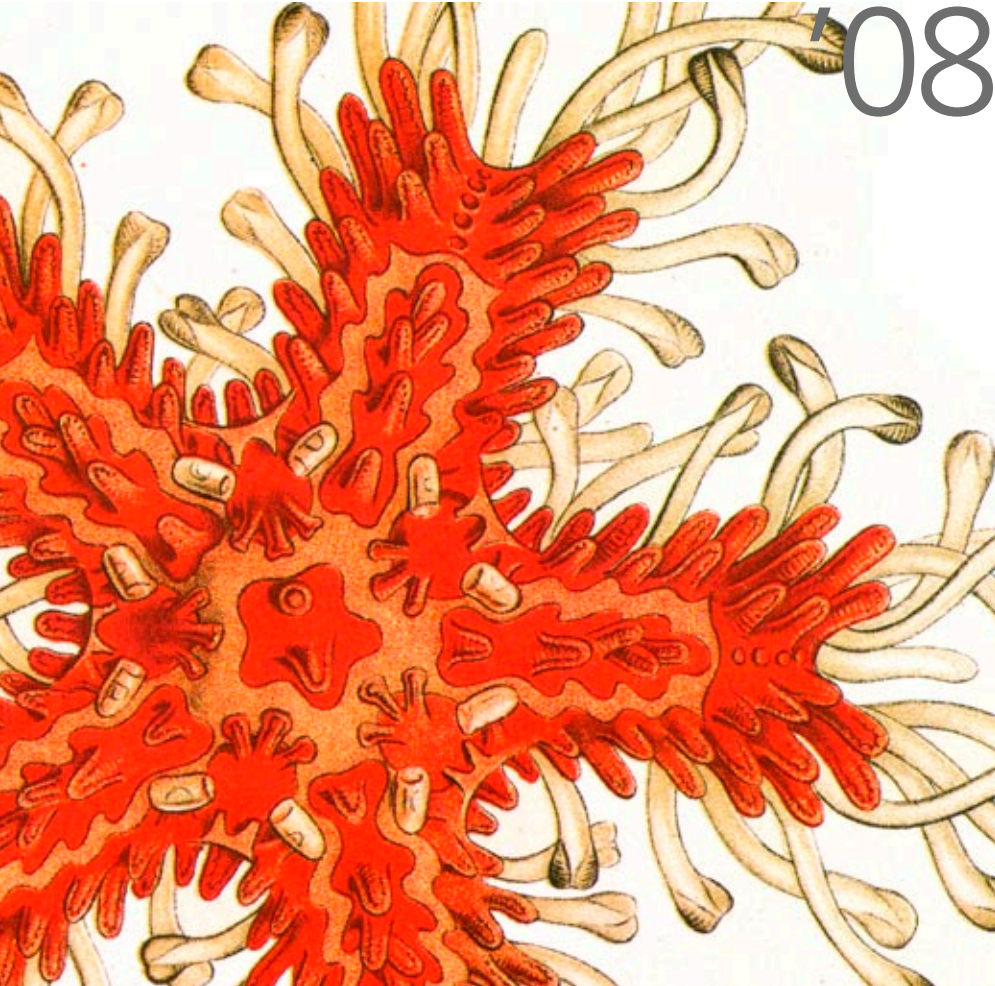


Tätigkeitsbericht Report

2008



activities  
of the  
KLI



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# Jahresrückblick und Struktur des KLI

## Review 2008 and Structure of the KLI

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*A modern equivalent of Plato's ideal  
symposium, an environment in which  
ideas are exchanged freely among friends  
who share the excitement that comes  
when knowledge is valued and preserved  
for its own sake.*

*Karl J. Niklas,  
Cornell University*

## 1.1 Jahresrückblick 2008 The Year in Review

Die Reichhaltigkeit der Aktivitäten des KLI bewirkt, dass in verschiedenen Jahren unterschiedliche Highlights auftreten. 2008 war ein Jahr der herausragenden wissenschaftlichen Veranstaltungen. Teils in Eigenverantwortung und teils in Kooperation wurden vom KLI mehr Veranstaltungen organisiert als je zuvor. Allein in der Reihe *Altenberg Workshops in Theoretical Biology*, die traditionsgemäß am KLI selbst stattfinden, wurden drei Workshops abgehalten, sodass wir im vergangenen Jahr den 20. Workshop seit Begründung der Reihe im Jahr 1996 feiern konnten. *Towards an Extended Evolutionary Synthesis*, ein Workshop der im Vorausblick auf das Darwin-Jahr 2009 organisiert worden war, erhielt aufgrund seiner reputierten Teilnehmer und seiner revolutionären Befürwortung einer erweiterten Evolutionstheorie besondere internationale Beachtung, unter anderem auch in den hochrangigen Wissenschaftsjournalen *Science* und *Nature*.

Selbstverständlich sind 2008 neben den wissenschaftlichen Veranstaltungen auch alle weiteren Aktivitäten des KLI vorangetrieben worden, wie die große Zahl der Projekte, Stipendiaten, Gastwissenschaftler und Publikationen zeigt. Seit der letzten Generalversammlung haben insgesamt 20 Wissenschaftler und Wissenschaftlerinnen ihre Projekte am KLI verfolgt. Unsere Fellows und Mitarbeiter publizierten 24 wissenschaftliche Artikel in internationalen Fachzeitschriften oder Buchbänden und hielten insgesamt 71 Vorträge und Präsentationen im In- und Ausland. Im Rahmen der „Altenberg Seminars“ wurden 7 Vorträge abgehalten, und 16 „Brown Bags“ fanden am KLI statt. Das KLI beteiligte sich auch an verschiedenen Veranstaltungen außer Haus, wie z.B. am Workshop *Cultures of Seeing 3D and Beyond* am Max Planck Institut für Wissenschaftsgeschichte in Berlin, und organisierte Festveranstaltungen zum 70. Geburtstag von Erhard Oeser und zum 80. Geburtstag von Irenäus Eibl-Eibesfeldt. Weiters beteiligte sich das KLI erstmals an der Organisation einer Summerschool in Philosophy of the Life Sciences und dem EUNICE Post Graduate Program Mastering Structural Change.

Die vom KLI herausgegebene Zeitschrift *Biological Theory* hat weiter an Profil gewonnen. Die steigende Zahl der Einreichungen zeigt, dass die Zeitschrift inzwischen in der Scientific Community als anstrengenswertes Publikationsorgan gilt. Mit *Evolution of Communicative Flexibility* ist auch in der KLI-Buchreihe Vienna Series in Theoretical Biology 2008 ein weiterer Band erschienen, sodass mit dem inzwischen erschienen 10. Band auch hier ein Jubiläum begangen werden kann.

Die Details zu den genannten und weiteren Aktivitäten finden Sie auf den nachfolgenden Seiten. Wie immer danke ich an dieser Stelle allen, die dies bewerkstelligt und ermöglicht haben sehr herzlich für ihren Einsatz. Mein besonderer Dank gilt den Förderern, dem Vorstand und dem Mitarbeiterstab des KLI.

Univ. Prof. Dr. Gerd Müller  
Vorstandsvorsitzender

## 1.2 Das KLI The KLI



4 Das KLI ist ein internationales Zentrum für theoretische Biologie. Das Institut fördert die Formulierung, Analyse und Integration biologischer Theorien sowie die Untersuchung ihrer wissenschaftlichen und kulturellen Konsequenzen. Der thematische Schwerpunkt liegt auf den Gebieten der Evolutionstheorie, der Entwicklungstheorie und der Kognitionstheorie. In diesen Bereichen unterstützt das KLI interdisziplinäre Forschungsprojekte, die entweder Modelle lebender Systeme herstellen oder metatheoretische Darstellungen geschichtlicher, philosophischer oder kultureller Aspekte von biologischen Theorien zum Ziel haben. Die wissenschaftlichen Arbeiten werden durch die Vergabe von Stipendien gefördert, die aufgrund eingereicherter Projektanträge und internationaler Begutachtung in sieben verschiedenen Kategorien vergeben werden.

Neben den wissenschaftlichen Projekten verfolgt das KLI seine Ziele durch die Organisation von internationalen Workshops, Symposien und Vortragsreihen, sowie durch die Herausgabe einer wissenschaftlichen Zeitschrift und einer Buchreihe, beide in Zusammenarbeit mit MIT-Press. Das KLI unterhält weiters eine frei zugängliche Internet-Datenbank, die bio- und bibliographische Informationen zu den für das KLI wichtigen Fachgebieten und angrenzenden Disziplinen zusammenfasst, eine kleine Tierhaltung, in der die Durchführung empirischer Projekte möglich ist, und das Konrad Lorenz Archiv, das Briefkorrespondenz, Photographien, Manuskripte, Tagebücher und Auszeichnungen von Konrad Lorenz umfasst. Mit dem KLI Gästehaus steht den Visiting Fellows und Gästen auch eine attraktive Wohnmöglichkeit in Institutsnähe zur Verfügung.

## 1.3 Institutsorganisation Organization of the KLI

### Vorstand / Board of Directors

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DR. ASTRID JÜTTE (Geschäftsführung)

## **Editor-in-Chief Biological Theory**

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Department of Systems Biology, Harvard Medical School, Boston, MA, USA

PROF. DR. MANFRED LAUBICHLER  
Department of Biology, Arizona State University, Tempe, AZ, USA;  
Max-Planck-Institut für Wissenschaftsgeschichte, Berlin

PROF. DR. STUART NEWMAN  
Department for Cell Biology and Anatomy, New York Medical College, Valhalla, NY, USA

PROF. DR. D. KIMBROUGH OLLER  
School of Audiology and Speech-Language Pathology, University of Memphis, TN, USA



## Wissenschaftliche Projekte Scientific Projects

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*Für Projekte im Bereich der theoretischen Biologie vergibt das KLI sieben verschiedene Arten von Stipendien für Studenten, Postdoktoranden und Gastwissenschaftler für eine Dauer von jeweils einigen Wochen bis zu 3 Jahren. Alle eingereichten Projekte werden einem internationalen Review unterzogen.*

2.1 Bewerbungen Applications

Insgesamt erhielt das KLI im Jahr 2008 über 50 Anfragen für Stipendien und Fellowships, wovon 15 vom Vorstand behandelt, und 11 für das laufende oder kommende Jahr genehmigt wurden.

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	Anträge	genehmigt
Thesis-Stipendien und Junior-Stipendien	2	1
Postdoktoranden- / Przibram-Stipendien	6	4
Gastwissenschaftler-Stipendien	7	6

2.2 Dissertations-Stipendien Thesis Fellowships

Nathalie GONTIER  
(February - May 2008)



*Nathalie Gontier studied Philosophy at the Vrije Universiteit Brussel (Brussels, Belgium) and Comparative science of culture (cultural anthropology) at the University of Ghent (Belgium). Her PhD in Philosophy (2008) was on the origin of language from within an evolutionary epistemological framework. She co-edited (with J. P. Van Bendegem and D. Aerts) Evolutionary Epistemology, Language and Culture: A Non-Adaptationist Systems Theoretical Approach (Springer, 2006).*

Epistemologizing Evolutionary Theories: Redefining Evolutionary Epistemology  
Eine Neudefinition von evolutionärer Erkenntnistheorie

At present, three observations concerning Evolutionary Epistemology can be made: 1. The evolutionizing of epistemology and cognition has for the most part taken place in a selectionist framework of evolution. 2. Evolutionary Epistemology that works within a selectionist framework goes beyond the study of merely epistemology and cognition for it contains a variety of different topics including memetics, culture, the brain, language, etc. 3. Because of the advances made in (1) and (2), the epistemologizing of evolutionary theories other than natural selection has been for the most part neglected by researchers.

Since the selectionist turn has turned out to be so successful in biological and extra-biological fields alike, it could be extremely productive if we were to (re)turn to these neglected evolutionary theories (cfr. 3) and see how they might contribute further to the study of cognition on the one hand, and on the other to the study of language, culture, the brain and so on. Pursuing this goal would, for the most part, imply a redefinition of evolutionary epistemology as a discipline, where not only cognition and epistemology, but also a variety of other phenomena can be understood from within a wide spectrum of epistemologized evolutionary theories.





In order to accomplish this goal, basically two questions need to be asked: 1. How can we epistemologize non-selectionist approaches such as the serial endosymbiotic theory of evolution, punctuated equilibrium, drift, epigenetics, and systems theory, to name only the most pertinent alternative and complementary views of the Modern Synthesis? 2. To which phenomena can these epistemologized evolutionary theories be applied besides epistemology and cognition?



**Joeri WITTEVEEN**

(December 2007 - June 2008)

*Joeri Witteveen obtained his liberal arts undergraduate degree from University College Maastricht, the Netherlands, in 2006. He took courses towards his degree at the University of California, Berkeley. In September 2007 he finished his work on theories of cultural evolution for the MSc in Philosophy of the Social Sciences at the London School of Economics and Political Science. He plans to commence with a PhD in philosophy in fall 2008.*

### **The Concept of „Replicator“ in Biological, Cultural and Conceptual Evolution**

**Das „Replikator“-Konzept in der biologischen, kulturellen und begrifflichen Evolution**

Richard Dawkins introduced the replicator in *The Selfish Gene* as his contribution to the units of selection debate. The replicator has since gained widespread adoption in biological evolutionary theory, but also in theories of conceptual and cultural evolution. Soon after the publication of *The Selfish Gene*, discussion arose about what other entities than genes and memes could count as replicators (e.g. Bateson, 1978), and discussion has recently revived, especially in relation to conceptual and cultural evolution. Cause of the confusion over the role and presence of replicators in these domains of evolution is the ambiguity in the definition of the replicator. Dawkins' loose definition has recently been made more articulate by biologists and philosophers, but consensus remains absent.

In the light of the adoption of evolutionary theory in the social sciences it has become increasingly important to have a clear definition of replicator. An analysis is needed of the different definitions that have been suggested. These need to be assessed on their applicability in the various domains where evolutionary theory is used, to advance to a well-defined replicator concept. Furthermore, there is lack of agreement about whether replication is necessary for evolution. The answer to this problem hinges on the question what is regarded as a replicator. A well-defined replicator concept can potentially take away confusion about whether replication is necessary. The need for such a solution is especially pressing in recently emerged

discussion between theorists of cultural evolution: in dual inheritance theory replicators are regarded as the limiting case of cultural evolution, whereas meme-theory regards the replicator as essential for cultural evolution to take place. I suggest to research the uses and definitions of the replicator concept, to advance to a definition of the replicator that illuminates its use in the different domains in which evolutionary theory is used.

### 2.3 Postdoktoranden-Stipendien Postdoctoral Fellowships

**Dr. Sabine BRAUCKMANN**

(April - June 2008)



*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.*

**Edition: The Selected Works of Karl Ernst von Baer (1792-1876)**

**Edition: The Selected Works of Karl Ernst von Baer (1792-1876)**

The edition „The Selected Works of Karl Ernst von Baer (1792-1876)“ presents a collection of Baer’s most important papers on comparative embryology, anthropology, ecology and evolution for the first time in an English translation. Besides it, they will display the opposing views of Baer and Darwin on evolution as one of the great controversies in the history of science. They do it with compelling examples from embryology, botany, evolution, ecology, and anthropology in an exceptionally clear, concise and, nevertheless, poetic diction. This first volume portrays Baer as the father of embryology, or, as Darwin emphasized once, „the most important zoologist of this [19th] century“. Baer discovered the mammalian egg and the notochord, described the five primary brain vesicles, and studied the functions of the extra-embryonic membranes. The experimental (observational) studies on the mammalian egg and comparative embryology will demonstrate his aim to discover the natural system of all animal classes, which, according to Baer, relies upon the integrative mecha-

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nisms of development. Furthermore, he formulated the germ-layer theory and the law of corresponding stages, or serial homologies in the development of embryos, which put a preliminary end to the preformism-epigenesis debate of the 18th century. The second section presents Baer's reasoning about evolution and its relations to physical anthropology and comparative embryology. This volume informs about his ideas on race, species, and the intricate net of type and generation, besides his critical argument concerning the homology between vertebrates and invertebrates. Modern evolutionary thought has gained from Baer's ideas partly via recitations by Darwin, who honoured and used Baer's ideas as central arguments in his work *The Descent of Man*.



**Dr. Christophe HEINTZ**  
(July 2007 - September 2009)

*Christophe Heintz studied mathematics at the University of Paris 7 (Jussieu), specializing, at the master level, in mathematical logic. He also studied philosophy at the Universities of Paris 4 (Sorbonne) and Cambridge, specializing, at the master level, in the philosophy of science. Mr Heintz completed his PhD work at the Institut Jean Nicod – EHESS. His main research interest concerns the relations between cognitive and social factors in scientific knowledge production, especially mathematics and social anthropology. He has lately renewed his interest in mathematics with evolutionary game theory and complex system theory as tools for modelization.*

### **The Co-evolution of Scientific Cognition and Institutions** **Die Co-Evolution von wissenschaftlicher Erkenntnis und Institutionen**

The project consists of an analysis of the historical evolution of scientific knowledge that integrates social studies of science and studies on the biological basis of cognition from evolutionary psychology. My research investigates how cognitive abilities with a plausible evolutionary history can beget scientific knowledge. The conclusion I have drawn is that scientific thinking heavily relies on the cultural environment, which provides the interpretative framework for scientific reasoning. Social intelligence and metarepresentative abilities put innate inference processes (designed by evolution) at work on cultural scientific environments. The latter are thus being exploited and enriched by minds that need not be either domain general calculating devices or extremely plastic and evolving structures. On the other hand, the evolution of science is said to rely on the interaction between the social and the cognitive factors in scientific knowledge production. In order to understand the processes of



co-evolution of culture and cognition in the history of science, I have especially drawn on the theoretical resources of cognitive anthropology (Sperber's epidemiology of representation, Hutchins' distributed cognition) and situated cognition.

The project consists of showing the relevance of another theoretical resource, New Institutional Economics, in order to account for an understudied form of co-evolution of cognition and culture: the co-evolution of scientific institutions and scientific cognition. The evolution of scientific institutions is of special interest because institutions provide the rules of proper scientific practices that constrain and empower scientific thinking. Also, economic models of the emergence of institutions promise to be relevant to evolutionary epistemology because they provide a framework allowing for the study of the flow of information in social structure with models of agents that are psychologically adequate. Also, evolutionary game theory provides the formal basis of Institutional Economics, thus placing my own research in an evolutionary perspective.

My case study shall be the institutions that organize the access to scientific information, such as journals, ISI's evaluative processes and, recently, the Internet. These institutions, indeed, determine scientists' trusting behaviour and need be incorporated in an account of scientific cognitive processes for the attribution of cognitive resources to scientific sources of information.

#### Dr. Simon HUTTEGGER

(April 2006 - March 2008)

*Simon Huttegger studied philosophy, history, and mathematics at the University of Salzburg (MA, 2002, with a thesis on subjective probabilities). He spent the academic year 2004/05 at the University of California at Irvine. His research concentrates on evolutionary game theory and its applications in philosophy, particularly in the philosophy of science, the philosophy of biology, epistemology, and social philosophy. In his dissertation, *Language and Coordination: Evolution, Social Learning, and the Explanation of Meaning*, he studied adaptive dynamics applied to interactions.*



#### Communication Networks in Adaptive Systems

##### Kommunikations-Netzwerke in adaptiven Systemen

Signaling games provide a basic model for investigating epistemological questions surrounding information transfer, reference and meaning. As such, they have played a prominent role in theoretical biology, economics, AI, and philosophy. So far, mostly two-agent interactions have been studied by embedding them into some evolutionary dynamics. This project aims at investigating how agents

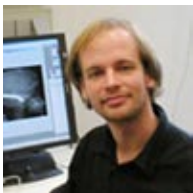


network to distribute valuable information (thus shifting attention to interactions between more than two agents). There are two baseline models that will be studied. In the first one, each agent has a piece of information that is valuable to all other agents. They start to connect to each other. Connections are costly. The agents' decisions are governed by some (adaptive) learning mechanism. Each agent gets the information from the agents directly connected to her and from agents indirectly connected to her via her direct connections. The ring turns out to be the unique efficient network structure in this case.

It will be studied what a minimal learning algorithm must look like so that the agents may converge to the ring. Preliminary simulations suggest that some kind of forward-looking property and the ability to take account of the perspectives of other agents might be a necessary condition of convergence. A second baseline model extends this to a setting where agents simultaneously connect to each other and learn to signal.

The first main objective of this project is to understand more about the constraints on agents who are able to distribute information efficiently.

The second one is related to problems in evolutionary epistemology. If epistemology is the study of the role of information about the world in knowledge systems, then we aim at understanding more about the epistemology of how pieces of information might be put together, when information keeps on flowing, when it is stored, and so on. Finally, the ring structure is also of anthropological interest. Exchange networks like the Kula ring of the Trobriand islands have the structure of a ring. This raises fundamental questions about the strategical aspects and the dynamics of the formation of those kind of networks.



**Dr. Philipp MITTERÖCKER**

(August 2007 - February 2009)

*Philipp Mitteröcker obtained his PhD from the Institute for Anthropology, University of Vienna. He is working on new geometric morphometric methods and applies them to the study of the evolution and development of primate anatomy. He published on morphological integration, ontogeny and phylogeny of hominoid craniofacial morphology, and morphometric methods for curves and surfaces.*

### **Modularity and Morphological Integration in the Hominoid Cranium**

**Modularität und morphologische Integration des menschlichen Schädels**

There is wide agreement that modularity is a prerequisite for the hierarchical phenotypic organization of higher organisms as well as for the appearance of complex adaptations. While studies of modularity are often experimental, morphological integration is a more descriptive concept whereby groups of correlated phenotypic characters are often interpreted as modules. I will show that the classic assumption of morphological integration (high correlations within modules, lower correlations between modules) is met only for the unrealistic case of nearly isometric growth factors and discuss the consequences for the morphometric assessment of modularity.

My focus will be on the empirical analysis of modularity and integration in the hominoid cranium. I compare postnatal ontogenetic trajectories of humans, chimpanzees, and gorillas by a geometric morphometric approach and draw conclusions about regional dissociation during development and evolution. Additionally, I describe conserved modes of shape variation that integrate facial and neurocranial morphology among the investigated taxa. I will discuss possible phylogenetic conclusions and how such morphometric findings may be interpreted in the light of contemporary evo-devo theory.

#### Dr. Alejandro ROSAS LOPEZ

(July 2008 - June 2010)



*Alejandro Rosas is associate professor at the philosophy department, Universidad Nacional de Colombia. Trained initially as a Kant scholar, he later turned to pursue a naturalistic worldview. His current project is to develop a picture of the evolutionary genesis of a moral agent. This involves work on moral psychology and moral theory, experimental economics, multilevel selection theory, the evolutionary theory of cooperation, and the evolution and phylogeny of typical human cognitive and behavioral traits. Recent publications include „The sociobiological dilemma“ (Zygon 2007), „Multilevel selection and human altruism“ (Biology and Philosophy 2008) and „The return of reciprocity“ (Biology and Philosophy 2008). Prof. Rosas is currently a Senior Fellow at the KLI.*

#### The Genesis of a Moral Agent

##### Die Entstehung eines moralischen Agents

I propose a multidisciplinary project on the evolution of moral behavior, connecting the evolutionary theory of altruism and cooperation to several behavioral sciences. The research subject is approached by focusing on the evolution of an agent with the psychological profile of a contractarian moral agent – in the Kantian rather than Hobbesian tradition –, which implies that fairness and a respect for persons as equals are intrinsically valued, without denying





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that humans also exhibit a natural tendency to betray these values.

\_The evolutionary explanation faces two challenges, both addressed by the project: the paradox of biological altruism, i.e., the fact that altruistic traits seemingly contradict the theory of natural selection, as first noted by Darwin (1871); and the need to theorize over a plausible phylogenetic origin of moral agents. Building upon recent proposals that link human cooperation to motivations to comply with norms of fairness and to punish norm-violations, the project proceeds along the following hypotheses:

1. In the evolution of morality, individual and group selection are not opposed, but synergistic forces. The psychology of norm-endorsement is designed to support social practices and institutions that suppress the advantages of selfish, freeloader behavior. Under these conditions, moral behavior benefits both the individual and the group.

2. All human cooperative strategies, strong reciprocity, indirect reciprocity and reciprocal altruism are norm-guided, and guided in fact by the same general norm of conditional or reciprocal cooperation.

3. Concerning the phylogenesis of moral agents, the selection pressures responsible for the evolution of the appropriate moral psychological architecture began only to operate after humans had developed the ability to perceive the opportunities for cooperation with delayed reciprocity in interactions with a prisoner's dilemma structure.

4. The suitable interaction type for promoting the evolution of fairness norms was not contest for dominance between males, but interaction between males and females for the rearing of offspring. This interaction has the structure of a prisoner's dilemma. It requires the fulfillment of expectations for mutual constraints on behavior and favors the evolution of fairness. Once the psychological profile for human long-term mating strategies evolved, involving male parental investment and trust between sexual partners, the profile influenced other social interactions.



**Dr. Konrad TALMONT-KAMINSKI**

(June - July 2008)

*Konrad Talmont-Kaminski is a lecturer at the Marie Curie Skłodowska University in Lublin, Poland. He obtained his BA in History and Philosophy of Science from the University of Melbourne, his MA from the University of Western Ontario, and his doctorate from Monash University. His work lies within analytical epistemology and philosophy of science and focuses on developing a broadly Peircean naturalized account of reason. For many years he has been working with John Collier, a past KLI Fellow.*

## Superstition as a Natural Cognitive Phenomenon

### Aberglaube als natürliches kognitives Phänomen

Superstition is generally understood as the paradigmatic example of irrationality. While this view is correct in so far as it goes, it fails to explain two very significant questions. Firstly, why it is that superstitious thinking should arise in evolved beings when it would seem that it is an impediment rather than an aid in survival. Secondly, why superstition, itself, should have not just survived but done very well despite ongoing efforts to weed it out.

Both questions become much easier to answer when we see superstition not as the opposite of rationality but, rather, as the lamentable by-product of the limited cognitive capabilities and mechanisms available to us. Indeed, once we understand that rationality is bounded, systematic shortcomings such as superstition become predictable. And, while it is impossible to know at this point the actual evolutionary history of superstition, it should be possible to see how it could be that superstition could arise in organisms undergoing evolutionary change.

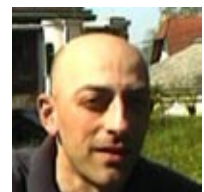
This naturalist theoretical framework allows us to look at a number of interesting issues regarding superstition. The first is the possibility of characterising superstition, as opposed to false or irrational beliefs in general. The second is to try and understand the relationship between superstitious beliefs and superstitious practices. The third is to see to what degree and for what reasons superstition is a problem. The fourth is the nature of the relationship between superstition and another element of human beliefs that would seem surprising from a purely rational point of view – religious beliefs. The fifth is to examine which of our cognitive mechanisms fail us and cause superstition to be so attractive to us. The sixth is whether superstition is a necessary element of human nature or if its influence may be eliminated.

The overall aim of the project, therefore, is to fit superstition into a thoroughly naturalised world view, and, in particular, a naturalised view of rationality as bounded and evolved. The hope is that the result will be to cast light upon superstition and, in reflection, upon rationality.

**Dr. Davide VECCHI**

(October 2006 - September 2008)

*Davide Vecchi obtained his first degree in philosophy from the University of Bologna, Italy. After unconvincingly attempting to pursue a career in business, he has been fully lured back to the temptations of philosophy. He was recently awarded a PhD from the London School of Economics and Political Science, where he worked under Elliott Sober's co-supervision. His main research*





*aim is to apply the idea of the universality of selection to science by developing a variation-selection model of evolutionary epistemology that manages to make sense of the apparent progress of scientific knowledge.*

### **The Epistemological Implications of Selection Theory**

#### **Erkenntnistheoretische Implikationen der Selektionstheorie**

In recent years the research program labelled Selection Theory has seen a number of extensions that would certainly have pleased Donald T. Campbell. My opinion is that this expansion of the framework is a necessary evolutionary step in the long-term process of evaluation of the progressiveness of the program. However, even though such an expansion is necessary, it has not been generally accompanied by a more philosophical assessment and reconsideration of the fundamentals of the program. I wish to avert this trend.

Campbell (1974) spoke of the thesis of the universality of selection as the „dogma“ of his approach. I wish to reconsider, by exploring Campbell's work and the recent work on selection theory, whether the universality thesis can be genuinely treated as an empirical hypothesis, and, above all, if it is a sound one. After Campbell proposed it, the thesis in all its different formulations was either snubbed or happily endorsed, but never seriously criticized. More recently a number of well-articulated criticisms have been raised against the universalism of the thesis, generally pointing to its more circumscribed range of application.

I first wish to analyze the nature and status of Campbell's blind-variation-and-selective-retention model. In particular, I wish to focus on the metaphysical issues concerning the nature of selection processes (i.e. their logic and range of application, and the nature of the various formulations of the universality thesis) and on their characterization (i.e., the nature of the slippery notion of „blindness“ of variation involved, their populational requirements, their limits).

Being primarily an evolutionary epistemologist, I will then move to reconsider the epistemological implications of the universality thesis. The trend in recent years has been to give up the search for a logic of science in favor of a sociology of scientific validity. For instance, Hull and Campbell (1997) put stronger emphasis on the sociological analysis of the scientific process, seemingly in line with the naturalism of their epistemological approaches. Even though I consider the sociological approach as an indispensable part of a complete evolutionary epistemology, I believe that something has been left out by endorsing a hard-core sociological perspective. This is why I plan to investigate whether there are any good reasons to revive our interest in the „logic“ of selection. My suspicion is that selection theory can provide a „logic“ of discovery and justification (or, more properly, a sound account of the scientific processes of hypotheses generation and selection) somehow along the lines — aptly revised, of course — of what Popper sought (the logic of trial and error).



In a sense, I would like to revive the deep implications of Campbell's and Popper's work by proposing that selection theory per se has normative value.

Finally, I wish to consider what implications would a revived interest in the logic rather than sociology of scientific validity have on evolutionary epistemology as a naturalized epistemology.

**Dr. Zsófia VIRÁNYI**

(June 2006 - July 2009)



*Zsófia Virányi studied biology at Eötvös Loránd University, Budapest and graduated with a thesis on knowledge attribution in dogs and children. During her PhD studies in ethology she examined the domestic dog's reasoning abilities and in some aspects compared them to children, apes, monkeys, and wolves. She participated in the project of the Department of Ethology, Eötvös Loránd University comparing hand-raised wolves and dogs in their relationship and communication with humans. At the Max Planck Institute for Evolutionary Anthropology, Leipzig, Germany she made a comparative study on knowledge attribution in great apes and dogs under the supervision of Josep Call. Later at Kazuo Fujita's lab, Primate Research Institute, Kyoto University she tested pigeons and capuchin and squirrel monkeys in a task on inferential reasoning about the location of food.*

### **Rationality and Attentional Coordination in Social Learning in Marmosets and Dogs**

**Rationales und aufmerksamkeitsgesteuertes soziales Lernen bei Kallaffen und Hunden**

Imitation has been demonstrated in apes, monkeys, and birds. In accordance with some recent theories (e.g. Associative Learning (ASL) Theory), imitative capacity may depend on cognitive mechanisms (learned perceptual-motor links), which are likely to be available in various non-human species. Human imitation, however, shows some intriguing characteristics: It is not about automatically copying some others' behavior, but shows context-dependency in at least two ways:

1) It seems to involve some selective, inferential processes, taking not only the performed behavior but also its outcomes and constraints into account.

2) It seems to be interlinked with and affected by coordinated gazing behavior and other social cues of the demonstrator and the learner.

While non-human research has tried to determine whether and which species of animals are able to imitate others' behavior, human research focuses on the question which specialities of human imita-



tion and which other characteristics of human social information transmission might have contributed to the evolution of human culture. Candidates are the capability for reasoning, which goes beyond associative psychological processes and the attentional coordination of companions, which makes social information transmission more effective.

Both marmosets and dogs have been found to engage in different forms of social learning but the above aspects have hardly been examined, although they may provide valuable non-human models with the special interest of the distinctive evolutionary histories of these two species.

## 2.4 Austausch-Stipendium Exchange Fellowship



**Mag. Sebastian Voigt**  
(August 2008 - July 2010)

*Sebastian Voigt studied biology in Hamburg and Innsbruck, where he specialized in physiology and embryology. He also attended courses in protein biochemistry and cell biology and carried out work on neotenic hemoglobin expression patterns in pupfish (*Cyprinodon*) in Umeå, Sweden, in 2001. He obtained his MA in zoology on physiological maternal effects in zebrafish (*Danio rerio*) in Innsbruck in 2003. Until 2006 he studied veterinary medicine in Vienna. He is currently attending biology courses at the University of Vienna.*

### **DevoEvo of the Pupfish Genus *Cyprinodon*: A Phenotypic Engineering Approach**

**DevoEvo von Kärpfingen: Ein phenotypischer Entwicklungszugang**

The traditional gene centered view of the Modern Synthesis is losing ground against a perspective that focuses on development as the pacemaker of evolutionary innovation (DevoEvo). These rising theories, arranged around the phenomenon of phenotypic plasticity, are much in need of further experimental grounding. The proposed work on pupfish of the genus *Cyprinodon* is an effort to fill this gap. These tiny fish have been described as being able to "survive almost everything" (Soltz et al., 1978) and react with a high degree of phenotypic plasticity towards changing ecological conditions.

Environmental induction (West-Eberhard, 2003), epigenetic origination (Müller et al., 2005), and „neophenogenesis“ (Johnston et al., 1990) are potential mechanisms thought to underlie the origin of phenotypic novelty in changing environmental conditions. These concepts will be tested using closely related species of pupfish adapted to various kinds of extreme conditions. The empirical and experi-

mental work of this project will focus on the “making of new species” under artificial conditions (phenotypic engineering) and on fast evolving species in the laboratory of nature (Feder et al., 2000). The comparative physiological and morphological approach will include the use of advanced quantitative tools such as Micro-CT (Weninger et al., 2006) and Digital Motion Imaging (Schwerte et al., 2000).

## 2.5 Przibram-Stipendien Przibram Fellowships

**Dr. Joanna BRYSON**

(August 2007 - July 2009)

*Joanna Bryson holds degrees in behavioral science, psychology and artificial intelligence from Chicago (BA), Edinburgh (MSc and MPhil), and MIT (PhD). Since 2002 she has been assistant professor at the University of Bath, where she founded Artificial Models of Natural Intelligence. She has forty-nine reviewed research publications, including articles in Animal Cognition and in Philosophical Transactions of the Royal Society - B, Biology. She serves as an expert consultant for the European Commission on cognitive systems.*



### Factors Limiting the Evolution of Cultural Evolution

#### Die Evolution der kulturellen Evolution limitierende Faktoren

This project examines the hypothesis that cultural learning is rare not because the mechanisms of learning required for an individual learner are difficult to evolve in themselves, but because of the impact on the ecological and social system supporting learners. While cultural evolution has the potential to be a powerful means to search for new and more optimal behaviour, where cultural evolution exists, it must co-evolve with a set of constraints that damp its effects on the society and its ecosystem. Many of these constraints are set as a part of development. This hypothesis will be explored by extending the current models of the evolution of communication, of primate social behaviour, and of individual learning.

The idea of this research is to model existing learning and development in primate species other than humans, such as orangutans (van Schaik et al., 2003) and capuchins (Perry et al., 2003). By looking at the range of behaviours that are theoretically possible and examining where within this range modern non-human primates exist, we can learn about the evolved mechanisms for controlling cultural evolution. This work could ultimately have substantial impact on our understanding of human culture and development.



Dr. Adrianna WOZNIAK

(September 2008 - August 2009)

*Adrianna Wozniak obtained her European Doctorate at Jean Moulin University Lyon 3 in 2006. Her PhD thesis, "Evolutionary Theory of Knowledge: The Phylogenetic Relation from Representation to Object," was supervised by Dr. A. Reboul. Her research interests are in the philosophy of biology, evolutionary epistemology, and cognitive science. Before joining the KLI as a post-doctoral fellow Dr. Wozniak worked at the School of Computer Science, University of Windsor, Canada, on questions of speciation and biodiversity in simulated ecological communities.*

### Relativity in Evolutionary Causation

#### Relativität in evolutionärer Kausalität

With Extended Evolutionary Synthesis (EES, here the Theory of Niche Construction and the Evolutionary Developmental Biology) theoretical biology undeniably enters into a post-Synthesis period. We will show that causal asymmetry is inherent to the very notion of the evolution by natural selection (as is Darwinian version and the one of the Moderns Synthesis), according to which environmental factors differentiate fitness and selectively act on variation, the latter being thus selectively causally passive. We will argue that EES's understanding of natural selection makes a step toward a symmetric causality by showing that variation can determine its own fitness and thus its evolutionary fate. We will propose a model for symmetry in evolutionary causation (Relativity in Evolutionary Causation, REC); we use as illustration the concept of causality underlying the General Theory of Relativity. We also will propose an individual-based simulation evaluating REC's predictions about the role of individual variation (measured by species abundance distribution) and especially of ontogenetic variation (e.g. stemming from learning) in the origin and spread of evolutionary novelty and speciation (measured by diversification rate). We will discuss REC's possible consequences for sympatric speciation as well as for Baldwin effect and studies devoted to the evolution of language and social capacities.



## 2.6 Gastwissenschaftler Visiting Scientists

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**Dr. Xabier E. BARANDIARAN**

(November - December 2008)



*Dr. Xabier E. Barandiaran is a philosopher of biology, cognitive neuroscience, and robotics with a special focus on robotic simulation modelling techniques as integrative tools for the study of cognitive systems. He obtained his MSc on Evolutionary and Adaptive System from COGS, University of Sussex, UK, and his PhD on „Mental Life. A Naturalised Approach to the Autonomy of Cognitive Agents“ (supervised by Prof. Alvaro Moreno) from the University of the Basque Country . He is currently a post-doctoral researcher in the ICEA project (Integrating Cognition, Emotion, and Autonomy) at the Autonomous Systems Lab, School of Industrial Engineering, Polytechnical University of Madrid.*

### **Evolutionary Robotics as a Tool for Evolutionary Epistemology**

**Evolutionäre Robotik als Werkzeug für Evolutionäre Erkenntnistheorie**

Evolutionary Epistemology conceives cognition as resulting from a process of natural selection. However, some current issues on cognitive and biological sciences might be said to challenge traditional conceptions of evolutionary theory with important consequences for Evolutionary Epistemology: a) The integration of development and learning with evolutionary theory, b) the integration of the interactive and embodied dimension of behaviour and the dissolution of a strong system-environment dichotomy and c) the critique of externalist and historical selective accounts of normative functionality from the perspective of autonomous systems. The central hypothesis is that cognitive or epistemic processes involve the mediation of a developmentally open neurodynamic organization of behaviour that needs to satisfy interactive conditions for its own organizational stability.

In order to explore the consequences of this hypothesis for evolutionary epistemology, I propose the use of an Evolutionary Robotic model that integrates evolutionary, developmental and interactive aspects in the same computational process and permits to gain theoretical and conceptual insights for Evolutionary Epistemology.



**Prof. Dr. William BECHTEL**  
(August 2008)

*William Bechtel is Professor of Philosophy in the Department of Philosophy and a faculty member in the interdisciplinary programs in Science Studies and Cognitive Science at the University of California, San Diego.*

*His research explores issues in the philosophy of the life sciences, including cell biology, biochemistry, neuroscience, and cognitive science. In recent work, he characterized mechanistic accounts that draw upon resources of dynamical systems theory to explain the temporal orchestration of operations within a mechanism as dynamic mechanistic explanations. A second focus of his research is how scientists discover and reason about mechanisms. He has also been engaged in an examination of the development of cognitive science, neuroscience, and cognitive neuroscience in the 20th century.*

*William Bechtel is currently Chair of the Cognitive Science Society and Editor of the journal Philosophical Psychology, and past president of the Society for Philosophy and Psychology, the Southern Society for Philosophy and Psychology, the Society for Machines and Mentality, and the Central States Philosophical Association.*

### **Oscillations and Synchrony in Active Biological Mechanisms** **Oszillation und Synchronisierung biologischer Mechanismen**

The view that explanation in many fields of biology involves identifying and describing the operation of the mechanism responsible for a given phenomena has gained considerable currency in the last two decades. But most accounts of mechanism, including those I have advanced, do not do justice to the phenomena of biology insofar as they construe mechanisms as reactive systems, not self-maintaining, active systems. Correcting this shortcoming requires focusing far more than has commonly been the case on the nature of organization in biological systems. Such systems are dissipative structures far from thermodynamic equilibrium, and to maintain themselves as such they must recruit matter and energy from their environment and direct its use in building and repairing the system itself. As one moves beyond the simplest conceptions of such systems, such as Gánti's chemoton, to more realistic models of organisms with multiple mechanisms responsible for providing different resources to the system, achieving control over different operations is critical. Control is often viewed as imposing regulation top-down on otherwise functioning components, but a feature of the complex dynamics of biological mechanisms often provides a more integrated mode of control. Non-linear interactions of components often give rise to oscillations within biological mechanisms and the ability to synchronize these with each other and with external fac-

tors allows for sophisticated control of the mechanisms themselves. I am focusing most of my investigation on circadian oscillations. Even in cyanobacteria an oscillatory system with a near 24-hour period allows competing operations—e.g., photosynthesis and nitrogen fixation—to proceed without interfering with each other. In other organisms the circadian oscillator takes advantage of the differentiation between components of the organisms. In single-celled eukaryotic cells the circadian oscillator involves the synthesis of proteins in the cytoplasm which in turn inhibit the transcription of their own genes in the nucleus. In animals, such as *Drosophila* and mammals, multiple oscillators occur which are synchronized with each other in a complex fashion. This distribution of operations over components of the organism with still significant conservation of key components of the mechanism provides a vehicle for understanding how synchronized oscillation provides a means of controlling active biological mechanisms. As a further comparison of this example, I am also exploring research on a number of other ultradian oscillators, such as oscillations in mitochondrial function, oscillations in cAMP in *Dictyostelium*, and neuronal oscillations.

**Dr. Wayne CHRISTENSEN**  
(September - October 2008)

*Wayne Christensen is at the MACCS cognitive science centre at Macquarie University, Australia. From 2002-4 he was a Fellow at the KLI. His research interests include the evolution of cognition, executive control, skills, and memory.*



### **Model-based representation as the basis for the emergence of representationally mediated flexibility in the evolution of cognition**

**Modellierung von Repräsentation zur Erklärung der Evolution von Kognition**

Most work on the evolution of cognition assumes that cognition is a representational form of information processing that arises in circumstances in which there is selection for behavioral flexibility. It is common in empirical research to define cognition operationally in terms of behavior that cannot be accounted for by associative learning. However there is no consensus on the nature of the representational information processing that marks the emergence of cognition, nor is there any clarity on how it might enable enhanced behavioral flexibility. This a crucial gap that needs to be filled: research on animal cognition and its evolution is diverse and productive, but it sorely lacks a theoretical framework that poses core issues in a systematic way.

Empirical research is fragmented across many fields that use a



diverse range of concepts for characterizing cognition. Two areas of research are especially promising: work on the hippocampus and its role in spatial cognition (Jacobs 2003) and declarative memory (Eichenbaum 2000, 2004), and work on the neural mechanisms subserving goal-directed behavior (Yin and Knowlton 2006). This research casts light on the fundamental mechanisms of representational flexibility and their neural substrate. However its nature and significance are not widely appreciated in animal cognition research generally, and there is currently no theoretical analysis that develops appropriately generalized concepts that could serve as a synthetic framework for the diverse areas of research in the evolution of cognition.

The main objective of this project is to develop just such a theoretical analysis. It will elaborate a concept of model-based representation and show that it is an appropriate focus for understanding the emergence of representationally mediated behavior control. Model-based representation can be regarded as a generalization of Tolman's 'cognitive map' concept. The analysis will outline the nature of model-based representation, show some of the kinds of flexibility that it provides, and characterize computational mechanisms likely to be involved in the formation of representational models. Some steps will be taken towards showing that this concept can serve as a framework for integrating a diverse range of findings on animal cognition; in addition to the research mentioned above, it will address research on animal conceptual abilities, and work on behavioral innovation and problem solving.



**Dr. Andrea LOETTGER**  
(June - August 2008)

*Andrea Loettgers is a postdoctoral fellow in history at the California Institute of Technology with an focus on historical, methodological, and epistemological aspects of the development of scientific instruments, and development and application of computer simulations in modern physics.*

### **Synthetic Models in the Exploration of Gene Regulatory Mechanisms**

#### **Modelle zur Erforschung von genetischen Regulationsmechanismen**

The aim of the project is to examine the configuration of synthetic biology. A special focus will be put on the modeling approach of this field. Synthetic biologists take an engineering approach in exploring design principles of genetic networks. One of the main questions studied in the project is how this specific approach is relates to model organisms and mathematical models. This ques-

tions is examined by investigating the special case of the circadian clock. First results have shown that a crucial conceptual point in the engineering of genetic networks is the justification and evaluation of the assumptions made in the design of the genetic networks. The assumptions underlying the engineering of genetic networks are based on a particular understanding of how biological systems are organized. In case of synthetic biology, the understanding of the organization of biological systems has two main components: Biological functions arise from the interactions between components. Biological systems have a modular organization. This specific understanding of biological systems has its roots outside of biology in fields such as physics and engineering. Related to this specific understanding of the organization of biological systems are concepts from engineering and physics, such as cooperativity, feedback loops, noise, and robustness. These concepts have not entered biology with synthetic biology but have been used before in mathematical models and the interpretation of results gained in experiments on/with model organisms. In both cases one finds discussions concerning the appropriateness of these concepts in the description of biological systems. Does synthetic biology provide by reconstructing genetic networks a way of evaluating the specific understanding of how biological systems are organized and the concepts used in the modeling approach? During the three months at the Konrad Lorentz Institute I would like to investigate the mathematical modeling of the synchronization of circadian clocks. A special focus will be on the work of the theoretical biologist Arthur Winfree. The results of this research will be important for a deeper understanding about what kind of developments and motivations led to the development of synthetic biology.

### **Laura NUÑO DE LA ROSA GARCÍA**

(September - December 2008)

*Laura Nuño de la Rosa is a PhD student in philosophy of biology at the University Complutense of Madrid and the IHPST (University Paris 1). Her thesis deals with the concept of form in contemporary biology, especially in EvoDevo.*



### **The problem of form in molecular biology, developmental biology, and evodevo**

**Das Problem der Form in der molekularen Biologie, Entwicklungsbiologie und EvoDevo**

In my PhD thesis project I investigate from a philosophical point of view the concept of form in contemporary biology. Within this framework, during my three months stay in the KLI my goal is to discuss and elaborate the chapters of my thesis dedicated to the





issue of Form in three biological areas: molecular biology, developmental biology and evolutionary developmental biology:

The Nature of Form: a) The nature of individual forms: static and dynamical forms, Pattern and Process; b) The nature of the morphospace: sequence-morphologies asymmetry, macromolecular and taxonomical types; c) Morphological wholes and morphological parts: modularity and homology.

The Generation of Form: a) The generation of individual forms: macromolecular folding and epigenetic systems; b) The generation of taxonomical forms: evolutionary questions: developmental constraints, variability, evolvability, novelty, discrete change.



Dr. Peter J. TAYLOR  
(October 2008)

*Peter Taylor directs two Programs at the University of Massachusetts Boston: Critical & Creative Thinking; and Science, Technology & Values; and organizes the New England Workshop on Science and Social Change. His work is most clearly affiliated with the interdisciplinary area of Science and Technology Studies (STS), contributing to and connecting the disciplines of history, philosophy, and social/cultural studies of science, but it also maintains a close engagement with the life and environmental sciences themselves. Building on his early formation in the sciences and in political-environmental activism of the 1970s, he tries to frame STS interpretations of science in ways that can inform the current and future practices of researchers. „Unruly Complexity: Ecology, Interpretation, Engagement“ (U. of Chicago Press, 2005) synthesizes 20 years work examining the complexity of „intersecting processes“ that cut across scales, involve heterogeneous components, and develop over time. Prof. Taylor is now taking these interests in new directions through engagement with various social epidemiological approaches that address the intersections of environment, health, and development. Recent publications (including three in „Biological Theory“) raise new challenges to standard accounts of the relative size of genetic and environmental influences in human traits as well as to critiques of these accounts.*

### Control and analysis of human variation

#### Kontrolle und Analyse von Variation

The proposed research begins from a simple observation about two foundational developments of modern biology. The theories of evolution by natural selection and the genetic basis of heredity were built from language, arguments, evidence, and practices of controlled breeding in agriculture and the laboratory. What does it

mean that understandings of the origins over time in the diversity of forms of life were formed in a crucible of human control of biological materials? Taking the control of complexity as an entry point, I have been examining life scientists' conceptual and practical engagement with varied scientific and social projects that, broadly speaking, attempt to control human variation and to discipline the complexities of change. The research and collegial interaction proposed for the KLI visit focuses on two extended episodes:

1. The mid-twentieth century transfer of methods of analysis of heredity and variation from agricultural and laboratory breeding into human behavioral genetics, and from there into the persistent, heated debates around genes, environment, and IQ.
2. The shift of research on the genetics of complex traits from the partitioning of variation into "genetic" and "environmental" fractions to identification of DNA variants associated with risk for diseases or behaviors, a shift accelerating with the advent of Genome-Wide Association studies that hit the headlines last year.

**Dr. Denis WALSH**

(October 2008)

*Denis Walsh is Canada Research Chair in the Philosophy of Biology. He is a member of the Department of Philosophy, Institute for the History and Philosophy of Science and Technology, and the Department of Ecology and Evolutionary Biology at the University of Toronto. He did his PhD in biology at McGill University on the systematics of amphibians and his PhD in Philosophy at Kings College London on modal logic and modal metaphysics. He is currently doing research on the modes of explanation in evolutionary biology.*

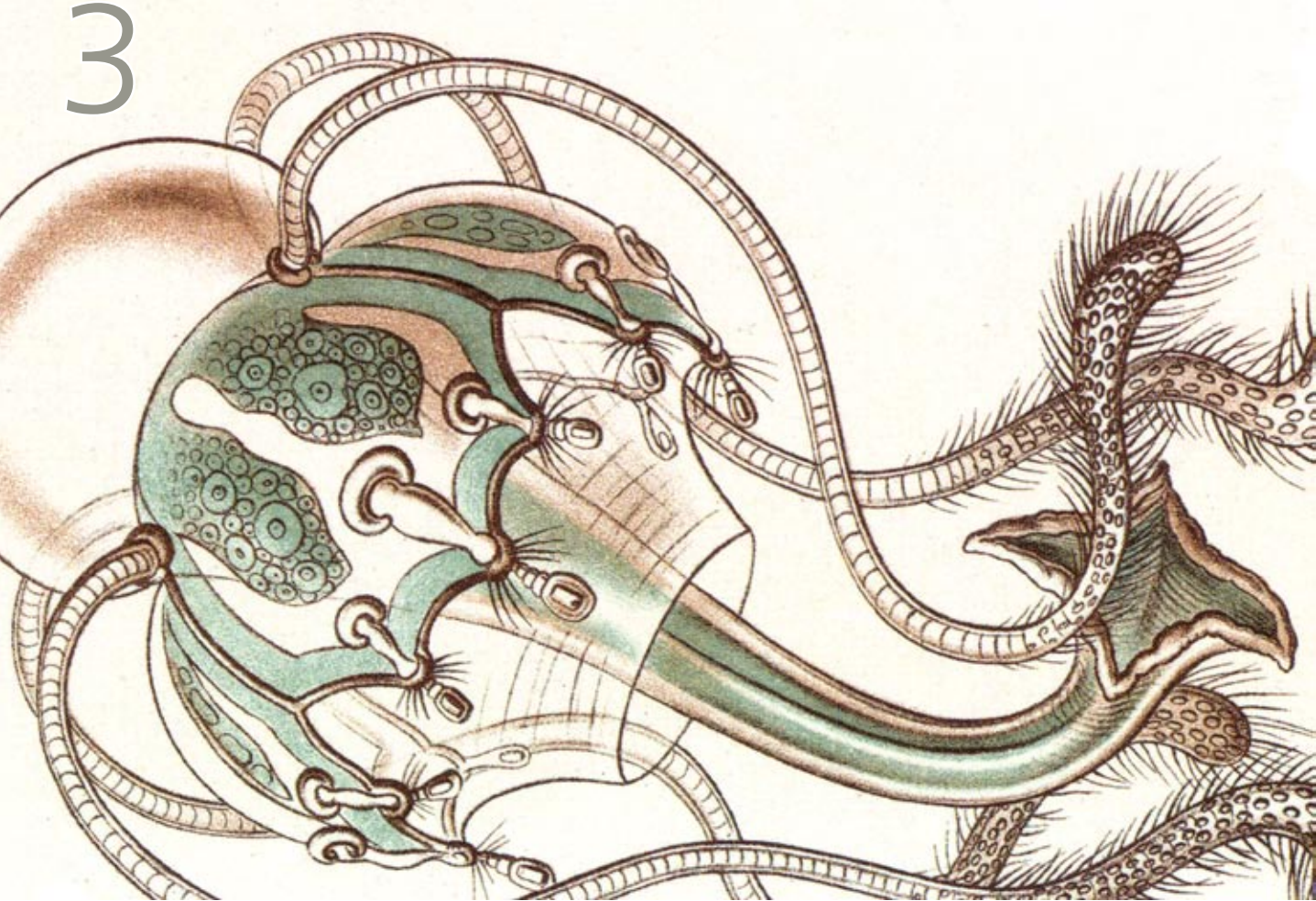
### **Fitness, Probability and Causation**

**Fitness, Wahrscheinlichkeit und Kausalität**

This is a defence of the statistical interpretation of fitness. I distinguish three interpretations of the evolutionary explanations in which fitness figures: the Two Factor Model, The Single Factor Model and the Statistical Interpretation. They differ in their degrees of causal commitment. The first two are committed to fitness distribution being a cause of population change. The last maintains that fitness distribution correlates with population change, but does not cause it. The defence of the statistical interpretation relies upon a distinctive feature of fitness - that fitness is a function of the mean and variance of reproductive output and population size--and a distinctive feature of causation - that it conforms to the Sure Thing Principle.

## Wissenschaftliche Veranstaltungen Meetings and Lectures

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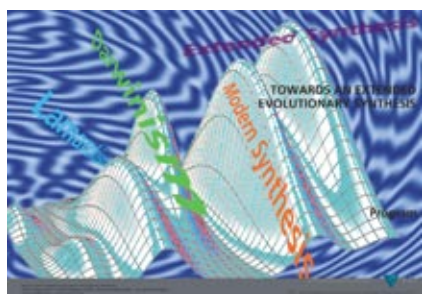


*Das KLI fördert internationale Work-  
shops, Symposien, Vortragsreihen und  
Einzelvorträge, die entweder vom KLI  
organisiert werden oder in Kooperation  
mit anderen Institutionen stattfinden.*

### 3.1 Altenberg Workshops in Theoretical Biology

Die „Altenberg Workshops“ befassen sich jeweils mit einer Schlüsselfrage der biologischen Theorie. Jeder Workshop wird von führenden Fachleuten auf dem jeweiligen Gebiet organisiert, die eine Gruppe internationaler Experten als Teilnehmer einladen. Die daraus resultierenden Bücher werden von MIT Press im Rahmen der „Vienna Series in Theoretical Biology“ herausgegeben. Die Altenberg Workshops haben das Ziel, konzeptionelle Fortschritte und Forschungs-Initiativen mit deutlich interdisziplinärem Charakter zu generieren. Weitere Informationen zu den Teilnehmern und ihren Vorträgen stehen auf der KLI Website zur Verfügung.

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#### 18th Altenberg Workshop in Theoretical Biology 10-13 July 2008

##### Toward an Extended Evolutionary Synthesis

Organization: Massimo Pigliucci (State University of New York, NY, USA)  
and Gerd B. Müller (University of Vienna, Austria)

#### The topic

More than 60 years have passed since the conceptual integration of several strands of evolutionary theory into what has come to be called the Modern Synthesis. Despite major advances since, in all methodological and disciplinary domains of biology, the Modern Synthesis framework has remained surprisingly static and is still regarded as the standard theoretical paradigm of evolutionary biology. But for some time now there have been calls for an expansion of the Synthesis framework through the integration of more recent achievements in evolutionary theory.

The challenge for the present workshop is clear: How do we make sense, conceptually, of the astounding advances in biology since the 1940s, when the Modern Synthesis was taking shape? Not only have we witnessed the molecular revolution, from the discovery of the structure of DNA to the genomic era, we are also grappling with the increasing feeling – as reflected, for example, by the proliferation of “-omics” (proteomics, metabolomics, “interactomics,” and even “phenomics”) – that we just don’t have the theoretical and analytical tools necessary to make sense of the bewildering diversity and complexity of living organisms.

By contrast, in organismal biology, a number of new approaches have opened up new theoretical horizons, with new possibilities for integration and expansion in evolutionary theory, such as EvoDevo, Niche Construction, Epigenetic Inheritance, and many more.





30 JOHN BEATTY

Department of Philosophy, University of British Columbia, Vancouver, Canada

**Chance, History, and Natural Selection**

WERNER CALLEBAUT

Konrad Lorenz Institute for Evolution and Cognition Research, Altenberg, Austria, and Hasselt University, Belgium

**Properties and Scope of an Extended Synthesis**

SERGEY GAVRILETS

Department of Ecology and Evolutionary Biology, University of Tennessee, Knoxville, TN, USA

**High-Dimensional Fitness Landscapes**

EVA JABLONKA

Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Tel Aviv, Israel

**The Epigenetic Turn: The Challenge of Soft Inheritance**

DAVID JABLONSKI

Department of Geophysical Sciences, University of Chicago, Chicago, IL, USA

**Patterns and Processes in Macroevolution**

MARC KIRSCHNER

Department of Systems Biology, Harvard Medical School, Boston, MA, USA

**Facilitated Variation**

ALAN C. LOVE

Department of Philosophy, University of Minnesota, Minneapolis, MN, USA

**The Structure of Evolutionary Theory and Biological Knowledge: Epistemic Materials for a 21st Century Synthesis**

GERD B. MÜLLER

Department of Theoretical Biology, University of Vienna, Austria

**Epigenetic Innovation Theory**

STUART A. NEWMAN

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

**Dynamical Patterning Modules: A "Pattern Language" for Development and Evolution of Metazoan Form**

JOHN ODLING-SMEE

Institute of Social and Cultural Anthropology, Oxford University, Oxford, UK

**Niche Construction and Niche Inheritance**

MASSIMO PIGLIUCCI

Department of Ecology and Evolution, State University of New York, Stony Brook, NY, USA

**Phenotypic Plasticity as Causal Factor in Evolution**



MICHAEL PURUGGANAN

Department of Genomics and Systems Biology, New York University, New York, NY, USA

**Epistasis, Selection, and the Evolutionary Synthesis in the Age of Genomics**

EÖRS SZATHMÁRY

Collegium Budapest, Budapest, Hungary and The Parmenides Foundation, Munich, Germany

**Evolution by Natural Selection in the Brain**

GÜNTER P. WAGNER

Department of Ecology and Evolutionary Biology, Yale University, New Haven, CT, USA

**Modularity, Evolvability, and the Evolution of Genetic Architecture**

DAVID SLOAN WILSON

Departments of Biology and Anthropology, Binghamton University, Binghamton, NY, USA

**Multilevel Selection, Major Transitions, and Human Evolution**

GREGORY WRAY

IGSP Center for Evolutionary Genomics, Duke University, Durham, NC, USA

**Gene Regulatory Networks and Natural Selection**



## 19th Altenberg Workshop in Theoretical Biology 11-14 September 2008

### Measuring Biology: Quantitative Methods: Past and Future

Organization: Fred L. Bookstein (University of Washington, Seattle, WA, USA)  
and Katrin Schaefer (University of Vienna, Austria)

#### The topic

Just fifty years ago the historian of science Harry Woolf edited the slim volume *Quantification: A History of the Meaning of Measurement in the Natural and Social Sciences* in which Thomas Kuhn first sketched his approach to the centrality of quantitative anomalies in the progress of science. Just a few years later there appeared Wigner's wonderful phrase about the „unreasonable effectiveness of mathematics in the natural sciences.“ Here in 2008, our understanding of science as a social system has been utterly transformed, and yet the role of numbers themselves has not come under much sustained scrutiny.

So this KLI workshop comes at a propitious time in a propitious locale. If science studies are relatively silent on quantification, the rest of us can speak as practitioner-scholars. At the same time, the explosion of biological information resources, more sudden than the corresponding transition in any other field, has made the search for a re-foundation of quantitative methods most compelling just where it overlaps with our own cognitive



- 32 limitations. Biological information resources are expanding at an enormous rate, but likewise the data density of the scientist's tools of exposition. The quantitative load of our presentations thus grows at least as fast as our data resources themselves. All this is overdue for serious interdisciplinary study; hence this workshop.

FRED L. BOOKSTEIN

Department of Statistics, Washington University, and  
Department of Anthropology, University of Vienna, Austria

**Measurement, Explanation, and Biology: Lessons from a Long Century**

CLIVE E. BOWMAN

GlaxoSmithKline R&D, London, and  
School of Biological Sciences, University of Reading, United Kingdom

**Megavariable Genetics: What You Find is What You Go Looking For**

GYÖRGY DARVAS

Symmetrion, and  
Institute for Research Organisation of the Hungarian Academy of Sciences, Hungary

**The Unreasonable Effectiveness of Symmetry in the Sciences**

RODRIGO J. DE MARCO

Freie Universität Berlin, Institut für Biologie – Neurologie, Germany  
**A Suitable Foundation for Theories Dealing with Biological Systems**

RICHARD GORDON

Department of Radiology, University of Manitoba, USA  
**Building Quantitative Understanding of an Embryo as it builds Itself**

BENEDIKT HALLGRIMSSON

Department of Cell Biology and Anatomy, University of Calgary, Canada  
**Measurement, Morphology and Mechanism: Why Developmental Biology Needs Morphometrics**

HARALD MARTENS

Centre for Integrative Genetics, Norwegian University of Life Sciences, and University of Copenhagen, Denmark  
**Bio-Chemometrics: Finding Dynamics and Harmonics in the Cacophony of Data from Molecular Biology**

MAGNI MARTENS

Matforsk AS-Nofima Food, Norway, and  
University of Copenhagen, Faculty of Life Sciences, Denmark  
**Human Senses in Action: Multivariate Measurements of Quality**

DEIRDRE McCLOSKEY

University of Illinois at Chicago, USA  
**The Unreasonable Ineffectiveness of Fisherian Statistical Methods in Biology and Especially Medicine**

PHILIPP MITTERÖCKER

Konrad Lorenz Institute for Evolution and Cognition Research, Austria

**The Concept of Morphospaces in Evolutionary and Developmental Biology**

RAFAEL NÚÑEZ

Department of Cognitive Science, University of California, San Diego, USA

**Numbers and Quantification: Where do They Come From?**

CHARLES OXNARD

Anatomy and Human Biology, University of Western Australia, and  
York Hull Medical School, United Kingdom

**Biology Certainly Needs Morphometrics: Does Morphometrics Need Biology?**

KATRIN SCHAEFER

Department of Anthropology, University of Vienna, Austria

**Psychomorphospace—From Biology to Perception, and Back: Towards an Integrated Quantification of Facial Form and Function**



**20th Altenberg Workshop in Theoretical Biology  
18-21 September 2008**

**Origins of Evo-Devo:  
A Tribute to Pere Alberch**

*Organization: Gerd Müller (University of Vienna and KLI)  
and Diego Rasskin-Gutman (University of Valencia, Spain)*

**The topic**

Pere Alberch has been one of the most gifted and inspirational figures in developmental and evolutionary biology. In particular, he had been one of the founding proponents of the research endeavor that has come to be known as EvoDevo, the study of how the processes of individual development interact with the processes that cause evolutionary change. Whereas much of today's EvoDevo is focused on developmental genetics, the field had been triggered by the desire to understand the evolution of organismal phenotypes, a topic much sidelined by the Modern Synthesis framework of evolutionary theory.

Pere's main interest was the generation and transformation of animal form. The depth and breadth of his integrative approach was such that he was willing to transcend the purely scientific enquiry by bridging the world of biological objects with the way artists create new worlds. This workshop is an occasion to celebrate Pere's life and work by bringing together those who had the occasion to work with him as well as those who have been inspired by his intellectual legacy. Thus, this workshop is a second occasion to honor Pere, after the first meeting that was hosted at the Institute Cavanilles for Biodiversity and Evolution, where Pere was going to continue his research activities, a plan



34 that had reached an advanced stage when he tragically passed away in 1998.

We have divided this workshop into four sessions in a rather idiosyncratic way: no manner of reductionism can be imposed on the scientific legacy of such an exuberant mind!

The session on ORIGINS highlights Pere's influence on the nascent field of EvoDevo, from historical and conceptual perspectives, and its evolution from the pre-HOX times to today's understanding of the links between development and evolution. The session on EXPERIMENTS commemorates Pere's work on amphibian life histories and limb development, some of the finest examples of early morphological EvoDevo that inspired a whole generation of subsequent researchers. Pere's theoretical insights will be discussed in session three, INTERNALISM, a title that characterizes his strong opinion that internal causes are fundamental for any understanding of evolutionary dynamics, because of the constraints imposed by the developmental programs of organismal lineages. The final session, CONNECTIONS, shall build bridges with the future, exploring the ways in which the legacy of Pere's work connects with today's research in the biosciences. Theoretical biology, genomics, and stem cell research will be discussed before the final lecture will bring back glimpses of the atmosphere in those Harvard days.

GERD B. MÜLLER

Department of Theoretical Biology, University of Vienna

**Origins and Diversification of EvoDevo**

JOHN O. REISS

Department of Biological Sciences, Humboldt State University

**Origins of EvoDevo: Gould and Alberch, Raff and Kauffman**

LAURA NUÑO DE LA ROSA

Universidad Complutense de Madrid and IHPST Paris 1-Sorbonne

**Patterns, Processes and Mechanisms in the Early Stages of EvoDevo**

RICHARD HINCHLIFFE

Biological Sciences, Aberystwyth University

**Making Very Long Larval Limbs: Heterochronic Modulation of Skeletogenesis in the Pelagic Larvae of the Southern Crested Newt, *Triturus karelinii***

CHARLES W. ARCHER

School of Biosciences, Cardiff University

**Evolution of Synovial Joints**

ANN CAMPBELL BURKE

Department of Biology, Wesleyan University

**Journey to the Lateral Somitic Frontier**

CHRISTOPHER S. ROSE

Department of Biology, James Madison University

**Pere Alberch, the Internalist Viewpoint of Morphological Evolution and Amphibian Metamorphosis**

MIQUEL DE RENZI

Cavanilles Institut of Biodiversity and Evolutionary Biology, Universitat de València

**Development and Palaeobiology: A Fruitful Feedback**

ARANTZA ETXEBERRIA

Department of Logic and Philosophy of Science, Universidad del Pais Vasco

**A World of Opportunity Within Constraint: Pere Alberch's Early EvoDevo**

DIEGO RASSKIN-GUTMAN

Cavanilles Institut of Biodiversity and Evolutionary Biology, Universitat de València

**What's the (New) Story with Heterochrony and Developmental Constraints?**

HERNÁN DOPAZO

Bioinformatics and Genomics Department. Centro de Investigación Príncipe Felipe

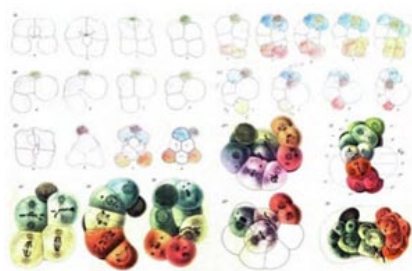
**Adaptation at the Genome Scale: A Gene or a Function Centered Concept?**

EMILY GALE

Medical Research Council, London

**"Show me the gene for remorse." (Pere Alberch)**

### 3.2 Symposien Symposia organized or co-organized by the KLI



**Workshop at the Max Planck Institute for the History of Science, Berlin**  
**11-15 June 2008**

**Cultures of Seeing 3D and Beyond**

*Organization: Sabine Brauckmann (Science Center, Tartu, Estonia), Denis Thieffry (INSERM, Marseille, France), Christina Brandt (MPI for the History of Science, Berlin, Germany), and Gerd Müller (KLI)*

#### The topic

Following a workshop recently held in Naples in May 2007 (cf. Brauckmann & Thieffry, *BioEssays* 29 (2007): 1059-61), this second meeting will focus on elaborated analyses of how the life sciences visualize and represent their objects of study. The imagery produced by current experimental or in silico research will be contrasted to former observational studies depicting organisms, embryos, cells, genetic factors, and molecules from around 1800 to the 21st century. We will address the issue how biological scientists mastered to manifest the dimensionalities living organisms exhibit when taking shape. To fully trace the (epistemic) steps of representing 3D specimen, the scientists will offer detailed information about their techniques, tricks and tools to visualize genes, cells, embryos and species, using images of distinct scales and dimensions. Besides clarifying the pro-





36 cess of image construction, they will explicate what their images reveal, what is filtered out, and if so, why. Scholars will supply these information with historical case studies on the changing practices of visualization, encompassing the specificity of different biological disciplines, specific techniques, model organisms and styles of communication. Their task will be to delineate an epistemic archeology of spatial forms which occur naturally beyond the range of unaided vision, e.g., rotating embryos, differentiating cells and their components, the fine structure of organisms, or yet the branching of species in models of evolution.

The progressive development of fate maps from the 1850s onwards provides an interesting example of biologists' visual practices. Fate maps were developed to enable the projection of developmental specifications onto static embryonic images. These maps were part of a dynamic learning process, relying on the coordination of attentively watching eyes with hands drawing and moulding wax models. Furthermore, we will follow the apparition and change of meaning of graphical symbols, either depending on different theoretical perspectives, or simply enforced by technical constraints. For example, arrows are used to represent displacement or dimensional modification to translate Baer's observation how a two-dimensional plate coils to three-dimensional tubes. Similarly, the development of three dimensional organs such as drosophila wings and legs are projected onto two-dimensional cell tissues (imaginal discs). From a historical perspective, getting from 2D to 3D has been an enormous problem, and still is, even if developmental biologists now claim to have arrived at the 5th dimension by combining a 3-dimensional exploration across time with the characterization of gene expression patterns. Dimensionality treatment also appears to vary widely among the biological disciplines.

The recent development of systems biology revives the issue of the representation of complex, heterogeneous and dynamic data sets graphically, using 2D or 3D graph-based representations. As hinted during the Naples workshops, these abstract representations (once properly formalized) can be used as powerful computational models to address sophisticated biological questions (e.g. regarding the number, stability and robustness of cell differentiation pathways).

Finally, all these questions bearing to the spatial and temporal deployment of individual organisms can be transposed to population and evolutionary levels. In this respect, we want to portray the corresponding specific styles of visualization and clarify the modes of mapping mental images or concepts to material models.

The following issues were discussed:

- Does biological imagery show unique features when compared to other natural sciences?
- How did shifts in the conception of cells or genes relate to different styles of imaging?
- To what extent have imaging techniques themselves influenced, directed and modulated scientific observation and data analyses?
- What is needed to redraw, reproduce a picture? Mere analogical rendering will not let us redraw, or fabricate the image we have just observed.
- What is the feeling, or idea to be inside a cell-space, or inside a molecular space?
- What and how visual representations are utilized for scientific lectures, public talks, scientific articles, textbooks, mass media publications?

The workshop fulfills two main purposes, (1) it reconstructs some chapters of the visual biography of genes, cells, and embryos in the life sciences and related specialties (e.g., architecture), and (2) it traces the influence of specific issues, like dimensionality, scale and pattern on biological imagery from around 1800 to the 21st century.

RICHARD M. BURIAN

(Philosophy Department, Virginia Tech, Blacksburg, VA, USA):

**The Dimensional Difference between (Biological) Information and (Systems of) Heredity**

SEMA K. SGAIER

(Harvard Medical School, Boston, MA, USA) :

**Imaging Fate: Tracking Cell Migration in the Developing Embryo**

NORBERTO SERPENTE

(The Wellcome Trust Centre for the History of Medicine at UCL, London, UK):

**Visualising the Invisible in Cell Biology (1970-2000)**

CLAUDIO D. STERN

(Department of Anatomy & Developmental Biology, University College London, London, UK):

**The Dimensions of Gastrulation**

IVAR PUURA

(Department of Geology & Paleontology, University of Tartu, Estonia):

**Spaces and Patterns of Geology**

NANCY ANDERSON

(Department of Visual Studies, University at Buffalo, Buffalo, NY, USA):

**Conrad H. Waddington, or the Organic Form of Pattern and Rhythm**

SILVIA CAIANIELLO

(Max Planck Institute for the History of Science, Berlin, Germany):

**Adaptive vs Epigenetic Landscape. A Visual Chapter in the History of EvoDevo**

PATRICK LEMAIRE

(IBDML - UMR CNRS 6216, Université de la Méditerranée, Marseille, France):

**The Assemblage of the Virtual Ascidian Embryo**

JUDY JOHNS SCHLOEGEL

(Clarendon Hills, IL, USA):

**Progressive Scales of Magnification: Herbert Spencer Jennings' Studies of Cell Lineages**

SORAYA DE CHADAREVIAN

(Center for Society and Genetics, University of California at Los Angeles, Los Angeles, CA, USA):

**Chromosome Banding: From Measuring to Pattern Recognition**

ARIANE DRÖSCHER

(Dipartimento di Biologia evoluzionistica sperimentale, Università degli Studi di Bologna, Bologna, Italy):

**Cellular Dimensions and Cell Dynamics, or How to Capture Time and Space in the Era of Electron Microscopy**

MARIA STRECHT ALMEIDA



- 38 (Instituto de Ciências Biomédicas Abel Salazar. Universidade do Porto, Porto, Portugal):  
**Ways of Looking at Aging Cells: Visualization of Erythrocytes, their Damage and Fate since the 1950s**

ERNA FIORENTINI

(Max Planck Institute for the History of Science, Berlin, Germany):

**Placing Oneself at an Adequate Point of View". Santiago Ramón y Cajal on Microscopic Vision and Drawing**

BRIAN METSCHER

(Department of Theoretical Biology, University of Vienna, Vienna, Austria):

**In Three Small Dimensions: X-Ray Microtomography as a Way of Seeing**

LAURA FLANNERY

(Center for Teaching and Learning, St. John's University, Queens, NY, USA):

**A New Technique for Analyzing Cell Dynamics in Plant Tissue**

MAIT METSPALU

(Estonian BioCentre, Tartu, Estonia):

**Tracing the mtDNA Trail**

MARIANNE KLEMUN

(Institute for History, University of Vienna, Vienna, Austria):

**Refined Concentration of Botanical Expert Knowledge. From the Herbarium to the Engraving via Tracing**

THOMAS BRANDSTETTER

(Institute for Philosophy, University of Vienna, Vienna, Austria):

**Embryos and Empathy: The Model Experiments of Wilhelm His**

MATTHIAS BRUHN

(Hermann von Helmholtz-Zentrum für Kulturtechnik, Humboldt Universität zu Berlin, Berlin, Germany):

**The Cell - A Technical Image: Views, Perspectives, Incisions and Notches**

SILVER RATTASEPP

(Institute of Semiotics, University of Tartu, Tartu, Estonia):

**The Perception of Biographs: On Icons and Images of the Life Sciences**

RISTE KESKPAIK

(Institute of Semiotics, University of Tartu, Tartu, Estonia) :

**The Challenge of Biosemiotics**

JANINA WELLMANN

(The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel):

**The Developmental Series: Christian Pander's and Karl Ernst von Baer's Images of Embryogenesis**

MARION VORMS

(IHPST, Université Paris 1, Paris, France):

**From Mendel's Laws to Molecular Genetics: The Format and Visual Representation**

LAURA PERINI and CHERYL KERFELD

(Department of Philosophy, Pomona College, Pomona, CA, USA):

**Genome Sequence Databases and Ortholog Neighborhood Figures**

TIMOTHY HERMAN

(Center for BioMolecular Modeling, Milwaukee School of Engineering, Milwaukee, WI, USA):

**Contemplating the Invisible: Using Physical Models to make the Molecular World real.**

SHELLEY WALL

(Institute of Medical Science, University of Toronto, Toronto, ON, Canada):

**Difference Engines: Using Flash Programming to Visualize the Hormone Cascade**

CAITLIN BERRIGAN

(Visual Arts Program, MIT, Cambridge, MA, USA):

**Improvising Glycoproteins: A Case Study in Artistic Virology**



**Symposium anlässlich des 70. Geburtstags von  
Erhard Oeser  
21. Juni 2008**

**Homo Universalis: Erhard Oesers wissenschaftliches  
Weltbild in Präsentationen von Weggefährten und  
Kollegen**

Vortragende:

FRANZ M. WUKETITS

(Universität Wien, Institut für Wissenschaftstheorie und KLI)

HANS-DIETER KLEIN

(Universität Wien, Institut für Philosophie)

WERNER GABRIEL

(Universität Wien, Institut für Philosophie)

WERNER LEINFELLNER

(University of Nebraska, Lincoln, USA und Universität Graz)



- 40 MANFRED WIMMER  
(BG Waidhofen a.d. Thaya und KLI)
- MARIA WUKETITS  
(Verein Bunte Demokratie für Alle, Wien)
- STEPHAN HALTMAYER  
(Universität Wien, Institut für Philosophie)

**First European Graduate Meeting in the Philosophy of the Life Sciences  
2-6 September 2008, Gorino Sullam, Italy**

Organization:  
*EGenIS ESRC Centre for Genomics in Society, University of Exeter,*  
*IHPST Institut d'Histoire et de Philosophie des Sciences et des Techniques, Paris I Sorbonne,*  
*MPIWG Max-Planck-Institut für Wissenschaftsgeschichte, Berlin,*  
*SEMM Scuola Europea di Medicina Molecolare, Milano, and*  
*KLI*

Themen und Vortragende:

**Systems Biology**

Giovanni Boniolo SEMM  
Pierre-Alain Braillard IHPST  
Sabina Leonelli EGenIS  
Alex Powell EGenIS  
Frederico Vanci SEMM  
Vincent Ramillon MPIWG

**Postgenomics**

Silvia Camporesi SEMM  
Margaret Curnutte SEMM  
Paolo Maugeri and Aleksandra Sojic SEMM  
Bartolomiej Swiatczak SEMM  
Giuseppe Testa SEMM  
Frédérique Théry IHPST

**Cultural Evolution**

Werner Callebaut KLI  
Hugo Viciani IHPST  
Joeri Witteveen KLI  
Sandra Pravica MPIWG and IHPST

**Heredity**

Maria Kronfeldner MPIWG  
Francesca Merlin ISHPST  
Robert Meunier SEMM  
Staffan Müller-Wille EGENIS  
Christian Reiss MPIWG  
Matthias Grote MPIWG

**Origins and Evolution**

Phillipe Hunemann IHPST  
Matteo Mossio IHPST  
Dan Nicholson EGENIS  
Maureen O'Malley EGENIS  
Davide Vecchi KLI





**Vienna Conference on Consciousness 2008**  
**26 September 2008**

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*Organization: Center for Organismal Systems Biology - Faculty of Life Sciences, KLI, Ludwig Boltzmann Institute for Urban Ethology, Institute Vienna Circle, Konrad Lorenz Research Station, Wissenschaftsförderung der Stadt Wien*

DANIEL C. DENNETT

(Tufts University, Medford, MA, USA):

**Does One Part of our Brain not Control Others? - How Can You Deal with Modularity if You are a Monist?**

GIULIO TONONI

(University of Wisconsin - Madison, WI, USA):

**Is Subjective Experience Noting Else but a Neural Process?**

MARK MAHOWALD

(University of Minnesota Medical School, Minneapolis, MN, USA):

**How can One Explain Hypnosis or Hysteria?**

GIULIO TONONI

(University of Wisconsin - Madison, WI, USA):

**What Benefit do Changes in Conscious State have for the Brain?**

DANIEL C. DENNETT

(Tufts University, Medford, MA, USA):

**How Many Selves are in the Brain?**

J. ALLAN HOBSON

(Harvard Medical School, Boston, MA, USA):

**Dream Consciousness**

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### **Lecture Series „Knowing and Seeing“ 28-30 October 2008**

Vortragender:  
HELLMUT WOHL  
(Boston University, Boston, MA, USA)

**Looking at Pictures - The Current Scientific Understanding of Vision and the Ways in which it is Relevant to How We Look at Pictures**

**Reflections on a Toothache - The Body Image, the Felt Sensations of our Inner Body, and its Visualization in Art**

**Perchance to Dream - The Neuroscientific Understanding of Dreams and the Light it Sheds on Pictures of Actual as well as Imagined Dreams**



### **Matinée anlässlich des 80. Geburtstags von Irenäus Eibl-Eibesfeldt 30 November 2008**

Mit Beiträgen von:

BERND LÖTSCH  
(Naturhistorisches Museum Wien)

KARL GRAMMER  
(Ludwig Boltzmann Institut für Stadtethologie):

BENEDIKT KUBY  
**Filmportrait: „Mit Leidenschaft und Neugier“**

HUBERT CHRISTIAN EHALT  
(Kulturabteilung der Stadt Wien)

JOHN DITTAMI  
(Department für Verhaltensbiologie, Universität Wien)

### 3.3 Altenberg Seminare in theoretischer Biologie

Die „Altenberg Seminare in theoretischer Biologie“ greifen im Rahmen einer Vortragsreihe jedes Semester ein Thema von wissenschaftlicher und philosophischer Bedeutung auf. Die Vorträge werden an der Universität Wien abgehalten, die Folge-Diskussionen finden am jeweils darauffolgenden Tag am KLI statt. Die Seminarreihe soll neben dem Fachpublikum auch die wissenschaftlich interessierte Öffentlichkeit erreichen. Weitere Informationen zu den Teilnehmern und ihren Vorträgen stehen auf der KLI Website zur Verfügung.



#### Altenberg Seminars in Theoretical Biology Summer 2008

##### Symposium: „Interpreting Climate Change“

Climate change refers to variations in the Earth's climate on many different time scales — from decades to millions of years. This seminar deals, among other things, with the possible causes of such variations. „Climate change“ is often used in a restricted sense to denote a significant change — such as a change having important economic, social, or environmental effects — in the mean values of a meteorological element (in particular temperature or amount of precipitation), where the means are taken over periods of the order of a decade or longer. In the most general sense, climate change encompasses “all forms of climatic inconstancy (that is, any differences between long-term statistics of the meteorological elements calculated for different periods but relating to the same area) regardless of their statistical nature or physical causes” (Arctic Climatology and Meteorology Primer).

Climate change may result from changes in solar activity, long-period changes in the Earth's orbital elements (eccentricity, obliquity of the ecliptic, precession of equinoxes), natural internal processes of the climate system, or — the factor that, obviously, most often catches people's imagination — anthropogenic forcing, such as increasing atmospheric concentrations of carbon dioxide and other green-house gases.

Even if some actors continue to stubbornly deny it, the very sophisticated climate models that have been developed in the last twenty years “justifiably provide an additional strand in the argument that anthropogenic climate change is a critical global problem” (Stainforth). Whenever such models are used to develop policy, however, uncertainties of all kinds emerge that may seem to make the task insurmountable (cf. our Summer 2004 seminar, “Living Dangerously: Coping with Risk and Uncertainty in Complex Biological Systems”). Where to derive confidence from? Three of the eminent speakers in this seminar will deal with uncertainty and risk as related to climate change and scientific and political strategies to cope with it (and, as Stehr emphasizes, adapt to it) from a number of (inter)disciplinary perspectives, whereas Shrader-Frechette will investigate the question what energy techniques best address climate change.

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LEONARD A. SMITH

(Centre for the Analysis of Time Series, London School of Economics and Political Science):

**Contrasting the Diversity of Our Models with the Uncertainty in Our Future**

NICO STEHR

(Zeppelin University, Friedrichshafen):

**Adaptation to Climate Change**

MICHAEL THOMPSON

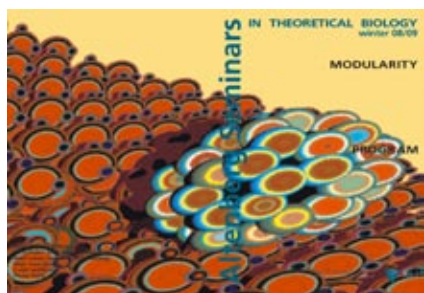
(Stein Rokkan Centre, University of Bergen, Norway & IIASA, Laxenburg):

**Too Much Carbon Dioxide and Not Enough Clumsiness**

KRISTIN D. SHRADER-FRECHETTE

(University of Notre Dame, Indiana, USA):

**Nuclear Theology and Climate Change: Why IPCC (and Other Arguments) Err in Proposing Nuclear Power to Address Climate Change**



**Altenberg Seminars in Theoretical Biology  
Winter 2008/2009**

**Modularity**

Hierarchy “is a property of nature, not only a conceptual scheme for organization” (Vrba & Gould 1986). Most of the complex systems we encounter in the world—from atoms to galaxy clusters—have clearly hierarchical structures: they consist of subsystems, which consist of subsystems, etc. The components interact with each other, but the frequencies associated with their interactions drop steadily as one moves upward in the hierarchy—typically by an order of magnitude or two for each level one ascends. A module is to be understood most generally as a component of a larger system that operates largely independently of other components. More specifically, modules are characterized by the integration of their (sub)components and by their autonomy vis-à-vis aspects of their environment. It is the ubiquitous modularity of most natural (as well as artificial) systems that largely explains why they are “nearly decomposable”, which in turn makes plausible that a reliable understanding of complex systems is attainable by us cognitively “bounded” beings at all.

Although hierarchy is a central phenomenon of life as well as of inorganic nature, it did not feature prominently in biological theory until quite recently. Yet, a general theory of biology ought to be “a theory of hierarchical levels—how they arise and interact” (Bolker seminar). A hierarchical living world contains entities such as genes, organisms, species, etc. that act as “evolutionary individuals” at several levels of ascending inclusion. In such a world, the traditional equation of selection—a causal process—and sorting—dif-

ferential birth and death among varying organisms within a population—no longer holds: Sorting can arise from selection at the focal level itself, and as a consequence either of downward causation from processes acting on individuals at higher levels or upward causation from lower levels. Likewise, during development, components that operate as integrated and context-insensitive units (“developmental modules”) have been recognized at many different levels ranging from molecular interactions to entire organisms.

The recent surge in interest in modularity among biologists stems mostly from accumulating evidence that some of the modular units of development were highly preserved but “promiscuously recombined” during evolution, fueling hopes that understanding developmental and/or behavioral modularity will provide deep insights into constraints on evolution. But the underlying assumption that modules of development will act as coherent and “quasi-independent” units of evolutionary transformations, as it turns out, is not necessarily true. In order to make an independent fitness contribution (i.e., to accomplish “autonomy” in the afore-mentioned sense), developmental modules must not only be quite invariant vis-à-vis the environment in which they are imbedded (regardless of whether they themselves have strong effects on their surroundings or not) but also be relatively isolated regarding their functional effects—say, locomotion or sensory functions). Different developmental modules with an overlapping genetic basis may be linked together into a single module of evolution by frequent pleiotropic effects of heritable variations. One important open question is whether modules arise through the action of natural selection or because of biased mutational mechanisms.

In the opening seminar, Chris Klingenberg will illustrate the use of morphometric methods and model systems to investigate how development produces covariation between traits, and how this affects evolution. Jessica Bolker will focus on the status of modules (in particular species) as individuals, how they interact, and the ways in which they arise, transform, and function through time. The question under what precise conditions modularity can be expected to enhance evolvability will be at the center of both Thomas Hansen’s and Claudia Lorena García’s seminars. Whereas the first three seminars will consider modularity primarily from the perspective of evolutionary developmental biology (EvoDevo), García will expand EvoDevo-type considerations to discuss, and criticize, aspects of the influential “massive modularity” thesis in recent philosophy of mind.

CHRIS KLINGENBERG

(Faculty of Life Sciences, University of Manchester):

**Developmental Integration and Modularity: Inferences from Morphology**

THOMAS F. HANSEN

(Centre for Ecological and Evolutionary Synthesis, University of Oslo):

**Measuring Evolvability and Constraints in Complex Characters**

JESSICA BOLKER

(Department of Biological Sciences, University of New Hampshire):

**Modularity: Putting the Pieces Together**

CLAUDIA LORENA GARCIA

(Institute of Philosophical Research, National Autonomous University of Mexico):

**Functional Modularity and the Structure of Mind**





## 46 3.4 Mittagsdiskussionen Brown Bag Discussions

*„Brown bag“ bezieht sich auf das informelle Format dieser öffentlichen Vorträge: bringen Sie Ihr Mittagessen mit, lehnen Sie sich zurück, genießen Sie den Vortrag und nehmen Sie an der Diskussion teil! Die „Brown Bag Discussions“ finden mittags in der Bibliothek des KLI in Altenberg statt. Die Abstracts zu den Vorträgen und Informationen zu den Vortragenden stehen auf der Instituts-Website zur Verfügung.*

D. KIMBROUGH OLLER

(University of Memphis):

**Naturalistic Recording and Automated Vocal Analysis: Human Ethology for a New Generation**

XABIER BARANDIARAN

(Universidad Politécnica de Madrid and KLI):

**From Biology to Cognition: The Origins of Mental Life**

JASON SCOTT ROBERT

(Arizona State University):

**The Darwinian Ark**

ADRIANNA WOZNIAK

(KLI):

**Relativity in Evolutionary Causation**

DENIS WALSH

(University of Toronto and KLI):

**Not A Sure Thing: Fitness, Probability and Causation**

ALEJANDRO ROSAS

(KLI):

**Preliminary Thoughts on the Phylogeny of Moral Cognition**

PETER TAYLOR

(University of Massachusetts, Boston):

**Farms, Families, and Fantasies of Control: Puzzles in the History and Philosophy of Heredity that Warrant More Attention**

WAYNE CHRISTENSEN

(Philosophy, MACCS Macquarie University, Australia):

**Towards an Integrative Framework for Agency**

LAURA NUÑO DE LA ROSA

(University Complutense, Madrid):

**The Role of Form in Molecular Biology: Conceptual Parallelisms with Developmental and Evolutionary Biology**

JULIEN DELORD

(Ecole Normale Supérieure, Paris):

**An Analysis of the Elusive Nature of „Biodiversity“**

JOANNA BRYSON

(KLI and University of Bath):

**What Limits the Biological Evolution of Cultural Evolution? Modularity in Evolution and Learning**

JEFFREY SCHWARTZ

(University of Pittsburgh):

**Was the Modern Synthesis Really a Synthesis?**

TETSU SATO

(Nagano University, Japan):

**Intra- and Interspecific Interactions in Reproductive Behavior Among Cichlid Fishes: Implications for Niche Construction and Ecosystem Evolution**

ADRIANNA WOZNIAK

(University of Windsor, Canada):

**Relativity in Evolutionary Causation: A Model for Evolution**

SEBASTIAN VOIGT

(Vienna University):

**The Making of New Species: DevoDevo of the Pupfish *Cyprinodon* (Lacépède, 1803)**

DAN SPERBER

(Institut Jean-Nicod [CNRS, EHESS, ENS]):

**Modularity and Relevance in Cultural Evolution**

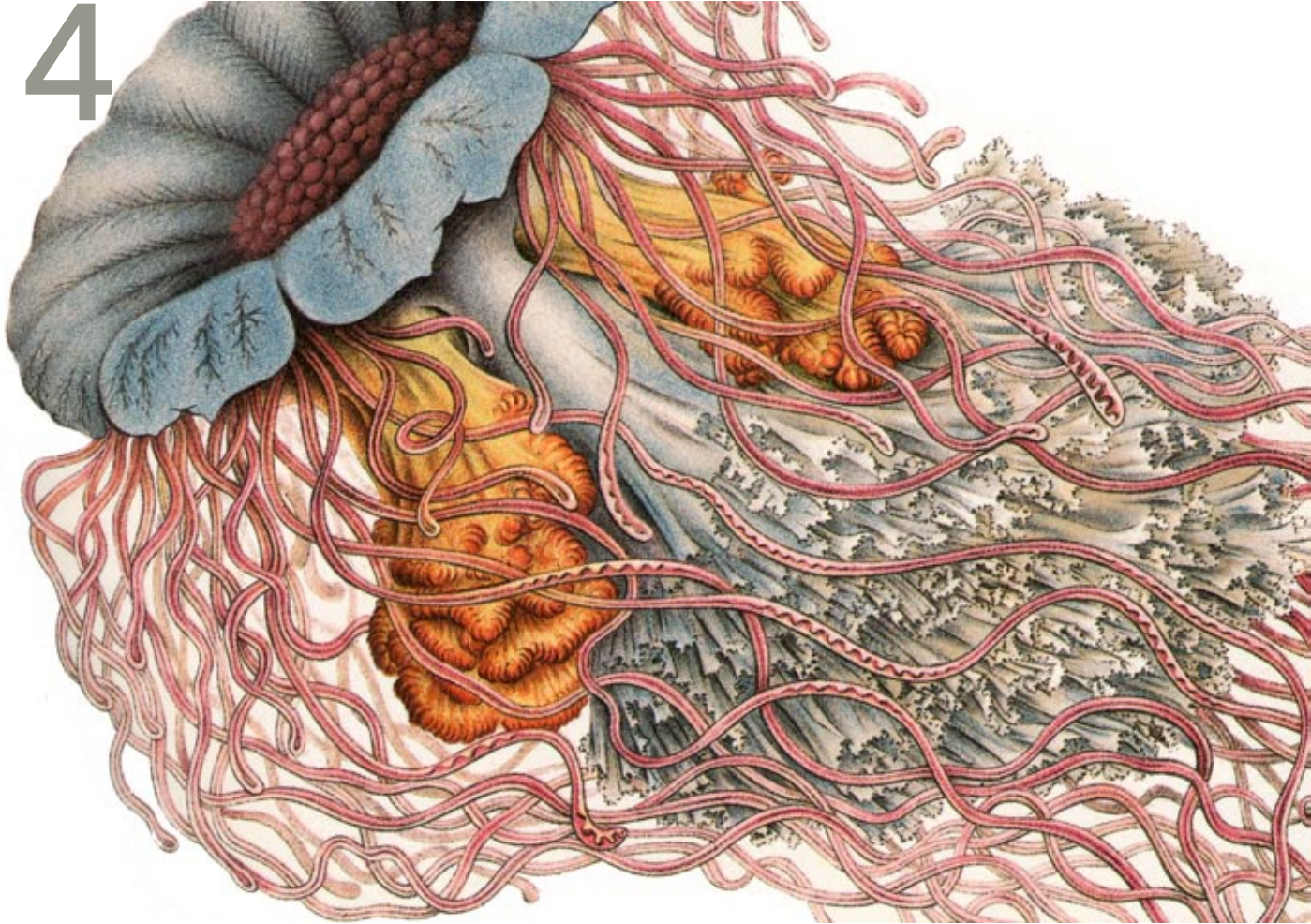
ALLAN HOBSON

(Harvard Medical School):

**AIM (Activation, Input-Output Gating, and Modulation): A Three-dimensional State Space Model of the Brain-Mind**

## Publikationen Publications

# 4



*Wissenschaftliche Publikationen und  
Vorträge von Fellows und permanenten  
Mitarbeitern des KLI, sowie Artikel in  
„Biological Theory“, die im Jahr 2008  
erschieden sind.*

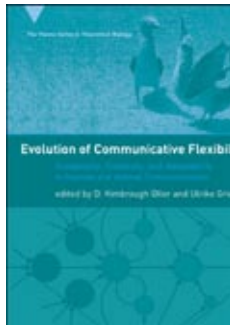
## 4.1 Vienna Series in Theoretical Biology

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*Die „Vienna Series“ wird von MIT-Press als Buchreihe des KLI herausgegeben.*

*Die Bücher beruhen größtenteils auf den Altenberger Workshops und den sich daraus ergebenden Beiträgen und neuen Synthesen. Die jeweiligen Buchprojekte werden von MIT-Press einem Review unterzogen.*

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BARANDIARAN X.  
**From Biology to Cognition: The Origins of Mental Life.**  
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BRYSON JJ.  
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BRYSON JJ.  
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BRYSON JJ.  
**The Role of Cognition in Cognitive Systems.**  
 AI Lab, Department of Informatics, University of Zürich.

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**Why Information Can be Free: The Evolution of Altruistic Communication and its Impact on Social Learning.**  
 Department of Behavioural Biology, University of Utrecht.



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**The Role of Cognition in Cognitive Systems.**  
School of Computer Science, University of Birmingham.
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**Organism, Environment, and Bounded Rationality.**

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**Contingency and Inherency in EvoDevo and Niche Construction.**

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CALLEBAUT W.

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HEINTZ C.

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**Evolutionary Determinates of Social Structure in Macaque Troops.**

The International Primatological Society's XXII Congress, Edinburgh, UK.

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Workshop "Growth, variation, and structure of the craniofacial complex in human evolution." Madrid.

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MÜLLER GB.

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NUÑO DE LA ROSA L.

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ROSAS A.

**Preliminary Thoughts on the Phylogeny of Moral Cognition.**

Konrad Lorenz Institute for Evolution and Cognition Research, Altenberg.

TALMONT-KAMINSKI K.

**Good Habits, Better Heuristics.**

Granada, Spain.

TALMONT-KAMINSKI K.

**Bounded Rationality, Biases and Superstitions.**

NTNU, Trondheim, Norway.

TALMONT-KAMINSKI K.

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Murcia, Spain.

TALMONT-KAMINSKI K.

**Arguing with Limited Beings (Us, that is).**

Argumentation as a cognitive process Conference, Toru, Poland.

TALMONT-KAMINSKI K.

**Heuristics, Naturalism and Pragmatism.**

Pragmatism and Naturalism Workshop, Tilburg, Holland.

TAYLOR P.

**Farms, Families, and Fantasies of Control: Puzzles in the History and Philosophy of Heredity that Warrant More Attention.**

Konrad Lorenz Institute for Evolution and Cognition Research, Altenberg.

VECCHI D.

**Some Lessons from Bacterial Adaptive Mutagenesis.**

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VIRÁNYI ZS, RANGE F.

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Poster presented at the EDICI workshop in Vienna, Austria.

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**Not A Sure Thing: Fitness, Probability and Causation.**

Konrad Lorenz Institute for Evolution and Cognition Research, Altenberg.

WITTEVEEN J.

**Individuating Inheritance Systems: What Makes Cultural Inheritance 'Cultural' Inheritance?**

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**Evolutionary Epistemology in the Light of Lewontin's Dialectics.**

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**Sympatric Speciation May be Common in Nature: Developmental Novelty as Biological Barriers.**

University of Vienna.

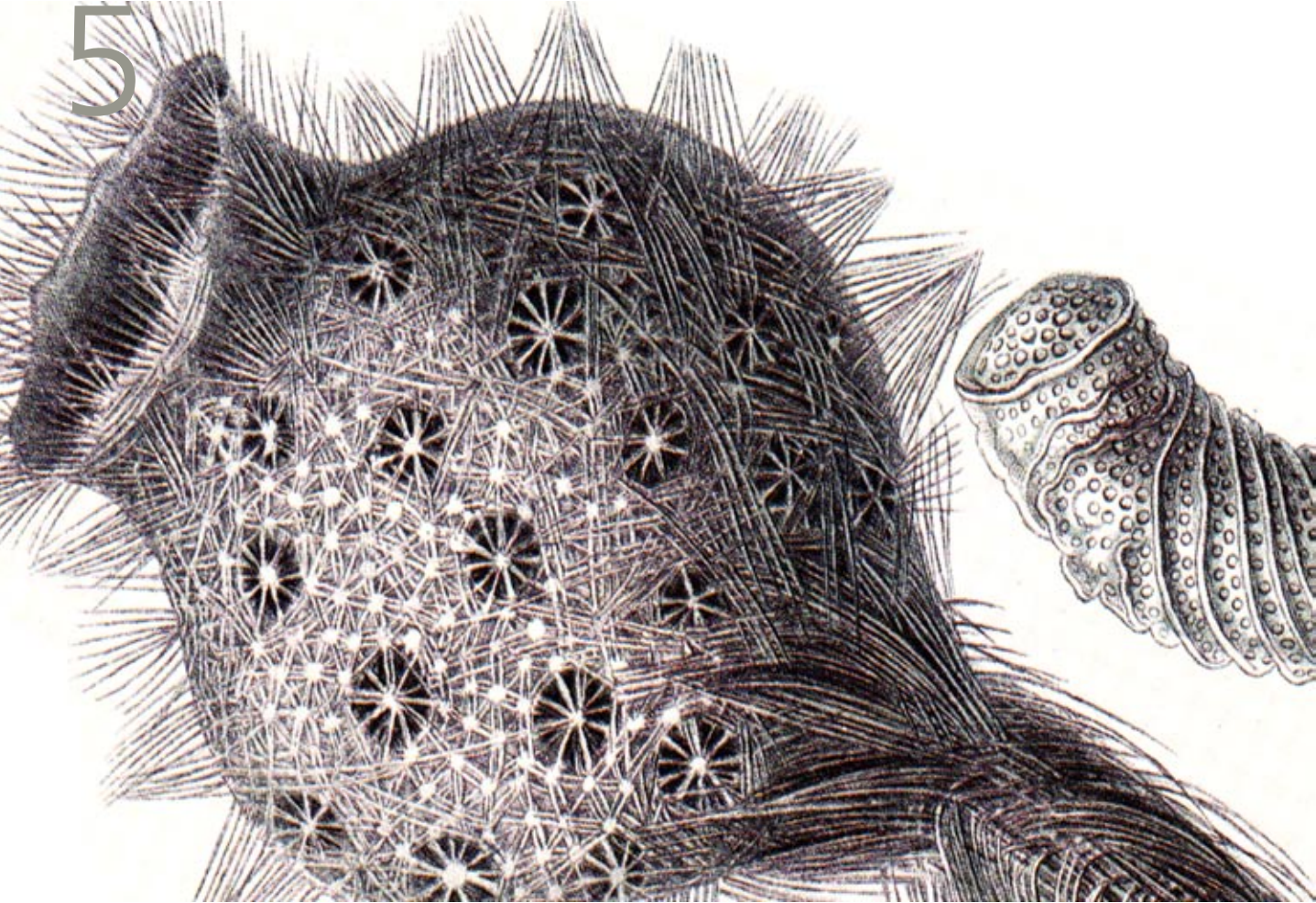
WOZNIAK A.

**Developmental Plasticity and Sympatric Speciation.**

Centre National de la Recherche Scientifique, Lyon.

## Weitere Aktivitäten Further Activities

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*Viele der Aktivitäten des KLI gehen über  
den wissenschaftlichen Kernbereich hin-  
aus. Von diesen sind einige hier stellver-  
tretend genannt und zusätzliche  
Förderungen werden dankend angeführt.*

## 5.1 Konrad Lorenz Archiv Konrad Lorenz Archive

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Das Konrad Lorenz Archiv umfasst Lorenz' Korrespondenz aus den Jahren 1964-1989 (mit Niko Tinbergen, Karl von Frisch, Jane Goodall, Otto Koehler, Karl Popper, Paul Weiss u.a.), Tagebücher, die umfassende private Photosammlung, Manuskripte zu den meisten seiner Bücher (wie das berühmte „Russische Manuskript“), seine Sonderdruck-Sammlung und die Auszeichnungen und Preise (wie den Nobel-Preis), die Lorenz im Lauf seines Lebens verliehen wurden.

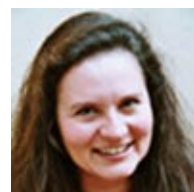
### MAG. TARQUIN MITTERMAYR

*Tarquin Mittermayr studied history at the University of Vienna and Archive Studies at the Institute for Austrian Historical Research. In 2000 he obtained a Diploma in Bookbinding at the University of Sussex. Subsequently he worked as a librarian at the University of Surrey Roehampton and at St. George's Hospital Medical School (University of London). In 2003 he graduated with a BA Hons in European Studies from the Open University (Milton Keynes).*



### MAG. GUDRUN BRAUN

*Gudrun Braun studied biology with a focus on behavioral sciences at the University of Vienna. She received her MA in 1997.*



2008 wurde ein großer Teil des Archivs digitalisiert. Sämtliche Photos, Tagebücher, das gesamte Russische Manuskript, alle vorhandenen Publikationen und wesentliche Briefe sind nun elektronisch verfügbar.

Dies dient mehreren Zwecken. Die Funktionalität des Archivs wurde damit wesentlich erhöht - Photos und Papers können nun leichter gesucht und für Publikationen zur Verfügung gestellt werden. Die wertvollen Originaldokumente, wie das Russische Manuskript und Lorenz' Tagebücher werden geschont während die Scans leicht zur Verfügung gestellt werden können.

2009 soll ein Teil der Dokumente, vor allem die Photosammlung, für den kontrollierten Web-Zugriff aufbereitet werden.



## 66 5.2 EUNICE Netzwerk EUNICE Network

In 2008 EUNICE, a European Network of Interdisciplinary Centers of Excellence, was founded, with the KLI as a participating institution.

EUNICE will offer a new type of postgraduate qualification focused on fostering advanced thinking skills. It addresses students that are heading for leadership positions in academia as well as in the public and private sector. The network will jointly grant a European degree of a Magister Cogitationis Artium (MCA). EUNICE is aimed to be specifically European in a twofold sense: It systematically tries to utilize the richness and variety of different scientific and cultural backgrounds. In addition the curriculum foresees work at three different nodes and, at least two different European countries. The goal of this is to help to develop personalities that combine the capability for cognitive leadership with a strong European identity.

## 5.3 European Advanced Seminars in the Philosophy of the Life Sciences

Today's life sciences are undeniably of enormous societal and ethical significance, but at the same time experience massive conceptual problems thrown up by the speed with which they advance and the amounts of data they produce. A need for conceptual clarification and coordination as well as ethical orientation is therefore felt across the life sciences. A broadened philosophy of the life sciences can provide novel lines of insight into biological and medical practice in ways that may prove relevant to the sciences as well as the philosophy of science in general.

In September 2008 the first European Graduate Meeting in the Philosophy of the Life Sciences was held in Gorino Sullam, Italy. It was the first meeting in the new founded series of European Advanced Seminars in the Philosophy of the Life Sciences. EASPLS was founded by five European institutions leading in the philosophy of science:

- Centre for Genomics in Society, University of Exeter,
- Institut d'Histoire et de Philosophie des Sciences et des Techniques, Sorbonne,
- Max-Planck-Institut für Wissenschaftsgeschichte, Berlin,
- Scuola Europea di Medicina Molecolare, Milano, and
- KLI

## 5.4 Zusätzliche Förderungen Additional Funding

### Für zusätzliche finanzielle Unterstützung dankt das KLI

dem Bundesministerium für Bildung, Wissenschaft und Kultur für die Förderung der „Altenberg Workshops“ und

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Mai 2009

**Bildnachweis**

E. HAECKEL  
**Kunstformen der Natur.**  
Prestel 2003.

Umschlag: Asteridae  
Kapitel 1: Polycyttaria  
Kapitel 2: Pennatulida  
Kapitel 3: Narcomedusae  
Kapitel 4: Discomedusae  
Kapitel 5: Hexactinellae

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