genome, identifying them as G-protein-coupled receptors. This discovery had important implications for further olfactory research, because it identified smell receptors as a class of G-proteins, which strongly suggests that molecules (causing a particular odor) dock on a specific primary receptor according to a “lock and key” mechanism by virtue of their shape. Orthodox opinion about primary smell recognition therefore takes shape to be the key feature underlying molecular recognition. However, this account faces several severe experimental problems and still lacks sufficient demonstration. An alternative account, questioning shape and referring to the molecular vibration in the infrared range as the key feature of olfactory molecular recognition, has nevertheless been widely disregarded - yet not sufficiently challenged on its experimental basis.

By contrasting the two accounts this project reconstructs the different strategies of modeling facts, and conducting and interpreting experiments implicit in the competing theories. This comparison will then be used to explore the extent to which scientific discoveries are bound to existing epistemic assumptions in order to be accepted as ‘evidential.’

### **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.

**Olivier MORIN**

(November 2013 – October 2014)



19

*Olivier Morin was a post-doctoral fellow at the Department of Cognitive Sciences, Central European University, Budapest. He studied philosophy and cognitive science at the Institut Jean Nicod in Paris with Dan Sperber. His work focuses on theoretical issues in cognitive anthropology. The method he promotes consists in using natural experiments as documented by folklorists or historians to explore the causes of cultural change. He has applied this tool to children's peer cultures and to visual history. He is also a participant in debates surrounding the philosophy of social science. His dissertation, Cultural Transmission: How Traditions Live and Die, has been published in French (2011); an English translation has been accepted by Oxford University Press (forthcoming). He is the blogmaster of the International Cognition and Culture Institute.*

**Biological Generations in Cultural Evolution**

Does the succession of biological generations structure cultural change — and if so, how? This research project will investigate the consequences of demographic turnover on the diffusion and mutations of traditions. Two reasons invite us to expect cultural change to be driven by demography. The first reason is the existence of sensitive periods for cultural acquisition: critical “windows” where grammatical parameters (for speakers of a given language), artistic styles (for painters), or theoretical options (for scientists) tend to get fixed more or less irreversibly. The second reason is the slow pace of some changes: they appear to be constrained by the supply of young learners (which in most populations is a more or less constant quantity) rather than determined by the number of models (which can grow exponentially). In spite of this, finding generational dynamics in cultural evolution is not easy. Identifying sensitive periods is a matter of some controversy. The cultural inputs that people are exposed to are changing with time, making the respective contributions of sensitive



periods, cognitive maturation, and changing environments difficult to tease apart. The pace and rhythm of cultural change may also differ depending on the subpopulation that one is observing: the adoption of evolutionary theory does not look the same if one looks at it among members of the Royal Society, French zoologists, or American clergymen. These difficulties partly explain why we still lack precise concepts and instruments to estimate, let alone predict, how important generational change will be for a given cultural change. This investigation will use a simple statistical tool to tackle the issue. The method uses the fact that any individual's birthdate is equal to the date at which s/he is observed, minus her or his age. For any cultural change (given two of these parameters for every data point), this method allows us to know whether the change is driven by generational turnover, by an event that is external to the population, or by a series of individual maturations. Several data sets will be explored using this method, with the aim of developing a general framework for cultural demography. This framework should predict the importance of generational turnover for various cultural changes, based on their time scale and on the cognitive mechanisms they recruit.



### **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 near disappearance in the context of the triumph of the Modern Evolutionary Synthesis and the genetic theory of development. Yet, 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.' Nonetheless, 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.



## 2.4 Senior Fellowship

### **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 complexity 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 levels. 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 Visiting Scientists

### **Jack BIRNER**

(January 2013 – July 2013)

*Jack Birner is a full research professor at the University College in Maastricht and an associate professor of economics at the Department of Sociology, the University of Trento. Previously, he held a position as an assistant professor at the Erasmus University in Rotterdam, and was visiting professor at the Université Aix-Marseille in Aix-en-Provence, at the International Center for Economic Research (ICER) in Turin, at the Université Louis Pasteur in Strasbourg, and at the George Mason University, Fairfax, Virginia.*

*Jack Birner has published several books and scientific articles, has participated in international research*





*projects, and was the national coordinator of a MIUR (Italian Ministry of Academic Education and Research) co-financed research project.*

### **F. A. Hayek's Evolutionary Research Program**

Right from the start of his scientific career in 1920 up till its very end in the late 1980s, F. A. Hayek, in each and every of the many fields of scientific endeavor in which he has been active, has followed a meticulously systematic approach. Whenever Hayek addresses a new problem, he starts with an extensive historical account of that problem and of the solutions that have been proposed for solving it – including the methodological constraints the solution has to satisfy. He then analyzes the strengths and weaknesses of previous theories. This allows him to identify the gaps between the desired theory of the future and the useful elements of theories of the past that remain to be filled. Filling these gaps constitutes Hayek's research agenda. (Karl Popper has modeled part of this procedure – independently from Hayek – in the scheme  $P1 > T1 > EE > P2$ , etc.) With hindsight, the development of this multitude of "partial research programs" can be seen to be driven, or inspired, by a limited number of scientific ideas and methodological principles. Two central scientific ideas are that mental and social processes are evolutionary phenomena that are driven by variation and selective retention, and that cognitive aspects, and more specifically the fact that individual human knowledge is limited, are crucial elements of social mechanisms and processes. Even though Hayek has only been very partially aware of this systematic and methodological coherency (and to the extent that he was, only late in his life; he became, however, fully aware of his "associative" style of thought) and his system of ideas is not fully coherent, it is nevertheless justified and fruitful because it allows a better understanding of how the various aspects of Hayek's thought are related, and hence guards against mistakes – also very fundamental ones – that have been made in interpreting it. The justification forms the core of the research project here proposed. Building on my own earlier work and that of authors such as Viktor Vanberg, Ulrich Witt, and Bruce Caldwell, I



intend to analyze the extent to which evolutionary ideas together with the central role attributed to cognitive aspects have driven the development of Hayek's various partial research programs, and hence his "grand research program."

### **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),

26



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.



### **Stuart GLENNAN**

(January 2013 – August 2013)

*Stuart Glennan received his BA in philosophy and mathematics from Yale University in 1985. After a few years doing public policy work for the United States government, he enrolled in the philosophy program at the University of Chicago, receiving a master's degree in 1989 and a PhD in 1992. Since that time, he has held an appointment at Butler University in Indianapolis, Indiana, where he currently is professor of philosophy and associate dean of the College of Liberal Arts and Sciences. Glennan's research is centered in the philosophy of science, with a focus on biology and psychology. He has written chiefly on topics concerning causation, scientific explanation, and the concept of mechanism. He has also written on science education and on the relation between science and religion.*

## The New Mechanical Philosophy

The past twenty years have seen the rapid expansion of a movement within the philosophy of science that I will call the new mechanical philosophy (or NMP). The movement offers an approach to understanding both the world that scientists explore and the tools they use to explore it. Its core claims are (1) that most or all natural and social phenomena are produced by the operation of things called mechanisms, and (2) that scientists seek to predict, explain and control these phenomena by the construction, testing and elaboration of models of mechanisms.

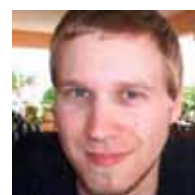
As a Visiting Fellow at the KLI, I will write a book on the topic of the new mechanical philosophy. That book would be an attempt to give a synoptic account of the NMP, articulating its general tenets and staking out a position on a number of central questions now under discussion.

## 2.6 Junior Visiting Scientist

### Stephan KOPSIEKER

(October 2013)

*Stephan Kopsieker is a PhD student in the Philosophy Department of Bielefeld University, working on his dissertation project in the philosophy of biology, which is concerned with the concepts of modularity and plasticity and their possible relations. He obtained his MA in History, Philosophy and Sociology of Science at Bielefeld University.*





## **Modularity and Plasticity as Forms of Organization in Biological Systems**

Modularity and plasticity are two fundamental properties of complex biological systems. However, the relationship between these two forms of organization is mostly unclear. For example in debates about the modularity of mind as proposed by evolutionary psychology, modularity and plasticity are often treated (mostly by critics of the modularity of mind) as opposites. Vindicators of the modularity of mind on the other hand maintain that plasticity provides no ground for objections against functional modules of the mind. Two problems arise in this context: First, the concept of plasticity (as opposite to modularity) is underdeveloped. Second, diverse concepts of modularity are applied in the debate that are not properly distinguished. I will differentiate between structural and functional modularity. I will further suggest that the structural/functional distinction can also be applied to the concept of plasticity. The proposed distinctions can then be used to clarify and bring together diverse perspectives on the relationship between modularity and plasticity in the context of giving mechanistic explanations of a system's behavior. One important aspect of the project is the application and further analysis of the conceptual distinctions by using a concrete example. To this end I will take a closer look at the immune system, which will be looked at from the perspective of clonal selection theory. The research question of the project is whether an opposition between functional modularity and functional plasticity can be developed that can then be understood as an opposition between two different forms of organization.

## 2.7 Scientists with their own funding

### **Teresa BLASCO MÁÑEZ**

(September 2013 – June 2014)

*Teresa Blasco Máñez is a doctoral student at the Universidad de Oviedo. She was a visiting student at the 'Centre de Lingüística Teòrica' (Universitat Autònoma de Barcelona). Her project advisors are Guillermo J. Lorenzo González (Universidad de Oviedo) and Sergio Balari Ravera (Universitat Autònoma de Barcelona).*



### **Biological Foundations of Music and Language: A Comparative Structural Approach**

The evolutionary study of language and music has traditionally been addressed within the context of a selectionist framework in which the emphasis placed on the functional uniqueness of mechanisms too often obscures parallels at the level of organic structure on which evolutionary accounts should be grounded. The main objective of my PhD project is to approach a comparison of the evolutionary biology of music and language as cognitive capacities following a structural (non-functional), internalist perspective, where data from different levels of organization (developmental, anatomical, genetic) become integrated in order to establish homologies and degrees of continuity. One of the central concerns of my work is thus to place the discussion about these capacities within a realistic, theoretically-informed and biology-grounded framework, by incorporating from biology the basic principles of modern evolutionary theory. In this sense, my project owes much to works previously carried out within the context of the research group led by Guillermo Lorenzo and Sergio Balari who were in turn influenced by the work of EvoDevo biologists such as Pere Alberch.

30



### Maarten BOUDRY

(April 2013 – October 2013)

*Maarten Boudry is a postdoctoral fellow of the Flemish Fund for Scientific Research (FWO) at Ghent University. In 2011, he defended his dissertation on the epistemic structures of pseudoscience, consisting of a collection of papers that have been published in Philosophy of Science, Philosophia, the Quarterly Review of Biology, Science & Education, and Philosophical Psychology. He is co-editor, with Massimo Pigliucci, of a volume on the Philosophy of Pseudoscience, which is scheduled to appear in early 2013. His current research deals with the problem of irrationality from the viewpoint of evolutionary epistemology. Other research interests include the conflict between science and religion, methodological naturalism, and skepticism. Together with Johan Braeckman, he also published a book (in Dutch) on critical thinking (2011), aimed at a wider audience.*

### Method in Madness: Naturalized Epistemology and the Problem of Irrationality

In the Enlightenment tradition, the faculty of reason was viewed as a unique and defining characteristic of man. Irrationality was put in stark opposition to reason, which was assumed to be founded on universal and logic-based principles. Although this conception of reason has been challenged by advancements both in cognitive psychology and philosophy of science, and in particular by the development of evolutionary theory, the philosophical views on irrationality are still steeped in the Enlightenment dualism between reason and unreason. This project aims to integrate irrationality in the framework of naturalized epistemology, which recognizes human reason as a biological faculty acquired over a long process of evolution. I will (1) investigate the role of reasoning heuristics and folk intuitions in the production of reasoning fallacies and irrational beliefs, (2) spell out the implications of this approach for an evolutionary understanding of human cognition, and (3) reconstruct how irrational belief systems develop and disse-

minate on a cultural level, by analyzing their cognitive appeal and their 'resilience' to adverse evidence. While salvaging what is valuable in Enlightenment philosophy, this research on 'method in madness' will challenge the traditional views on irrationality and contribute to a more realistic portrayal of human reason and its limitations.

### **Mathieu CHARBONNEAU**

(March 2013 – February 2015)

*Mathieu Charbonneau completed his PhD in philosophy of science and of biology at the Université de Montréal. His dissertation examined how the use of explanatory analogies between evolutionary biology and the social sciences informs the construction of a theory of cultural inheritance and structures its explanatory framework.*



### **Cultural Development and Cultural Evolution**

In the last forty years, Darwinian theories of cultural evolution have mainly focused on the transmission patterns of cultural variants, either at a micro-evolutionary scale (dual inheritance theory) or at a macro-evolutionary scale (cultural phylogenetics). This emphasis on transmission comes from an affinity with the modeling strategies used in population genetics and phylogenetics. From this, a research program analogous with evolutionary biology has been suggested to synthesize the social sciences into an evolutionary framework. However, clearly absent from this scheme is a study of cultural development serving as an analogous cultural science of EvoDevo. Nevertheless, implicit in these theories lies an underexplored developmental component. On the one hand, the modeling strategies borrowed from population genetics are based on the life cycle of human organisms, thus construing cultural development as the development and sequential enculturation of the socializing organism. On the other hand, the analogy between the ideational notion of culture and genotype/phenotype relationship suggests that cultural development should be understood as the processes by which cultural products



32

(behaviors, artifacts, and institutions) are produced by the cultural information transmitted from one individual to another. According to this reading, investigating cultural development would consist not so much in examining how social organisms develop but rather in explaining the neurocognitive processes, sensorimotor feedback loops, and behavioral sequences by which artifacts and institutions are produced and maintained. My post-doctoral project aims at elucidating how cultural development may be integrated in cultural evolution studies and to examine whether a cultural analog to EvoDevo makes sense and, if so, what kind of explanatory benefit it would offer. I'm also interested in clarifying the theoretical relationships between both perspective of cultural development (development of the socializing organism, development of the cultural object), the manner by which they can be integrated into a Darwinian framework of cultural evolution, and to determine if both interpretations can be complementary to one another, and if so, how.





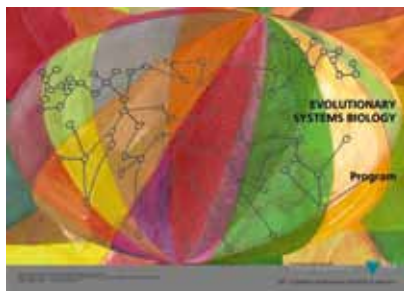
## Meetings and Lectures



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

### 3.1 Altenberg Workshop 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.



**29th Altenberg Workshop  
in Theoretical Biology  
5 – 8 September 2013**

**Evolutionary Systems Biology**  
KLI Altenberg

Organization: Maureen O'Malley, Sabina Leonelli, and Orkun Soyer

#### Topic and aims

Evolutionary theory is one of the great scientific achievements of the last century. In the biological domain, evolutionary theory is central to several closely related fields, including population genetics, molecular evolution, phylogeny, and comparative genomics. Despite its multiple facets, evolutionary research is still seldom implemented in many biological and biomedical fields. Evolutionary systems biology (ESB) may change this situation quite drastically. ESB is an emerging field of evolutionary investigation. It combines systems biology, which is focused on dynamic cellular processes, with evolutionary analyses of populations and organisms. There are several motivations for synthesizing evolutionary and systems-biological perspectives. One is that network properties need to be understood in a variety of organisms, and network models can effectively be generalized through evolutionary analyses. Another is to explain network-level properties such as robustness. A third is to gain a mechanistic understanding of mutational effects, and a fourth is to extend systems biology – currently focused on intracellular networks – to intercellular networks that have emerged in coevolutionary relationships.

To gain insight into these issues, researchers in evolutionary systems biology draw on and combine diverse approaches, including the construction of mechanistic models and *in silico* evolutionary simulations, the application of comparative



36 analysis of omic data to predict the evolution of network structure, and the use of synthetic constructs to analyze potential evolutionary trajectories in specific systems. The field is highly integrative and interdisciplinary. In addition to evolutionary biology, molecular and systems biology, ESB draws on engineering and computer science, and sometimes ecosystem science.

The KLI ESB meeting will take this integration further by engaging in philosophical and historical discussion of ESB. Scientists, philosophers, and historians will examine the different strands of ESB, discuss challenges, and anticipate future developments of the field. Arguments against ESB will also be very much on the agenda. A particular topic of interest will be the implications of ESB for evolutionary and systems biology considered separately. Workshop discussions will be developed as papers for publication after the workshop, some of them on the basis of collaborations between scientists and philosophers and historians.

PIERRE-ALAIN BRAILLARD  
Université Lille 1

**How Can Functional and Evolutionary Approaches be Integrated in Order to Avoid the Adaptationist Pitfalls in the Study of Biological Networks?**

BRETT CALCOTT  
Australian National University, Canberra

**Evolutionary Change as an Engineering Puzzle**

WERNER CALLEBAUT  
KLI

**Some Preliminary Reflections on Evolutionary Systems Biology**

ATHEL CORNISH-BOWDEN  
CNRS-IMM-BIP, Marseille

**The Evolution of Metabolic Systems**

MELINDA FAGAN  
Rice University, Houston

**Concerns About Evolutionary Systems Biology**

SARA GREEN  
Aarhus University

**Reverse Tinkering the Evolution of Organisms**

PAULIEN HOGEWEG  
Utrecht University

**Evolution Is a Multilevel Process and Should Be Studied as Such**

JOHANNES JÄGER

EMBL/CRG Research Unit in Systems Biology, Barcelona

**Life's Attractors: Reverse-Engineering the Evolution of Developmental Systems**

ULRICH KROHS

University of Münster

**Prospects of Overcoming Massive Underdetermination by Combining Data and Models from Different Fields of Research**

MANFRED LAUBICHLER

Arizona State University

**The Regulatory Genome in Development and Evolution**

ARNON LEVY

The Van Leer Jerusalem Institute

**Causal Order and Kinds of Robustness**

MICHAEL LYNCH

Indiana University Bloomington

**Mutation, Drift, and the Origin of Subcellular Features**

MAUREEN O'MALLEY

The University of Sydney

**Evolutionary Systems Biology: Pros and Cons**

CSABA PÁL

University of Szeged

**Is Evolution Predictable?**

MARK SIEGAL

New York University

**Two Empirical Challenges to Robustness**

ORKUN SOYER

University of Warwick

**Evolution of Response Dynamics in Cellular Networks**

ANDREAS WAGNER

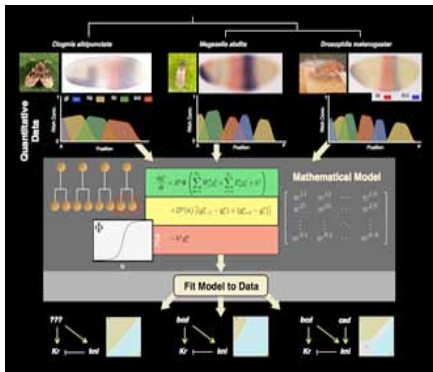
University of Zürich

**The Origins of Evolutionary Adaptations and Innovations**

OLAF WOLKENHAUER

University of Rostock

**Does the Notion of Evolvability Apply to a Society of Cells?**

38 **3.2 Summer School**
**3rd Summer School in Evolutionary  
Developmental Biology  
23 – 27 September 2013**
***From Gene Networks to Organismal  
Systems***

*Istituto Veneto di Scienze, Lettere ed Arti,  
Palazzo Franchetti, Venice*

*Organization: Alessandro Minelli, Gerd B. Müller, and Giuseppe Fusco*

**Topic**

Evolutionary developmental biology (evo-devo) faces a number of significant conceptual and methodological challenges as it is moving beyond qualitative comparative analyses of gene expression and key regulatory factors, and begins to focus on quantitative, systems-level studies of evolving developmental processes. This course will expose its participants to these challenges, with the aim of providing evo-devo PhD students and postdocs with the methodological and conceptual toolkit required to face them.

The course is centered on the complex relationship between genotype and phenotype. It will start with an introduction on the history and current status of evo-devo, and an introductory outline of a possible extended synthesis for evolutionary biology. We will discuss problems of phylogenetics and the choice of model organisms as a necessary practical prerequisite for any investigation into evo-devo. The course will cover different approaches to the study of evolution at the phenotypic level: comparative genomics, macro-evolutionary comparisons of body plans across phyla, comparative embryology/morphology, the principles of cis-regulatory evolution and its consequences on organismic form, the importance of other, post-transcriptional mechanisms, the role of regulatory networks in constraining and shaping evolutionary processes, as well as the influence of cell- and tissue-level processes and the environment. This will include discussions of central concepts such as evolvability, robustness, and phenotypic plasticity and their respective roles in evolution. Finally, we will explore the connections and differences between evo-devo and evolutionary genetics, discussing how these

approaches can be combined to study phenotypic evolution at the population level.

The course will follow a structure in which lectures by the invited speakers in the morning will alternate with participatory activities moderated by teachers, such as journal clubs and discussions on specific topics in small groups, in the afternoon. The course will also feature practical and demonstration sessions on building phylogenetic trees, as well as on modeling developmental networks and processes. On the final day, small groups of students will present small, virtual grant proposals to address specific challenges and open questions. These projects will be judged and criticized by an expert panel consisting of the invited teachers. The course will conclude with a plenary discussion on how to integrate the diverse topics covered during the week into a unified theoretical framework with the aim of extending existing evolutionary theory.

For the first time, our course this year will follow a somewhat unusual teaching format, inspired by a commentary by Martin Schwartz (2008; *J Cell Sci* 121: 1771), and an excellent short book by Stuart Firestein titled *Ignorance: How it Drives Science*. Teachers are asked to focus on what is not known in their field. Lectures are intended to be informal. After providing a brief introduction to their specific sub-discipline, each instructor will present three important unanswered questions. This format will facilitate student participation and discussions, and is very well suited to prepare young researchers for the challenges facing them in their own projects.

Gerd B. MÜLLER  
Altenberg/Vienna

**Introduction to EvoDevo and the Extended Synthesis in Evolutionary Theory**

Ronald JENNER  
London

**The Role of Phylogenetics in EvoDevo**

Gonzalo GIRIBET  
Harvard

**Comparative Genomics/Body Plan Evolution**

Graham BUDD  
Uppsala

**Constraining the Unconstrainable? Fossils and the Phenotype-Genotype Map**



40 Patricia BELDADE

Lisbon

**The Mechanisms for Variation and Diversity**

Claudio ALONSO

Sussex

**Post-transcriptional Gene Regulation During Development and Evolution**

Alessandro MINELLI

Padua

**Morphological Misfits and the Architecture of Development**

Johannes JAEGER

Barcelona

**Evolving Networks ´ In Silico Evolution**

Veronica GRIENEISEN

Norwich

**Tissue Mechanics and Polarity in Animals and Plants**

Alistair MCGREGOR

Oxford

**Evo-Devo and Evolutionary Genetics**

Christen MIRTH

Oeiras

**Phenotypic Plasticity and the Evolution of Polyphenisms (EcoDevo)**



### 3.3 Rupert Riedl Lecture in Science and Society



**Rupert Riedl Lecture  
Denis Noble (Oxford)  
18 March 2013**

#### **The Music of Life and the Billion-year Dance of the Genes**

*University of Vienna, Großer Festsaal*

*Organization: KLI and University of Vienna*

#### **Topic**

##### **Putting together – rather than taking apart**

“It is about integration rather than reduction.” Denis Noble reinterprets many facts of biology in a radical way. Instead of subscribing to the dogma of the ‘selfish’ gene, he views genes as cooperating in the systems of the body and terms the genome an “organ of the cell.” Transmission of information between genetic and organismal levels is not one-way. Instead, our DNA is the database from which the organism extracts the information required. Genes therefore do not have much of a chance to be ‘selfish,’ they are more like ‘prisoners’ of the organism.

Systems biology exploits integrative approaches for analyzing, evaluating, and recombining complex data from various experimental sources to develop predictive computer models of individual organs. However, these novel insights transcend the borders of biology by far. Arguing that genes did not create “us, body and mind,” but co-evolved with the systems that interpret them challenges the dominant view of life, and provides a new perspective on cultural dynamics.

#### **Biographical note**

Denis Noble is an internationally renowned physiologist and systems biologist. He discovered electrical mechanisms in heart cells and generated the first mathematical model of the rhythm of the heart. This work has grown into an international project, the Physiome Project, that aims at modeling all organs of the body. Noble is President of the International Union of Physiological Sciences and Professor Emeritus at Oxford University. *The Music of Life*, his popular science book on the principles of systems biology, has been translated into many languages.



## 42 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.*

WERNER CALLEBAUT

KLI & University of Vienna

**Voyage au bout du puits: A Vagary Through Biological Spacetime**

MAARTEN BOUDRY

University of Ghent & KLI

**In Mysterious Ways: On Belief in Supernatural Causation and the Truth Value of Religion**

SEBASTIAN MATUSZEWSKI

University of Vienna & KLI

**The Genetics of Adaptation in Changing Environments**

JACK BIRNER

University of Trento & KLI

**Friedrich A. von Hayek's Radicalism**

STUART GLENNAN

University of Indianapolis & KLI

**What is a Mechanistic Theory of Causation?**

SONJA WINDHAGER

KLI

**Increasing Facial Evidence: Geometric Morphometric Approaches for Relating Facial Shape to Physical and Perceptual Measures**

OLIVIER MORIN

CEU Budapest & KLI

**Cognitive Attraction and Demographic Turnover in Cultural Evolution**

ARGYRIS ARNELLOS

University of the Basque Country & KLI

**Autonomous Multicellular Systems: Organizational Requirements and Developmental Regulatory Mechanisms**

ANN-SOPHIE BARWICH  
University of Exeter & KLI

**Modeling Evidence: Theory Assessment in Olfactory Research**

JANA ŠVORCOVÁ  
University of Prague

**The Organic Memory Concept in 19th-Century Biology and its Implications for Current Biological Thinking**

BALÁZS KÖNNYÜ  
Eötvös Loránd University

**Template-directed Replication in Metabolically Coupled Replicator System and the Evolution of Early Metabolic Replicators**

KATHERINA ZAKRAVSKY  
University of Vienna

**Some Preliminary Remarks on the “Normal” and the “Pathological” in the Age of Neurobiology**

MATHIEU CHARBONNEAU  
KLI

**Populations without Reproduction**

MAARTEN BOUDRY  
Ghent University & KLI

**Philosophy of Pseudoscience: Revisiting the Demarcation Problem**

LYNN CHIEN-HUI CHIU  
University of Missouri & KLI

**The Impact of Niche Construction on Natural Selection Explanations**

STEPHAN KOPSIEKER  
University of Bielefeld & KLI

**Making Sense of the Distinction between Structural and Functional Modularity**

TERESA BLASCO MÁÑEZ  
University of Oviedo & KLI

**A Structural Approach to the Biological Foundations of Music and Language**

STEFAN WILTSCHNIG  
Copenhagen Business School

**‘Insights into Insight’: Data from the Design Realm – Conceptual Clarification Across Disciplines — Potential Links to EvoDevo**

## Publications



*Scientific publications and presentations of fellows and staff members of the KLI in 2013.*

## 4.1 Vienna Series in Theoretical Biology

The 'Vienna Series' is published by The MIT Press as a book series. Books are mainly based on the Altenberg Workshops and the resulting contributions and new syntheses. The book projects are subjected to a reviewing process by The MIT Press.



Volume 16:

BOUCHARD F, HUNEMAN P, eds

**From Groups to Individuals  
Evolution and Emerging Individuality**



Volume 17:

CAPORAE LR, GRIESEMER JR, WIMSATT WC

**Developing Scaffolds in Evolution, Culture,  
and Cognition**



46 **4.2 Professional Papers and Book**

BAETU T.

**Chance, Experimental Reproducibility, and Mechanistic Regularity**

International Studies in the Philosophy of Science 27: 255-273

BAETU TM, BARWICH A-S, BROOKS D, DUTREUIL S, GERMAIN P-L.

**Model thinking in the Life Sciences: Complexity in the Making**

Biological Theory 8: 121-124

BARWICH A-S.

**Science and Fiction: Analysing the Concept of Fiction in Science and its Limits**

Journal for General Philosophy of Science 44: 357-373

BAUDER JAS, HANDSCHUH S, METSCHER BD, KRENN HW.

**Functional Morphology of the Feeding apparatus and evolution of proboscis length in metalmark butterflies (*Lepidoptera: Riodinidae*)**

Biological Journal of the Linnean Society 110: 291-304

BOUDRY M, PIGLIUCCI M.

**The mismeasure of machine: Synthetic biology and the trouble with engineering metaphors**

Studies in History and Philosophy of Science Part C: Studies in History and Philosophy of Biological and Biomedical Sciences 44: 660-668

BOUDRY M.

**Loki's Wager and Laudan's Error. On Genuine and Territorial Demarcation**

In: Philosophy of Pseudoscience: Reconsidering the Demarcation Project (Pigliucci M, Boudry M, eds), 79-89

Chicago: University of Chicago Press

BOUDRY M.

**The Hypothesis that Saves the day: Ad hoc Reasoning in Pseudoscience**

Logique et Analyse 223: 245-258

CALLEBAUT W.

**Naturalizing Theorizing: Beyond a Theory of Biological Theories**

Biological Theory 7: 413-429

CALLEBAUT W.

**The Evolution of Chicago [Editorial]**

Biological Theory 7: 1-2

CALLEBAUT W.

**The Tension Between Tradition and Innovation [Editorial]**

Biological Theory 7: 187-188

CALLEBAUT W.

**Scholastic Temptations in the Philosophy of Biology [Editorial]**

Biological Theory 8: 1-6

CAPEK D, METSCHER BD, MÜLLER GB.

**Thumbs Down: A Molecular-morphogenetic Approach to Avian Digit Homology**

Journal of Experimental Zoology Part B: Molecular and Developmental Evolution 322: 1-12

CHARBONNEAU M.

**The Cognitive Life of Mechanical Molecular Models**

Studies in History and Philosophy of Biological and Biomedical Sciences 44: 585-94

ESTEVE-ALTAVA B, MARUGÁN-LOBÓN 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 40: 209-219

ESTEVE-ALTAVA B, MARUGÁN-LOBÓN 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 320: 489-500

ESTEVE-ALTAVA B.

**Structural Analysis of Network Models in Tetrapod Skulls: Evolutionary Trends and Structural Constraints in Morphological Complexity, Integration, and Modularity**

PhD thesis, Universitat de València



48 FISHMAN Y, BOUDRY M.

**Does Science Presuppose Naturalism (or, Indeed, Anything at All)?**

Science & Education 22: 921-949

HANDSCHUH S, BAEUMLER N, SCHWAHA T, RUTHENSTEINER B.

**A Correlative Approach for Combining MicroCT, Light and Transmission Electron Microscopy in a Single 3D Scenario**

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KAROLYI F, MORAWETZ L, COLVILLE JF, HANDSCHUH S, METSCHER BD, KRENN HW.

**Time Management and Nectar Flow: flower Handling and Suction Feeding in Long-proboscid Flies (*Nemestrinidae: Prosoeca*)**

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**A Corroboration of the Extended Evolutionary Synthesis: Non-genetic Inheritance Cannot be Ignored**

Biological Theory 7: 189-195

MITTEROECKER P, GUNZ P, WINDHAGER S, SCHAEFER K.

**Shape, Form, and Allometry in Geometric Morphometrics, with Applications to Human Facial Morphology**

Special issue: Virtual Morphology and Evolutionary Morphometrics in the New Millennium

Hystrix 24: 59-66

MÜLLER GB.

**Beyond Spandrels: EvoDevo, S. J. Gould, and the Extended Synthesis**

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MÜLLER GB.

**Evolutionary Theory Today: Three Myths Rejected**

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NUÑO DE LA ROSA L.

**El problema de la función en evo-devo**

Contrastes. Suplemento 18: 187–199

NUÑO DE LA ROSA L.

**El retorno de Owen. Ocaso y renacimiento de la forma orgánica**

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**¿Puede ser la vida objeto de ingeniería?**

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**Functional Flexibility of Infant Vocalization and the Emergence of Language**

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**On the Relationship Between Ontogenetic and Static Allometry**

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**What is Evolutionary Novelty? Process versus Character Based Definitions**

Journal of Experimental Zoology Part B: Molecular and Developmental Evolution 320: 345-350.

PIGLIUCCI M, BOUDRY M.

**Philosophy of Pseudoscience: Reconsidering the Demarcation Project**

University of Chicago Press



50 PIGLIUCCI M, STERELNY K, CALLEBAUT W.  
**The Meaning of “Theory” in Biology [Editorial Note]**  
Biological Theory 7: 285-286

ROGERS LJ, RIGOSI E, FRASNELLI E, VALLORTIGARA G.  
**A Right Antenna for Social Behaviour in Honeybees**  
Science Reports 3: 2045

SCHAEFER K, WINDHAGER S, SLICE DE, MITTEROECKER P.  
**A Man’s Face Reveals his Body Height: A GMM Approach to Ontogenetic and Static Allometry**  
American Journal of Physical Anthropology 150: 241

WINDHAGER S, MITTEROECKER P, SCHAEFER K.  
**It’s in Their Face: Quantifying Ontogenetic and Static Allometry in Human Male Faces [Special Feature]**  
Anatomical Record 296: 190-191

WINDHAGER S, PATOCKA K, SCHAEFER K.  
**Body Fat in Facial Shape: Evidence from Female Adolescents**  
American Journal of Human Biology 25: 847-850

### 4.3 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 and the Mosaic of Scientific Knowledge. The Case of Immunology**  
Studies in History and Philosophy of Biological and Biomedical Sciences 45: 49–56

BAETU T.

**When is a Mechanistic Explanation Satisfactory? How Mathematical Models Are Used to Evaluate Mechanistic Explanations**

In: Romanian Studies in the History and Philosophy of Science (Sandu G, Parvu I, Toader I, eds.)

Dordrecht: Springer

BARWICH A-S.

**A Sense So Rare: Measuring Olfactory Experiences and Making a Case for a Process Perspective on Sensory Perception**

Biological Theory

BARWICH A-S.

**Bending Molecules or Bending the Rules? The Application of Theoretical Models in Fragrance Chemistry**

Perspectives on Science

BIRNER J.

**Explaining Generative Mechanisms**

In: Paradoxes, Mechanisms, Consequences: Essays in Honor of Mohamed Cherkaoui (Manzo G, ed.)

Bardwell Press

BOUDRY M, PIGLIUCCI M, BLANCKE S.

**The Epidemiology of Pseudoscience**

Philosophical Psychology

BUEKENS F, BOUDRY M.

**The Dark Side of the Loon. Explaining The Temptations of Obscurantism**

Theoria

BUEKENS F, BOUDRY M.

**Searlean Reflections on Sacred Mountains**

Theoretical Anthropology

CHARBONNEAU M.

**Populations without Reproduction**

Philosophy of Science



52 EDIS T, BOUDRY M.

**Beyond Physics? On the Prospects of Finding an Oracle**

Foundations of Science

EL MOUDEN C, ANDRÉ J-B, MORIN O, NETTLE D.

**Cultural Transmission and the Evolution of Human Behaviour: A General Approach Based on the Price Equation**

Journal of Evolutionary Biology 27: 231-241.

GLENNAN S.

**Aspects of Human Historiographic Explanation: A View from the Philosophy of Science**

In: Explanation in the Special Sciences: The Case of Biology and History, (KAISER MI, SCHOLZ O, PLENGE D, HÜTTMANN A, eds.)

Dordrecht: Springer 273-291.

MORIN O.

**A Review of 'Inventer l'écriture', by P. Déléage**

Social Anthropology

MORIN O.

**Is Cooperation a Maladaptive By-product of Social Learning? The Docility Hypothesis Reconsidered**

Theoretical Biology

MORIN O.

**Comment la psychologie pourrait servir les historiens**

Tracés: revue de sciences humaines

NUÑO DE LA ROSA L.

**On the Possible, the Conceivable, and the Actual in Evolutionary Theory. A Critical Review of Gustavo Caponi's Requiem for the Centaurus**

Biological Theory

NUÑO DE LA ROSA L, MÜLLER GB, METSCHER B.

**The Lateral Mesodermal Divide: An Epigenetic Model of the Origin of Paired Fins**

Evolution & Development 16: 38-48

PAVLICEV M, WAGNER GP.

**Evolutionary Systems Biology: Shifting Focus to the Context-dependency of Genetic Effects**

In: Integrative Organismal Biology (MARTIN LB, GHALAMBOR CK, WOODS AH, eds.)

New York: Wiley Scientific

PIGLIUCCI M, BOUDRY M.

**Prove It! The Burden of Proof Game in Science vs. Pseudoscience Disputes**  
Philosophia

WATSON RA, WAGNER GP, PAVLICEV M, WEINREICH DM, MILLS R.

**The Evolution of Phenotypic Correlations and Developmental Memory**  
Evolution

XENAKIS I, ARNELLOS A.

**Aesthetics as an Emotional Activity that Facilitates Sense-making:  
Towards an Enactive Approach to Aesthetic Experience**

In: Aesthetics and the Embodied Mind: Beyond Art Theory and the Cartesian Mind-Body Dichotomy (SCARINZI A, ed.)

Dordrecht: Springer

## **4.4 Journal *Biological Theory***

### **Volume 8, Issue 1:**

CALLEBAUT W.

**Scholastic Temptations in the Philosophy of Biology**

HARMAN O, GRAND S.

**Animal Development, an Open-ended Segment of Life**

DOWNES SM.

**No Magic Bullet Explains the Evolution of Unique Human Traits**



54 GERRANS PS.

**Imitation, Mind Reading, and Social Learning**

SUTTON J.

**Skill and Collaboration in the Evolution of Human Cognition**

STERELNY K.

**The Evolved Apprentice Model: Scope and Limits**

SHRADER-FRECHETTE KS.

**Biomass and Effects of Airborne Ultrafine Particulates: Lessons About State Variables in Ecology**

AUNGER R, CURTIS V.

**The Anatomy of Motivation: An Evolutionary-Ecological Approach**

FELLMANN F, WALSH R.

**Emotional Selection and Human Personality**

GROSS LJ.

**Selective Ignorance and Multiple Scales in Biology: Deciding on Criteria for Model Utility**

TRESTMAN M.

**The Cambrian Explosion and the Origins of Embodied Cognition**

VALLES SA.

**Validity and Utility in Biological Traits**

YAKUBU Y.

**The Altruism Paradox: A Consequence of Mistaken Genetic Modeling**

SPENCER Q.

**Biological Theory and the Metaphysics of Race: A Reply to Kaplan and Winther**

BAETU TM, BARWICH A-S, BROOKS D, DUTREUIL S, GERMAIN P-L.

**Model Thinking in the Life Sciences: Complexity in the Making**

**Volume 8, Issue 2:**

55

HUTTEGGER SM, SKYRMS B.

**Strategic Interaction in Humans and Other Animals**

ZOLLMAN KJS.

**Finding Alternatives to Handicap Theory**

BERGSTROM TC.

**Measures of Assortativity**

BARRETT JA.

**The Evolution of Simple Rule-Following**

ROBALINO N, ROBSON AJ.

**Genes, Culture, and Preferences**

CRESSMAN R, WU J-J, LI C, TAO Y.

**Game Experiments on Cooperation Through Reward and Punishment**

FRANCHETTI F, SANDHOLM WH.

**An Introduction to Dynamo: Diagrams for Evolutionary Game Dynamics**

SKYRMS B.

**Natural Social Contracts**

HEGSELMANN R, WILL O.

**From Small Groups to Large Societies: How to Construct a Simulator?**

HUTTEGGER S.

**Probe and Adjust**

BINMORE K.

**Sexual Drift**



56 **Volume 8, Issue 3:**

SCHWARTZ JH.

**Emergence of Shape**

BOISVERT CA.

**From Cells to Structures to Evolutionary Novelities: Creating a Continuum**

DI GIACOMO R, SCHWARTZ JH, MARESCA B.

**The Origin of Metazoa: An Algorithmic View of Life**

FARGE E.

**Mechano-sensing in Embryonic Biochemical and Morphologic Patterning: Evolutionary Perspectives in the Emergence of Primary Organisms**

HABIB M.

**Constraining the Air Giants: Limits on Size in Flying Animals as an Example of Constraint-Based Biomechanical Theories of Form**

MARTINDALE MQ, LEE PN.

**The Development of Form: Causes and Consequences of Developmental Reprogramming Associated with Rapid Body Plan Evolution in the Bilaterian Radiation**

MIURA T.

**Modeling Lung Branching Morphogenesis**

NEWMAN SA, LINDE-MEDINA M.

**Physical Determinants in the Emergence and Inheritance of Multicellular Form**

SALAZAR-CIUDAD I, JERNVALL J.

**The Causality Horizon and the Developmental Bases of Morphological Evolution**

URDY S, WILSON LAB, HAUG JT, SÁNCHEZ-VILLAGRA MR.

**On the Unique Perspective of Paleontology in the Study of Developmental Evolution and Biases**



**Volume 8, Issue 4:**

KROHS U, BEDAU MA.

**Interdisciplinary Interconnections in Synthetic Biology**

MORANGE M.

**Comparison Between the Work of Synthetic Biologists and the Action of Evolution: Engineering Versus Tinkering**

GIESE B, KOENIGSTEIN S, WIGGER H, SCHMIDT JC, VON GLEICH A.

**Rational Engineering Principles in Synthetic Biology: A Framework for Quantitative Analysis and an Initial Assessment**

BEDAU MA.

**Weak Emergence Drives the Science, Epistemology, and Metaphysics of Synthetic Biology**

MALATERRE C.

**Synthetic Biology and Synthetic Knowledge**

BENNER SA.

**Synthesis as a Route to Knowledge**

BENSAUDE-VINCENT B.

**Ethical Perspectives on Synthetic Biology**

RUIZ-MIRAZO K, MORENO A.

**Synthetic Biology: Challenging Life in Order to Grasp, Use, or Extend It**

CORNISH-BOWDEN A, PIEDRAFITA G, MORÁN F, LUZ CÁRDENAS M, MONTERO F.

**Simulating a Model of Metabolic Closure**

BOLDT J.

**Life as a Technological Product: Philosophical and Ethical Aspects of Synthetic Biology**



58 **4.4 Scientific Presentations**

ARNELLOS A.

**From Primitive to Behavioral Agency**

Lab Excursion of Cognitive Science Students of the University of Vienna, KLI, Altenberg

BAETU T.

**When Is a Mechanistic Explanation Complete?**

PhilEAs Talks, University of Geneva

BAETU T.

**The Norms of Mechanistic Explanation**

International Society for the History, Philosophy, and Social Studies of Biology, Montpellier

BAETU T.

**The Completeness of Mechanistic Explanations**

UNISINOS, São Leopoldo

BAETU T.

**Models as Local Frameworks for Integrating Knowledge about Phenomena**

Philosophy & Theory in Biology Symposium, New York

BAETU T.

**The Mathematics of Molecular Mechanisms: Explanatory Pluralism in Systems Biology**

Charles University, Bucharest

BARWICH A-S.

**A Whiff of the Unknown: Contemporary Issues in Olfaction**

Lab Excursion of Cognitive Science Students of the University of Vienna, KLI, Altenberg

BIRNER J.

**Applicare le scienze cognitive: speranze ragionevoli e cautele necessarie**

Conference "Le scienze cognitive: applicazioni e valore socio-economico," Associazione Italiana di Scienze Cognitive, Trento

BIRNER J.

**Moneta cattiva, male collettivo; moneta buona, bene collettivo?**

Annual Conference of the Società italiana degli economisti, Matera

BIRNER J.

**F.A. Hayek: The Radical Economist**

Department of Economics, New York University

BOUDRY M.

**Loki's Wager? Reviving the Demarcation Problem**

Fourth Conference of the European Philosophy of Science Association (EPSA), Helsinki

CALLEBAUT W.

**La philosophie de la biologie comme biologie théorique: Une promesse mal tenue?**

Institut d'Histoire et philosophie des sciences et des techniques, Paris

CALLEBAUT W.

**Scholastic Temptations in Philosophy and Cognitive Science**

MEi:CogSci Lecture Series, University of Vienna

CALLEBAUT W.

**Some Preliminary Reflections on Evolutionary Systems Biology**

29th Altenberg Workshop in Theoretical Biology, "Evolutionary Systems Biology," KLI, Altenberg

CALLEBAUT W.

**Beyond Generalized Darwinism: Considering Alternative Ways to Articulate Evolutionary Economics**

International Society for the History, Philosophy and Social Studies of Biology, Montpellier

CALLEBAUT W.

**Presenting the KLI**

European School of Molecular Medicine (SEMM), Milan

CHARBONNEAU M.

**Ontological and Methodological Aspects of the Extension of Darwinism**

Conférence Darwin Maître d'Orchestre, Lyon



60 CHARBONNEAU M.

**Heredity Without Parents and Offspring**

International Society for the History, Philosophy, and Social Studies of Biology, Montpellier

CHARBONNEAU M.

**Evolution with Non-local Inheritance**

International Conference on Evolutionary Patterns, Calouste Gulbenkian Foundation, Lisbon

CHARBONNEAU M.

**Qu'est-ce qu'un mécanisme d'hérédité ?**

École thématique interdisciplinaire d'échanges et de formation en biologie de Berder, CNRS, Berder

CHARBONNEAU M.

**Evolutionary Developmental Considerations on Cultural Inheritance**

Lab Excursion of Cognitive Science Students of the University of Vienna, KLI, Altenberg

CHIU LC-H.

**The Natural Selection of Situated Cognitive Systems**

Colloquium Lecture, Institute of Cognitive Science, University of Osnabrück

CHIU LC-H.

**Niche Construction and Rethinking the Dichotomy of Externalist/Internalist Evolutionary Explanations**

Lab Excursion of Cognitive Scientist Students of the University of Vienna, KLI, Altenberg

GLENNAN S.

**Mechanistic Productivity and Difference-Making**

Workshop on Causality and Mechanism, Department of Philosophy, University of Cologne

GLENNAN S.

**Kinds of Mechanisms and Mechanisms as Kinds**

Invited Lecture, Institute for Philosophy, London

GLENNAN S.

**How-kind-of-actually Models**

International Society for the History, Philosophy and Social Studies of Biology,  
Montpellier

GLENNAN S.

**In Praise of Activities**

Workshop on Mechanisms, Causality and Explanation, Centre for Logic and the  
Philosophy of Science, University of Ghent

GLENNAN S.

**Prospects for a Mechanical Theory of Causation**

London Causality Workshop, Department of Science and Technology Studies,  
University College London

GLENNAN S.

**Prospects for a Mechanical Theory of Causation**

Workshop on Causality and Mechanisms, Egenis, University of Exeter

GLENNAN S.

**Kinds of Mechanisms**

Symposium, German Society for the Philosophy of Science, Hannover

GLENNAN S.

**Mechanisms and the Nature of Causation Revisited**

Invited Lecture, Autonomous University of Barcelona

MATUSZEWSKI S.

**Rapid Evolution of Quantitative Traits: Theoretical Perspectives**

Lab Excursion of Cognitive Science Students of the University of Vienna, KLI,  
Altenberg

MORIN O.

**What's in a Letter?**

Lab Excursion of Cognitive Science Students of the University of Vienna, KLI,  
Altenberg

MÜLLER GB.

**EvoDevo and Morphological Novelty: The Vertebrate Limb**

10th International Congress of Vertebrate Morphology, Barcelona



62 MÜLLER GB.

**The Modern Synthesis: Extension or Replacement?**

Congress of the International Union of Physiological Sciences (IUPS), Birmingham

MÜLLER GB.

**EvoDevo and the Extended Synthesis in Evolutionary Theory**

3rd European Summer School in EvoDevo, Istituto Veneto di Science, Lettere ed Arti, Venezia

NUÑO DE LA ROSA L.

**Image, Knowledge and Gestaltung in Morphology**

Morphology (Zoology) and Form History. Humboldt-Universität zu Berlin

NUÑO DE LA ROSA L.

**Designing life? On the Epistemological and Ontological Assumptions of Synthetic Biology**

Lab Excursion of Cognitive Science Students of the University of Vienna, KLI, Altenberg

PAVLICEV M.

**Evolving with a Complex Genome: From Population Genetics Towards Molecular Mechanisms**

Invited Lecture, Michigan State University

PAVLICEV M.

**How Evolution has Shaped Complex Genomes - Selection, Pleiotropy and Compensation**

Invited Lecture, Cincinnati Children's Hospital

SARTO-JACKSON I.

**The Neuroplasticity – Neuropathology Continuum: An Alternative View on Learning and Memory Formation**

International Society for the History, Philosophy and Social Studies of Biology, Montpellier

SARTO-JACKSON I.

**An Alternative View on Learning and Memory Formation**

Lab Excursion of Cognitive Science Students of the University of Vienna, KLI, Altenberg

SCHAEFER K, FINK B, WINDHAGER S.

**Digit Ratio, Physical Strength and Facial Shape: A Lesson from Ontogeny**

Meeting of the European Society for the Study of Human Evolution (ESHE),  
Vienna

SCHAEFER K, WINDHAGER S, MITTEROECKER P.

**Geometric Morphometrics as a Synergetic Tool: Towards an Integrative Assessment of Human Facial Form and Function**

Annual Meeting of the European Human Behaviour and Evolution Association (EHBEA), Amsterdam

SCHAEFER K, WINDHAGER S, SLICE DE, MITTEROECKER P.

**A Man's Face Reveals his Body Height: A GMM Approach to Ontogenetic and Static Allometry**

Symposium: Modern Morphometrics in Physical Anthropology II: papers in honor of Sokal. 82nd Annual Meeting of the American Association of Physical Anthropologists (AAPA), Knoxville (TN)

WINDHAGER S, MITTEROECKER P, SCHAEFER K.

**It's in Their Face: Quantifying Ontogenetic and Static Allometry in Human Male Faces**

10th International Congress of Vertebrate Morphology (ICVM-10), Barcelona

WINDHAGER S, MITTEROECKER P, SCHAEFER K.

**Ontogenetic and Static Allometry in Contemporary Human Male Faces, and Why It Matters**

Meeting of the European Society for the study of Human Evolution (ESHE),  
Vienna

WINDHAGER S, MITTEROECKER P, SCHAEFER K.

**Tall and Dominant: Facial Shape Cues to Body Height in Men**

Annual Meeting of the European Human Behaviour and Evolution Association (EHBEA), Amsterdam

## Further Activities

5



*Many activities of the KLI transgress  
the scientific core agenda.*

*Some are listed here.*



## 5.1 The New KLI

After more than two decades of productive and expanding work in the Lorenz mansion at Altenberg, in 2013 the KLI invested much effort in the planning of its new premises at Klosterneuburg. The historical Kremsmünsterhof (Fig. 1) had been acquired by the KLI Foundation already in 2012, and on February 1, 2013, the renovation and construction activity officially started with a kick off event including representatives of the Board, the Mayor of Klosterneuburg, and delegates of the municipal office.



Fig. 1

The Kremsmünsterhof in Klosterneuburg is a cultural heritage monument that evolved over several architectural periods. The planning of the adaptation of the historical residence to the exigencies of a modern scientific institute was carried out by the architect Walter Grohe, involving refurbishment of the old building and the design of a new annex. The Kremsmünsterhof is going to house the

66 administrative offices, the library, the tea kitchen, and the seminar area. The annex will provide spacious offices for fellows and visitors, and a lecture hall for scientific and public events. Together with the foyer of the lecture hall (Fig. 2), the medieval brick-arched basement of the main building will form an exciting exhibition space.



Fig. 2

In January 2014, the KLI moved to its new location in a preliminary fashion, using the first floor of the Kremsmünsterhof only, while building work continues in the annex and the garden. The scientific activity began soon after, with new fellows arriving and enjoying the new premises, and the new in-house lecture series, „KLI Colloquia,“ starting in March 2014. In addition, two workshops, a summer school, and an interdisciplinary science/art performance are scheduled to take place in the coming months.

## 5.2 Biological Theory at Springer

Since its migration to Springer, *Biological Theory* has increased the number of online subscribers significantly. Currently, there are 5,244 institutions with online access to *Biological Theory*. The number of full-text articles downloads also increased in 2013 from 2,700 to 10,400 (Fig. 3). The most frequently accessed articles were the ones by (1) Werner Callebaut, (2) Michael Habib, and (3) Alex Mesoudi, each of them being downloaded more than 200 times (Fig. 4).

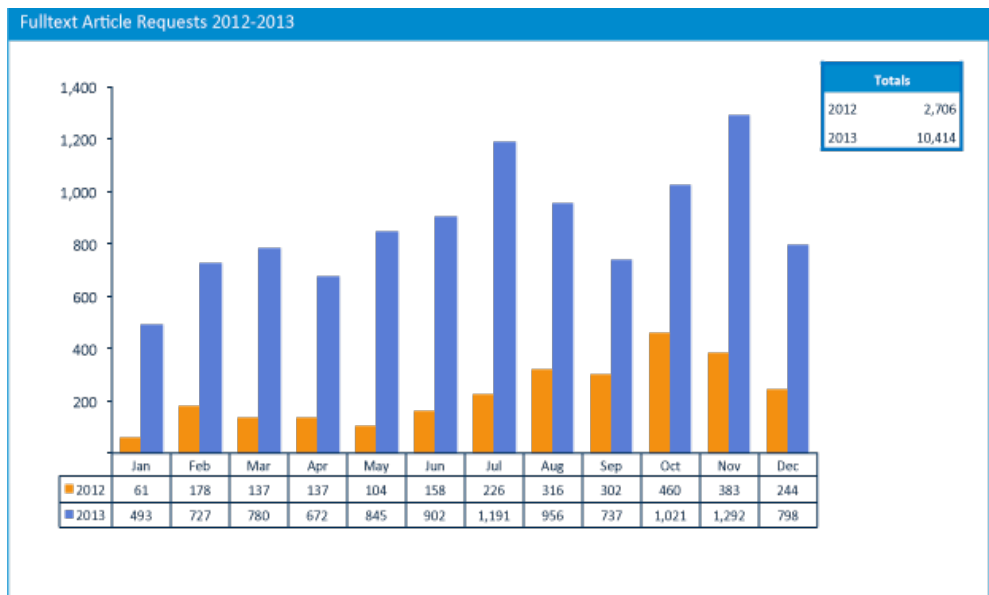


Fig. 3

(Source: SpringerLink.)

Title	Author	Volume	Issue	Year	Article Requests 2013 (Jan to Nov)
Scholastic Temptations In The Philosophy Of Biology	WERNER CALLEBAUT	8	1	2013	249
Constraining The Air Giants: Limits On Size In Flying Animals As An Example Of Constraint-Based Biomechanical Theories of Form	MICHAEL HABIB	8	3	2013	244
Is Non-Genetic Inheritance Just A Proximate Mechanism? A Corroboration Of The Extended Evolutionary Synthesis	ALEX MESOUDI	7	3	2012	207
The Meaning Of Theory In Biology	WERNER CALLEBAUT	7	4	2012	183
Emergence Of Shape	JEFFREY SCHWARTZ	8	3	2013	175
Human Behavior And Cognition In Evolutionary Economics	RICHARD NELSON	6	4	2011	174
Cognitive Evolution, Population, Transmission, And Material	DEREK HODGSON	7	3	2012	159
Cultural Niche Construction And Human Learning Environments: Investigating Sociocultural Perspectives	JEREMY KENDAL	6	3	2011	146
The Anatomy Of Motivation: An Evolutionary-Ecological Approach	VALERIE CURTIS	8	1	2013	143
How Evolutionary Is Evolutionary Economics?	CHRISTOPHE HEINTZ	6	4	2011	141

Fig. 4

(Source: SpringerLink)

68 A well-balanced international interest in *Biological Theory* is demonstrated in Fig. 5, showing that the journal’s website is visited by institutions from Europe (41%, especially the UK, Germany, and France), the US (35%), the Asia-Pacific (15%), and Latin America (6%).

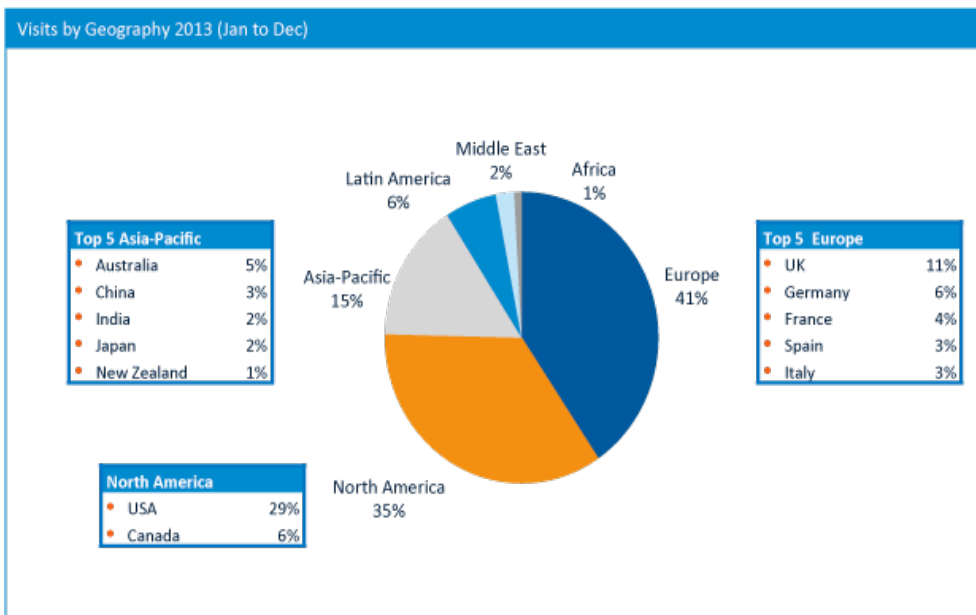


Fig. 5

(Source: WebTrek)

These figures together with a fast online-first publishing policy illustrate that the KLI made a foresightful decision to cooperate with Springer. The back issues of *Biological Theory* (volumes 1-5 originally published by MIT) will also be made accessible via the Springer site by the end of 2014.

### 5.3 Public Outreach

The KLI participated in public outreach activities organized by the Office of the State Government of Lower Austria: Marktplatz Wissenschaft in Baden, and the EU Researcher’s Night in St. Pölten. The KLI also took part in the 1<sup>st</sup> Education Fair “Bildungsmesse” in Klosterneuburg organized by the municipality

of Klosterneuburg. In addition, the KLI, its aims, and mission and the chairman Gerd Müller were featured in the book 'Wissenschaft[er]t Land' published by the Office of the State Government of Lower Austria

69

## **5.4 New Member**

The following new member was elected at the General Assembly 2013:

Isabella Sarto-Jackson, KLI, Austria.

## **5.5 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.

