Contents

Review 2015 and Structure of the KLI

1

From development and animal behavior to humanization
and the activities of the mind, scientists and others,
who themselves beomce aware in a reflective manner,
this is the spectacle that the KLI offers to us, specific breaks
in the continuity of a self-organizing nature.

Henri Atlan
(École des Hautes Études en Sciences Sociales, Paris)
translated from a French quotation by H. Atlan

1.1 The Year in Review

The year 2015 was marked by a suite of new endeavors. After moving from Altenberg to Klosterneuburg in 2014, the KLI could finally make use of the full capacity of the new KLI building. The fellows have moved to their new office spaces and enjoy the atmosphere that is provided by the institute´s design. The city council of Klosterneuburg even awarded the KLI the "Prize for Cityscape" honoring the architectural concept.

The official opening of the new institute building was celebrated in June 2015 together with about 140 friends, collaboration partners, neighbors, craftsmen, and experts who contributed to the construction and renovation of the building. Our guests enjoyed the delightful musical presentation of the renowned Auryn Quartett that performed at the opening ceremony. In his opening address, Eörs Szathmáry, Director of the Parmenides Center and Advisory Board Member of the KLI, made an assertive plea for the importance of non-university research centers that stimulate the advancement of new scientific ideas and act as stepping stones in the careers of young scholars. Along the same lines, the mayor of Klosterneuburg welcomed the KLI as a distinguished advanced study center that further upvalues Klosterneuburg as a location for international research.

Another important step was taken in the fall of 2015. After the unexpected passing of Werner Callebaut the previous year, the KLI Board was able to hire Johannes Jäger, previously a group leader at the Centre for Genomic Regulation (CRG) in Barcelona and a research fellow at the Wissenschaftskolleg zu Berlin as the new Scientific Director of the KLI. Dr. Jäger's broad scientific background in theoretical biology, including work on gene regulation, biomathematics, and philosophical issues, made him the ideal candidate for this position. With Dr. Jäger now spearheading the KLI, the institute will continue to establish international collaborations and new event formats to firmly position the KLI within the scientific community.

Other activities of the KLI were pursued with equal enthusiasm, such as the 32nd Altenberg Workshop in Theoretical Biology entitled "Is Paleoanthropology an Evolutionary Science? Or, Are Analyses of Human Evolution Biological?" organized by Jeffrey H. Schwartz (University of Pittsburgh), the publication of four issues of the journal *Biological Theory*, the organization of 20 KLI Colloquia, as well as a Summer School entitled "The Evolution of Developmental Processes" in collaboration with the Istituto Veneto di Science, Lettere ed Arti. In addition, the KLI hosted 15 fellows and visitors, thereby supporting the publication of 33 original papers and 36 scientific presentations at international meetings. The details of the fellow projects, events, and publications can be found in this report.

All this would not have been possible without the support of the members of the KLI Trust, the Board of Directors, the Scientific Advisory Board, as well as the staff and fellows of the KLI. Above all, we are indebted to Traudl Engelhorn for her generous support of the pioneering spirit of the KLI.

Gerd B. Müller
President

1.2 The KLI

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

The KLI also pursues its objectives by organizing international workshops, summer schools, and colloquia, and by publishing a scientific journal and a book series.

1.3 Organization of the KLI

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

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

Scientific Projects

2

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

2.1 Applications

In 2015, the KLI received a total of 54 applications for fellowships, 10 of these were granted for 2015 or 2016.

2.2 Writing-Up Fellowships

Chiara Elettra FERRARIO
(October 2015 – March 2016)

Chiara holds a Master´s degree from the University of Milan and has been working on her PhD thesis "The Evolutionary Role of Imitation in the Hominid Lineage: Time for a Reappraisal" at the Victoria University of Wellington, New Zealand as well as at the Australian National University, Canberra. Having received a Writing-Up Fellowship from the KLI she is currently completing her PhD thesis.

The Role of Imitation in Hominid Evolution: Time for a Reappraisal

Both humans and nonhuman animals have culture, but human culture is different in fundamental ways. Human culture has often been characterized as "cumulative" for its peculiar tendency to accumulate modifications in a seemingly irreversible manner over time (a property that we all exploit "standing on the shoulders of giants" with Google Scholar). Complex adaptations such as language, institutions, art, religions, but also technology and science, from its simplest (think stone artifacts or ancient trigonometry) to most complex forms (think spacecrafts or quantum theory), can be explained by the extraordinary human capacity to faithfully transmit progressive achievements through generations. New additions serve as platforms for further improvements, so that complexity increases steadily. The so-called ratchet hypothesis intriguingly suggests that this process might be due to the special high-fidelity properties of imitation, a social learning mechanism exclusively found in humans – so the argument

went. This scenario has undergone a series of challenges in recent years, perhaps the most relevant being the extent to which imitative capacities have been retrieved in nonhuman animals. Nonetheless, it continues to exert a singular influence on the field of cultural evolution. In my work, I look at how new evidence and methodology recently emerged in cultural evolution and social learning studies can be put at work to offer a meaningful re-evaluation of the "ratchet argument."

Verena HALSMAYER
(January 2015 – July 2015)

Verena Halsmayer holds a Master´s degree in History and a Master´s degree in Economics from the University of Vienna. Since 2010 she is a PhD student in the PhD program "The Sciences in Historical, Philosophical and Cultural Contexts" at the University of Vienna. After fellowships at the Center for the History of Political Economy (Duke University) and the Centre for the Philosophy of Natural and Social Sciences (London School of Economics), she currently works as a Writing-Up Fellow at the KLI.

Modeling, Measuring, and Designing "Modern Economic Growth." The Construction, Manipulation, and Circulation of the Neoclassical Growth Model

My dissertation project consists of a series of historical case studies analyzing the construction, manipulation, and circulation of the neoclassical growth model. Published in 1956, this model would become one of the paradigmatic theoretical models of modern macroeconomics. Building on archival material, published work, and unpublished manuscripts, each of my case studies focuses on the specific mathematical, and statistical objects that were used to create knowledge about economic growth: the newly created national income accounting framework that was applied to search for the "sources" of growth; planning techniques from wartime research that went into constructing linear equation systems

for the "rational organization" of production; and topological existence proofs, which helped formulating the concept of a "balanced growth path." Before the background of these different mathematical, quantitative, and model versions of a growing economy, Solow's "simple model of economic growth" developed as a rather incidental by-product. Initially thought of as a "design" for more complex empirical models, it soon became accepted as a particularly simple, clear-cut, and easy-to-use standard. Labeled "the neoclassical growth model," it circulated widely: it was used as a prototype for large-scale planning models, it became famous for providing an instrument for measuring "technical progress," and it is presented as a device for teaching mathematical modeling until the present day.

Berta VERD
(November 2015 – April 2016)

Berta holds a Bachelor´s degree in Mathematics from Polytechnic University of Catalonia (UPC), Barcelona and Master´s degrees from Kings College as well as Imperial College, London. She worked on her PhD thesis at the Centre for Genomic Regulation at the Pompeu Fabra University, Barcelona and at the Wissenschaftskolleg zu Berlin. Berta is a Writing-Up Fellow at the KLI where she is completing her PhD thesis.

Evolution of Different Dynamic Modes of Segmentation

My PhD project studies the evolution of developmental systems. As a case study, we are looking at the gap gene network involved in pattern formation and segment determination during early insect development. My approach focuses on under-standing the dynamics implemented by this system and how they constrain, and guide the evolution of developmental patterning processes. During my

project, I have used methods from dynamical systems theory – in particular the geometrical analysis of configuration space – to characterize gap gene regulation in *Drosophila melanogaster.* My analysis reveals a damped oscillator mechanism that underlies the dynamic expression of posterior gap domains. This is a very suprising finding in a long-germ-band insect, which forms its segments simultaneously, and is similar in kind to the oscillatory mechanism producing segments sequentially in short-germ-band embryos. I am currently extending my analysis to characterize the dynamic mechanisms underlying pattern formation by the gap genes in two more species of flies (*Megaselia abdita* and *Clogmia albipunctata*). My work raises fundamental questions concerning the evolution of evolving dynamical systems.

2.3 Postdoctoral Fellowships

Argyris ARNELLOS
(November 2013 – July 2016)

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

conferences in the areas of autonomous and complex systems, 2nd-order cybernetics, philosophy of biology, philosophy of mind, and interactivism, design theory, artificial intelligence, and human-computer Interaction.

Organizational Requirements and Regulation for Organismal Development and Maintenance

From an organizational perspective, organisms have the capacity to regulate and modify both their developmental processes and their interactions with the environment, while at the same time they are able to incorporate influences of the environment in their developmental and self-maintaining dynamics. They achieve this by exhibiting a developmental organization that fosters the endogenous construction of complex patterns of its own regulation, and which is brought about by the interplay between genetic, epigenetic, interactive, and environmental factors at the cellular, tissue and organismal levels. Several difficulties appear when one tries to specify the organizational conditions and the terms in which the development and maintenance of such an organization and its evolutionary characteristics should be accounted for. The main objective of this research project is to elucidate and provide a feasible explanation of the overall relation between the developmental organization and its endogenously produced regulation in multicellular organisms. More specifically, this project aims at getting a better understanding of: (1) the nature, form, and pattern of different types of developmental regulatory mechanisms in an organism; (2) the ways developmental regulation shapes the relation between cells (parts), groups of cells (tissues), and the organisms (wholes) in which they participate; (3) whether the concept of regulation (and which specific regulatory patterns) can be theoretically established as a general principle underlying the exportation of "organismality" from the unicellular to a meta-cellular level; (4) how the nervous system and the respective interactive and environmental regulatory factors contribute, influence, and transform the overall pattern for the regulation of development and maintenance; (5) the regulatory logic that allows for new forms of complex agency and flexible behavior.

Ann-Sophie BARWICH
(October 2013 – June 2015)

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

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

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

Until recently, biologists were in fact unable to identify the specific processes of odor recognition, because the odorant receptors in our nose were so far unknown. In 1991 Linda Buck and Richard Axel eventually discovered a multigene family encoding odorant receptors in the mammalian genome, identifying them as G-protein-coupled receptors. This discovery had important implications for further olfactory research, because it identified smell receptors as a class of G-proteins, which strongly suggests that molecules (causing a particular odor) dock on a specific primary receptor according to a "lock and key" mechanism by virtue of their shape. Orthodox opinion about primary smell recognition therefore takes shape to be the key feature underlying mole-

cular recognition. However, this account faces several severe experimental problems and still lacks sufficient demonstration. An alternative account, questioning shape and referring to the molecular vibration in the infrared range as the key feature of olfactory molecular recognition, has nevertheless been widely disregarded – yet not sufficiently challenged on its experimental basis.

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

Daniel BROOKS
(October 2015 – September 2016)

Daniel Brooks holds Bachelor´s degrees in Philosophy and German Studies from the University of Cincinnati and a Master´s degree in Philosophy from Bielefeld University. In 2014 he completed his PhD studies in Bielefeld under his dissertation project "The Concept of Levels of Organization in Biology." Before his Postdoctoral Fellowship at the KLI, Daniel taught graduate and undergraduate seminars in current topics in the philosophy of science and epistemology at the University of Münster.

The Role of Levels of Organization in Biological Thought

My research project will focus on analyzing the role of "levels of organization" in scientific reasoning about explanation in biology. The concept of "levels" evokes a hierarchical image of the world that is vertically stratified into a graduated continuity: The things found at one horizontal slice of the world somehow "make up" or "are continuous with" things found at another slice, and so on. Yet, despite its ubiquity, "levels" remains a decisively ambiguous concept in biology. The "things" that constitute the horizontal image of the world

can vary widely between different contexts. Sometimes they refer to real objects, like part-whole compositional relationships, or they can refer to epistemic units, such as the "level of genetics" or "level of ecology." In my dissertation, I showed that this variability reveals usage of "levels" in science to be governed mostly by its intuitive appeal, whose justification is based on context-dependent criteria of adequacy. Far from useless, however, "levels" instead exemplifies what one philosopher calls "productive ambiguity" of open-ended helping concepts in science. For this reason, philosophical analyses should abandon attempts to unify different uses of "levels" and acknowledge the fragmentary character of the concept.

This research project will expand on this foundation by explicating two distinct roles attributed to the concept of "levels" in different arenas of scientific reasoning concerning explanation. One of these roles is pedagogical, and is often encountered in introductory textbooks to biology, such as the Campbell Biology series, where "levels" is used to introduce the major unifying themes of the field. Another role is organizational, and is encountered in professional research literature of working scientists, in particular review articles and commentaries on the state of research in a certain area of investigation. Here "levels" is often used by scientists as a theoretical device with which to navigate within complex phenomena distributed across multiple levels, or to coordinate interdisciplinary efforts for investigating such phenomena that cannot be adequately addressed by any one of the involved disciplines alone. Though distinct, these roles complement one another in biological reasoning, albeit in starkly different contexts of scientific practice.

To conduct this analysis I will focus on two case studies from science in which levels are prominently used in both of the roles specified above. The first, macromolecular structure, is treated in a well-defined local manner, focusing on features of (some) macromolecules such as nucleic acid and proteins (but, tellingly, not lipids or sugars). The second, the nervous system, is treated in a more open-ended general manner, owing to the vast complexity of neural phenomena that "levels" is used to investigate.

James DiFRISCO
(October 2015 – September 2016)

James DiFrisco received his PhD in Philosophy from University of Leuven, Belgium, with a dissertation entitled "Process and Levels of Organization: A Dynamic Ontology for the Life Sciences." His research focuses on problems related to biological organization, functions, individuality, and levels, as well as on a variety of themes in naturalistic metaphysics including physicalism and the relations between scientific domains.

Hierarchy and Individuality

According to ordinary intuition, living individuals and organisms are the same thing. Developments in the life sciences, however, have indicated that familiar organisms are just one case of individuality among others, including genes, cells, colonies, groups, species, and even ecosystems. It has therefore become a problem to explain what it is, in general, that makes something a biological individual. My project takes its point of departure from the insufficiency of evolutionary explanations currently on offer, in which being an individual roughly means being a unit of selection. Instead of opposing this by recourse to more physiological explanations of individuality, however, I suggest it will be more illuminating to integrate both within a more general hierarchical framework. I propose to do this by introducing into the discussion a dynamical or process-based view of both individuation and hierarchical organization. A dynamical perspective ensures that biological individuation is explained as an ongoing, evolving process. A hierarchical perspective is necessary for accommodating the fact there are different dynamics at different levels and scales that are causally responsible for individuating biological systems.

Carrying out this project will involve developing an alternative to the dominant approaches to biological hierarchy theory that relies on dynamical parameters and pervasive scalar properties of the living world. I also connect the issues of biological individuality and hierarchy to wider

concerns about the explanatory power of natural selection, problems with biological functionalism, and the relationships between biology and the other natural sciences.

Barbara FISCHER
(October 2015 – September 2016)

Barbara Fischer studied at University College Cork, Ireland and University of Vienna where she graduated in Biomathematics. She made her PhD in Evolutionary Biology and Biomathematics at the University of Berne, Switzerland. She worked at the University of Helsinki, the University of Berne and at IIASA, Laxenburg/Austria. She has been a Postdoctoral Research Associate at the University of Oslo and a Researcher and Lecturer at the University of Vienna.

Evolvability and Integration of the Human Pelvis

Compared to other primates, childbirth is remarkably difficult in humans because the head of a human neonate is large relative to the birth-relevant dimensions of the maternal pelvis. In seems puzzling that females have not evolved wider pelvises despite the high maternal mortality and morbidity risk connected to childbirth in humans. In the proposed project, I will build a comprehensive novel model of the evolution of the human pelvis. With this project, I will contribute to answering the question why this "obstetric dilemma" still exists in modern humans. Current models explaining the evolution of human pelvic dimensions, or the lack thereof, are based on verbal arguments only. In contrast, I propose to use empirical data on phenotypic variation of pelvic dimensions in human populations (data from populations in North America, Europe and Southern Africa) as well as mathematical models of evolutionary dynamics (quantitative genetic models) that build on these data to quantitatively assess hypotheses on pelvis evolution. In particular, I will estimate the phenotypic integration and evolvability of different pelvic shape features. In an earlier study, I have shown that evolution has produced covariances between

pelvis shape and other body dimensions that contribute to ease childbirth. Based on these results, I will compare the variational properties of the pelvis across sexes and populations. I will devise a quantitative model of the constraints imposed upon the evolution of the human pelvis using the collected empirical data and data from the gynecological literature.

Olivier MORIN
(November 2013 – June 2015)

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

Biological Generations in Cultural Evolution

Does the succession of biological generations structure cultural change — and if so, how? This research project will investigate the consequences of demographic turnover on the diffusion and mutations of traditions. Two reasons invite us to expect cultural change to be driven by demography. The first reason is the existence of sensitive periods for cultural acquisition: critical "windows" where grammatical parameters (for speakers of a given language), artistic styles (for painters), or

theoretical options (for scientists) tend to get fixed more or less irreversibly. The second reason is the slow pace of some changes: they appear to be constrained by the supply of young learners (which in most populations is a more or less constant quantity) rather than determined by the number of models (which can grow exponentially). In spite of this, finding generational dynamics in cultural evolution is not easy. Identifying sensitive periods is a matter of some controversy. The cultural inputs that people are exposed to are changing with time, making the respective contributions of sensitive periods, cognitive maturation, and changing environments difficult to tease apart. The pace and rhythm of cultural change may also differ depending on the subpopulation that one is observing: the adoption of evolutionary theory does not look the same if one looks at it among members of the Royal Society, French zoologists, or American clergymen. These difficulties partly explain why we still lack precise concepts and instruments to estimate, let alone predict, how important generational change will be for a given cultural change.
This investigation will use a simple statistical tool to tackle the issue. The method uses the fact that any individual's birthdate is equal to the date at which s/he is observed, minus her or his age. For any cultural change (given two of these parameters for every data point), this method allows us to know whether the change is driven by generational turnover, by an event that is external to the population, or by a series of individual maturations. Several data sets will be explored using this method, with the aim of developing a general framework for cultural demography. This framework should predict the importance of generational turnover for various cultural changes, based on their time scale and on the cognitive mechanisms they recruit.

2.4 Senior Fellowship

Lee ALTENBERG
(April 2014 – May 2016)

Lee Altenberg is an evolutionary theoretician. He served most recently as Associate Professor in Information and Computer Sciences at the University of Hawaii at Manoa. He received his AB in Genetics with Prof. Glenys Thomson at the University of California, Berkeley, and his PhD in Biological Sciences with Prof. Marcus W. Feldman at Stanford University. His Postdoctoral Fellowships include Stanford University, North Carolina State University, and Duke University, and he served on the faculty of Duke University prior to the University of Hawaii at Manoa. Recently he was a long term visitor at the Mathematical Biosciences Institute at the Ohio State University, and a participant in the program on computational theories of evolution at the Simons Institute at UC Berkeley. He is an Associate Editor of the journal BioSystems, an Editorial Board member of the journal Genetic Programming *and* Evolvable Machines*, and is a founding member of the Board of Directors of the International Society for Artificial Life. He is a member of the Scientific Advisory Board of the EU-funded project, Speed of Adaptation in Population Genetics and Evolutionary Computation (SAGE). He served on the Board of the Maui Classical Music Festival, and was the Chair of the Native Hawaiian Plant Society on Maui.*

Evolution of Development by Natural Selection

My principal project at the KLI would be to establish a more comprehensive mathematical framework than currently exists for understanding the evolution of evolvability and robustness – a subject that despite its rapidly growing body of work remains piecemeal, and where a comprehensive treatment could, I believe, put the existing results in perspective and reveal new directions of inquiry. In particular I wish to focus on the

relationship between equilibrium and far-from-equilibrium dynamics and the variational properties that come along with these dynamics. My recent work has focused on the evolution of probabilities of transformation in near-equilibrium populations; the "reduction principle" manifest in this domain appears to also operate on magnitudes and directions of transformation in the form of canalization. The underlying mathematical unity found for transformation probabilities prompts one to ask whether this unity also extends to transformation magnitudes and directions. The most challenging area mathematically is far-from-equilibrium, but this is where the evolution of evolvability is mainly generated. Developing new theory for far-from-equilibrium dynamics will be a focus of this project. Specific topics include:

- The Theory of "Growth and Mixing";
- The Evolution of Evolvability under Recurrent Environmental Variation;
- Thresholds between Evolvability and Robustness;
- Determinants for the Evolution of Mutational Robustness;
- A Complex Systems-based Quantitative Genetics.

2.5 Visiting Scientists

Derek TURNER
(September 2015 – October 2015)

Derek Turner holds a PhD in Philosophy from Vanderbilt University, Nashville. He is a Professor of Philosophy at Connecticut College and the Associate Director of the Goodwin-Niering Center for the Environment of Connecticut College. Previously, Derek had fellowships at Goettingen and Pittsburgh, and he taught a summer school course on evolution in Lisbon in 2013.

The Role of Stasis in Macroevolutionary Theory

In the 1970s and 1980s, a number of scientists set out to show that paleontology could make important contributions to our understanding of how evolution works at large scales. The new research program(s) that emerged during this exciting period had an uneasy relationship with Darwin's ideas. For example, paleontologists challenged the assumption that natural selection is sufficient to explain larger-scale patterns and trends in the fossil record. Those trends might result from passive diffusion away from a fixed boundary, or perhaps from the differential extinction, persistence, and branching of entire lineages. In this project, however, I argue that there is another important (though less obvious) way of thinking about what the paleobiologists were up to. They were engaging critically with the Darwinian tradition by raising questions about our default expectations with respect to evolutionary processes. This is easiest to see in the case of Eldredge and Gould's theory of punctuated equilibria (PE), which challenged the idea that gradual morphological change should be our default expectation when we approach the fossil record. Eldredge and Gould famously argued that stasis is the dominant theme of evolutionary history, but early critics of PE complained that they had left stasis itself something of a mystery. What sorts of evolutionary mechanisms could explain why stasis characterizes so many lineages for most of their duration? Is stasis the default

expectation for evolving lineages? Is it something like an inertial state? Or is stasis a surprising phenomenon that needs to be explained by appeal to specific evolutionary forces, such as stabilizing selection? This debate about stasis is a good starting point for assessing what was going on during the paleobiological revolution.

Lennart OLSSON
(July 2015)

Lennart Olsson is Professor at the Institute for Comparative Zoology and Evolutionary Biology at Friedrich-Schiller University in Jena, Germany. Olsson took his first degree in biology at the University of Stockholm, Sweden, in 1988, and obtained his PhD in Zoology at Uppsala University, Sweden, in 1993, working on pigment cell migration and pattern formation. He has been a Lecturer at Uppsala University in Sweden and a Postdoctoral Fellow at the Department of EPO Biology, University of Colorado, as well as a visiting researcher at several institutions including Macquarie University in Sydney, Australia, the Anatomical Institute at the University of Vienna, Austria, the Museum of Comparative Zoology, Harvard University, USA, and the Center for History of Science at the Royal Swedish Academy of Sciences (RSAS), Stockholm, Sweden.

Evolutionary Novelties and Gene Regulatory Networks in Amphibian Head Development

The origin of evolutionary novelties is a long-standing issue in evolutionary biology. Changes in developmental processes and mechanisms must underlie novel anatomical structures, but exactly how this works is a much more difficult question. I propose to investigate this, based on a literature survey and data from two empirical research projects presently conducted in my lab, one on the role of FoxN3, the other on the role of

bagpape genes for the development of unique larval head skeletal structures in frog tadpoles.

Experimental work on the effects of knock-down of these genes on both the anatomical development and on the expression of genes belonging to the genetic regulatory network (GRN) have yielded a wealth of empitical data that now needs to be put in a wider discussion of the evolution of anatomical noveltis and their underlying gene regulatory mechanisms. FoxN3 knock-down has been shown to remove several unique larval structures only found in frog tadpoles, such as the elaborate, filigreed structure of the gill basket necessary for filter feeding, and the extra mouth structures present as unique novelties in frog tadpoles and especially well developed in tadpoles grazing algae. Knock-down of the bagpipe gene Zax has severe effects of the development and anatomy of a major novelty, the rostral cartilages, in frog tadpoles.

2.6 Scientists with Own Funding

Mathieu CHARBONNEAU
(March 2013 – February 2015)

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

Cultural Development and Cultural Evolution

In the last forty years, Darwinian theories of cultural evolution have mainly focused on the transmission patterns of cultural variants, either at a micro-evolutionary scale (dual inheritance theory) or at a macro-evolutionary scale (cultural

phylogenetics). This emphasis on transmission comes from an affinity with the modeling strategies used in population genetics and phylogenetics. From this, a research program analogous with evolutionary biology has been suggested to synthesize the social sciences into an evolutionary framework. However, clearly absent from this scheme is a study of cultural development serving as an analogous cultural science of EvoDevo. Nevertheless, implicit in these theories lies an underexplored developmental component. On the one hand, the modeling strategies borrowed from population genetics are based on the life cycle of human organisms, thus construing cultural development as the development and sequential enculturation of the socializing organism. On the other hand, the analogy between the ideational notion of culture and genotype/phenotype relationship suggests that cultural development should be understood as the processes by which cultural products (behaviors, artifacts, and institutions) are produced by the cultural information transmitted from one individual to another. According to this reading, investigating cultural development would consist not so much in examining how social organisms develop but rather in explaining the neurocognitive processes, sensorimotor feedback loops, and behavioral sequences by which artifacts and institutions are produced and maintained. My post-doctoral project aims at elucidating how cultural development may be integrated in cultural evolution studies and to examine whether a cultural analog to EvoDevo makes sense and, if so, what kind of explanatory benefit it would offer. I'm also interested in clarifying the theoretical relationships between both perspective of cultural development (development of the socializing organism, development of the cultural object), the manner by which they can be integrated into a Darwinian framework of cultural evolution, and to determine if both interpretations can be complementary to one another, and if so, how.

Lynn Chien-Hui CHIU
(July 2015 – August 2015)

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

Niche Construction and Natural Selection

Organisms construct their ecological niches when they define, create, and alter their surroundings by their metabolism, behavior, and choices. Richard Lewontin (1983, 1985, 2000, 2001) argues from these phenomena that the metaphor of construction should replace the metaphor of adaptation in evolutionary theory. In this dissertation, I argue that the subsequent literature on "niche construction," including modeling work, merely revises and extends the adaptationist explanatory schema. This literature fails to recognize how Lewontin's constructivist views undermine adaptationism as an explanatory framework and revolutionize interpretations of "fitness," "niche," and "natural selection." The key difference between Lewontin and the mainstream view is how they interpret the adaptationist assumption that the internal mechanisms of variation are independent from the external, environmentally driven process of natural selection, with "one generating 'problems' at random with respect to the organism, the other generating 'solutions' at random with respect to the environment" (Lewontin, 2001, p. 47). John Odling-Smee, Kevin Laland, Michael O'Brien, Peter Godfrey-Smith, and others merely focus on how organism-induced environmental changes affect evolutionary dynamics. However, this is consistent with the problem-solution metaphor if the niche-constructing organisms merely create the problems they later solve. I argue that niche construction undermines adaptationism because it implies that there is no "problem" in the

environment. When each individual creates its own niche, the environment of the population consists of a myriad of individual selective environments dependent on organismic variation, and no longer constitutes a single problem for the population to solve. After analyzing how the explanatory roles of these concepts are challenged by niche construction, I develop a theoretical model based on Lewontin's original view, and apply it to different disciplines.

Vanessa TRIVIÑO ALONSO
(March 2015 – May 2015)

Vanessa Trivino has studied Philosophy at the University of Murcia and obtained the "Extraordinary Prize" for her degree. She also did a Master on Contemporary Philosophy. In the year 2011, she received a fellowship from the Spanish Government to collaborate with the research group "E038-04 Cognitive Science." Vanessa started her PhD on "Contemporary Questions in Metaphysics of Biology: Emergence, Dispositions, and Persistence in Organisms" in 2014. Currently, she is working on the idea of fitness as being an emergent property of living organisms.

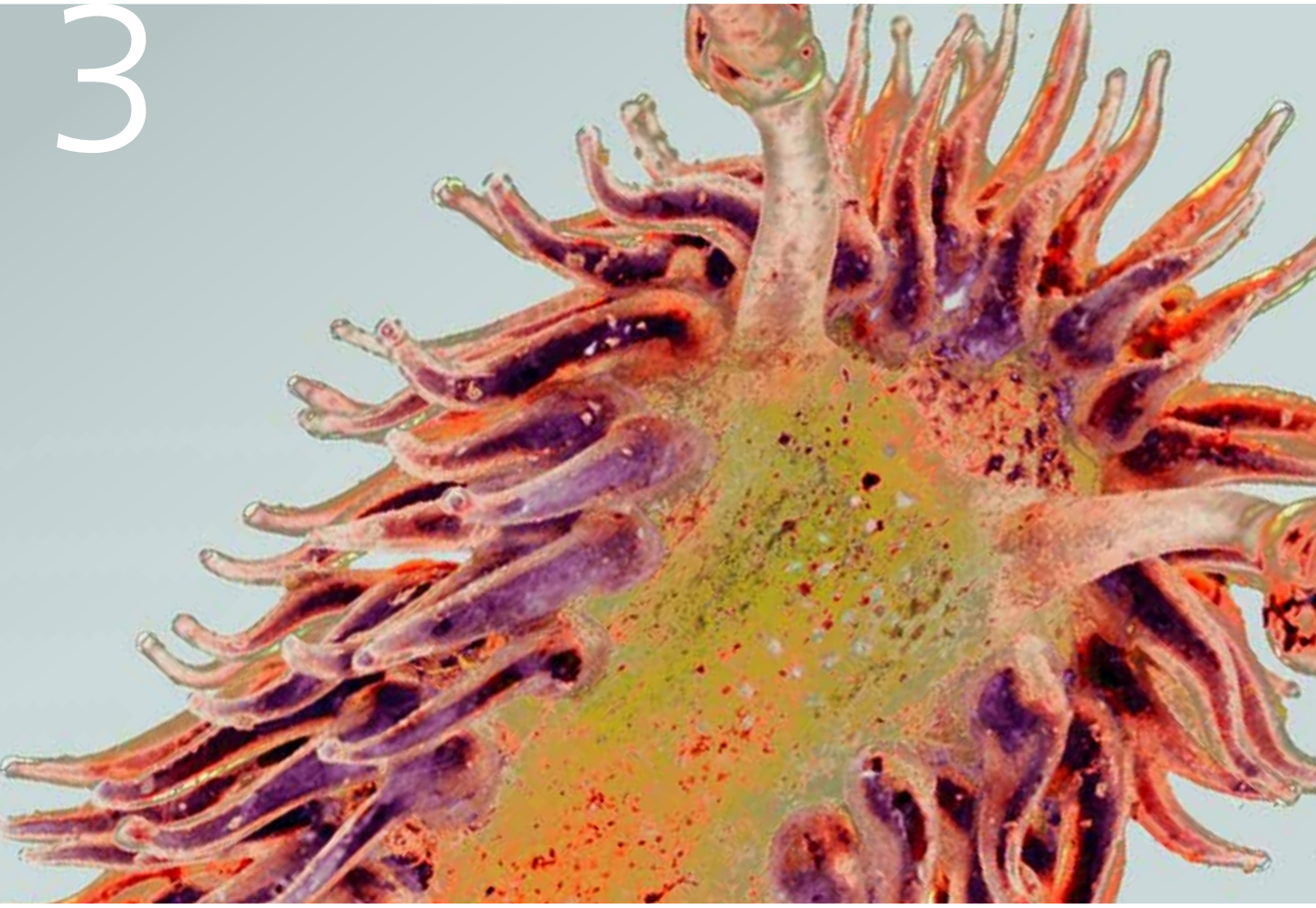
Contemporary Questions in Metaphysics of Bioloy: Emergence, Dispositions, and Persistence in Organisms

The notion of fitness is the key concept invoked in classical evolutionary biology to explain evolutionary change; and evolvability is studied in evolutionary and developmental biology (EvoDevo) as the way to explain the production of phenotypic adaptive mutations in organisms or systems of development. Due to their centrality and relevance in the different fields of Philosophy of Biology, the concepts of "fitness" and "evolvability" need to be clarified in order to achieve a better understanding of evolution.

The general aim of my project is to establish associations between Metaphysics and Philosophy of Biology in order to see to what extent the arguments developed in one particular field can be useful to clarify the arguments developed in the other. In particular, I will try to show in what sense metaphysical concepts such as "emergence" and "dispositions" can be helpful to clarify the biological concepts of "fitness" and "evolvability"; and vice-versa, that is, how the study of biological concepts such as „fitness" and „evolvability" can shed light on metaphysical debates such as the existence or absence of emergent properties.

Meetings and Lectures

3



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

3.1 Altenberg Workshop in Theoretical Biology

The "Altenberg Workshops" address key questions of biological theories. Each workshop is organized by leading experts of a certain field who invite a group of international specialists to the KLI. The Altenberg Workshops aim to make conceptual progress and to generate initiatives of a distinctly interdisciplinary nature. Further information concerning the participants and their presentations can be found on the KLI website. Workshops hosted at the new institute building in Klosterneuburg are continued as "Altenberg Workshops."

Organization: Jeffrey H. Schwartz

32nd Altenberg Workshop in Theoretical Biology 17 – 20 September 2015

Is Paleanthropology an Evolutionary Science, or Are Analyses of Human Evolution Biological?

KLI Klosterneuburg

Topic and Aims

Given the pronouncements about human evolution that dominate anthropology textbooks and frequent the pages of newspapers and science e-news websites, it would seem that the major questions in paleoanthropology have been answered. Indeed, it is commonplace to read that a new fossil or molecular analysis supports fully, or tweaks only a tiny bit, scenarios of who's related to whom and how, when, where, and why one species of human relative (hominid) transformed seamlessly into another. If this is so, one may ask: Why bother trying to find more fossils, another molecule, or evidence pertaining to the life-history and persistence of any hominid, or pursue these inquiries with the latest technology, if you already know the story?

In light of the impact pronouncements on human evolution have on the public and on non-biologically savvy academics, it seems appropriate to convene a workshop that focuses on the disconnect between human evolutionary studies and the theoretical and methodological standards and practice that inform the rest of evolutionary biology. The result of this workshop will be a broad-based publication that will bring to light the assumptions and misconceptions as well

as the positive and biologically viable aspects of human evolutionary studies. In turn, such wide-ranging collaboration should at the very least make apparent to scholars who assume that the study of human evolution is both biologically and theoretically sound that this is not necessarily or universally correct. More optimistically, such an endeavor – indeed, challenge – may provide a spark of intellectual curiosity among paleoanthropologists and their academic kin that could have long-lasting, positive effects on their disciplines. Although ambitious, I would also hope that some of the insights and recommendations that will emerge from this workshop will become known to the media and disseminated to the public that, after all, accepts pronouncements on human evolution as biologically sound fact.

Program

MARKUS BASTIR
Museo Nacional de Ciencias Naturales, Madrid
Back to Basics: Morphological Analysis in Paleoanthropology

CLAUDINE COHEN
École des Hautes Études en Sciences Sociales, Paris
Gender and Sex in Scenarios of Human Evolution

ROB DeSALLE
American Museum of Natural History, New York
How Real Are Genetic Data?

JOHN DE VOS
Naturalis Biodiversity Center, Leiden
Man the Beast

RICHARD DELISLE
University of Lethbridge, Alberta
The Deceiving Search for "Missing Links," 1860–2010: The Chaotic Development of Paleanthropology

ROBIN DENNELL
University of Sheffield
Where Evolutionary Biology Meets History: The Appearance of *Homo sapiens* in East Asia

GABRIELE MACHO
The Oxford University
Referential Models for the Study of Hominin Evolution: How Many Do We Need?

JAMIE FABRIZZIO GUERRO McMANUS
National Autonomous University of México, México City
Paleoanthropology and Human Evolution: A Philosophical and Feminist Assessment of a Complex Relationship

MICHAEL PETRAGLIA
University of Oxford
Out of Africa: Can Archaeological and Genetic Data Be Reconciled?

THOMAS PLUMMER
City University of New York & New York Consortium in Evolutionary Primatology
Scope and Scale in Paleoenvironmental Reconstructions of Early Hominin Archaeological Sites

JEFFREY H. SCHWARTZ
University of Pittsburgh
What´s Real about Human Evolution: Received Wisdom, Assumptions, and Scenarios

DIETRICH STOUT
Emroy University, Atlanta
Human Brain Evolution: History or Science?

ALAN TEMPLETON
Washington University, St. Louis
Hypothesis Compatibility versus Hypothesis Testing of Models of Human Evolution

PETER WADDELL
Ronin Institute, Massey University
It´s not Evolutionary Biology without Networks of Descent: Quantitative Phylogenetics and the Genus *Homo*

3.2 Summer School

4th Summer School in Evolutionary Devolopmental Biology
28 September – 1 October 2015

The Evolution of Developmental Processes
Istituto Veneto di Scienze, Lettere ed Arti, Venice

Organizers: Sandro Minelli and Gerd Müller
School Director: Johannes Jäger

Teaching panel
J. Jaeger (CRG Barcelona), P. Beldade (Gulbenkian Institute, Lisbon), G.E. Budd (University of Uppsala), G. Fusco (University of Padova), R. Jenner (Natural History Museum, London), A. Khila (Institut de Génomique Fonctionnelle de Lyon), A. McGregor (Oxford Brookes University), A. Minelli (University of Padova), C. Mirth (Instituto Gulbenkian de Ciencia, Oeiras), G.B. Müller (KLI Klosterneuburg, and University of Vienna), A. Peel (University of Leeds)

Topic and Aims

Evolution and development are two aspects of the same underlying dynamic. While morphological evolution occurs through changes in the underlying developmental processes, the regulatory structure of these processes in turn influences rate and direction of phenotypic change. Studying the complex feedback between development and evolution requires moving beyond qualitative comparative analysis of gene expression and key regulatory factors towards quantitative network-level studies of evolving developmental systems. This transition poses a number of considerable conceptual and methodological challenges.

This course will expose its participants to these challenges, with the aim of providing PhD students and postdocs interested in EvoDevo with the methodological and conceptual toolkit required to face them. This year's course is centred on approaches that explicitly acknowledge the processual nature of evolution and development. It will start with a brief introduction to key concepts of process

philosophy, which provide a unifying general conceptual framework for a possible extended synthesis for evolutionary biology. We will discuss problems of phylogenetics and the choice of model organisms as a necessary practical prerequisite for any investigation into EvoDevo. The following three days of the course will cover different approaches to the study of developmental evolution. First, we will cover regulatory evolution and how it results in altered developmental dynamics and phenotypic variation. Second, we will introduce concepts and approaches that deal with higher-level organisation in evolving developmental systems. And finally, we will explore the interaction of ecology and EvoDevo. Throughout the course, we will touch on central concepts such as evolvability, robustness, and phenotypic plasticity and their respective roles in evolution.

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

Program

JOHANNES JAEGER
Centre for Genomic Regulation, Barcelona & Wissenschaftskolleg zu Berlin
Introduction: The Process Perspective

GERD MÜLLER
University of Vienna & KLI Klosterneuburg
Introduction to EvoDevo and the Extended Synthesis in Evolutionary Theory

RONALD JENNER
Natural History Museum, London
The Role of Phylogenetics in EvoDevo

ANDREW PEEL
University of Leeds
Developmental Dynamics and EvoDevo

DAVID E. K. FERRIER
University of St. Andrews
Homeobox Gene Clusters and the Interplay Between Genome Organization & EvoDevo

ALISTAIR McGREGOR
Oxford Brookes University
EvoDevo & Evolutionary Genetics

JOHANNES JÄGER
Centre for Genomic Regulation, Barcelona & Wissenschaftskolleg zu Berlin
Biological Structuralism/Evolutionary Systems Biology/ Dynamical Modelling

GIUSEPPE FUSCO
University of Padova
Models and Descriptions in EvoDevo

GRAHAM BUDD
University of Uppsala
Constraining the Unconstrainable? Fossils and the Phenotype-Genotype Map

CHRISTEN MIRTH
Instituto Gulbenkian de Ciencia, Oeiras
Phenotypic Plasticity and the Evolution of Polyphenisms

ABDOU KHILA
Institut de Génomique Fonctionnelle de Lyon
Integrating EvoDevo with Ecology for a better Understanding of Phenotypic Evolution

3.3 Mini-Symposium

Mini-Symposium of the KLI Fellows
3 November 2015
KLI Klosterneuburg

Program

LEE ALTENBERG
Toward a Statistical Mechanics of Macroevolution

BERTA VERD
A Damped Oscillator Governs Posterior Gap Gene Patterning in *Drosophila melanogaster*

BARBARA FISCHER
Evolvability and Integration of the Human Pelvis

CHIARA ELETTRA FERRARIO
How Social Learning Can Change the Odds of Your Evolutionary Trajectory

ARGYRIS ARNELLOS
Organisms — an Organisational Perspective

JAMES DiFRISCO
Hierarchy and Individuality

DANIEL BROOKS
The Role of Levels of Organization in Biological Thought

3.4 KLI Colloquia

KLI Colloquia are informal, public talks taking place at the KLI institute in Klosterneuburg. Abstracts of the presentations and information about the lecturers can be found on the website of the institute.

JOHANNES JÄGER
Centre for Genomic Regulation, Barcelona
Life´s Attractors: The Evolutionary and Developmental Dynamics of the Gap Gene System

OMRI TAL
Max-Planck Institute, Leipzig
Assessing the Information Inherent in Population Structure

MATHIEU CHARBONNEAU
KLI Klosterneuburg
All Innovations Are Equal, but Some More Than Others: (Re)integrating Modification Processes to the Origins of Cumulative Culture

YOAV SOEN
Weizmann Institute of Science, Rehovot
Bridging Ecology and Evolution by Symbiotic and Epigenetic Mechanisms

JITKA POLECHOVA
Vienna
Limits to Adaptation and the Evolution of a Species´ Range

IGOR GROSSMANN
University of Waterloo, Ontario
Social Structure, Infectious Diseases, Disasters, Secularism, and Cultural Change in America

VANESSA TRIVIÑO ALONSO
University of Murcia & KLI Klosterneuburg
Contemporary Questions in Metaphysics of Biology: Emergence, Dispositions, and Persistence in Organisms

VERENA HALSMAYER
University of Vienna & KLI Klosterneuburg
Modeling, Measuring, and Managing Economic Growth: The Construction, Manipulation, and Circulation of the Neoclassical Growth Model

TERRENCE W. DEACON
University of California, Berkeley
Autogenesis and the Origin of Life: Why RNA-World and Autocatalysis Aren´t Sufficient

ANNA WEICHSELBRAUN
University of Chicago
Artifacts and Practices of "Technical Independence" at the IAEA´s Department of Safeguards

LYNN CHIEN-HUI CHIU
University of Missouri & KLI Klosterneuburg
An Interactionist Theory of Natural Selection

MATEJ PLANKAR
Ljubljana
Towards an Organisational Grounding of Normativity in Life and Cognition

JOHANNES JAEGER
KLI Klosterneuburg
Natural Philosophy for the 21st Century

ALVARO MORENO
University of the Basque Country, San Sebastian
A Critical Review of the Concept of Autonomy in Biology

DEREK TURNER
Conneticut College & KLI Klosterneuburg
Models for Explaining Evolutionary Stasis

WIM HORDIJK
Lausanne
Autocatalytic Sets: The Origin and Organization of Life

RAGHAVENDRA GADAGKAR
Indian National Science Academy, New Delhi
Evolution of Social Behavior in the Tropical Paper Wasp *Ropalidia marginata*: Do We Need to Look Beyond Kin Selection?

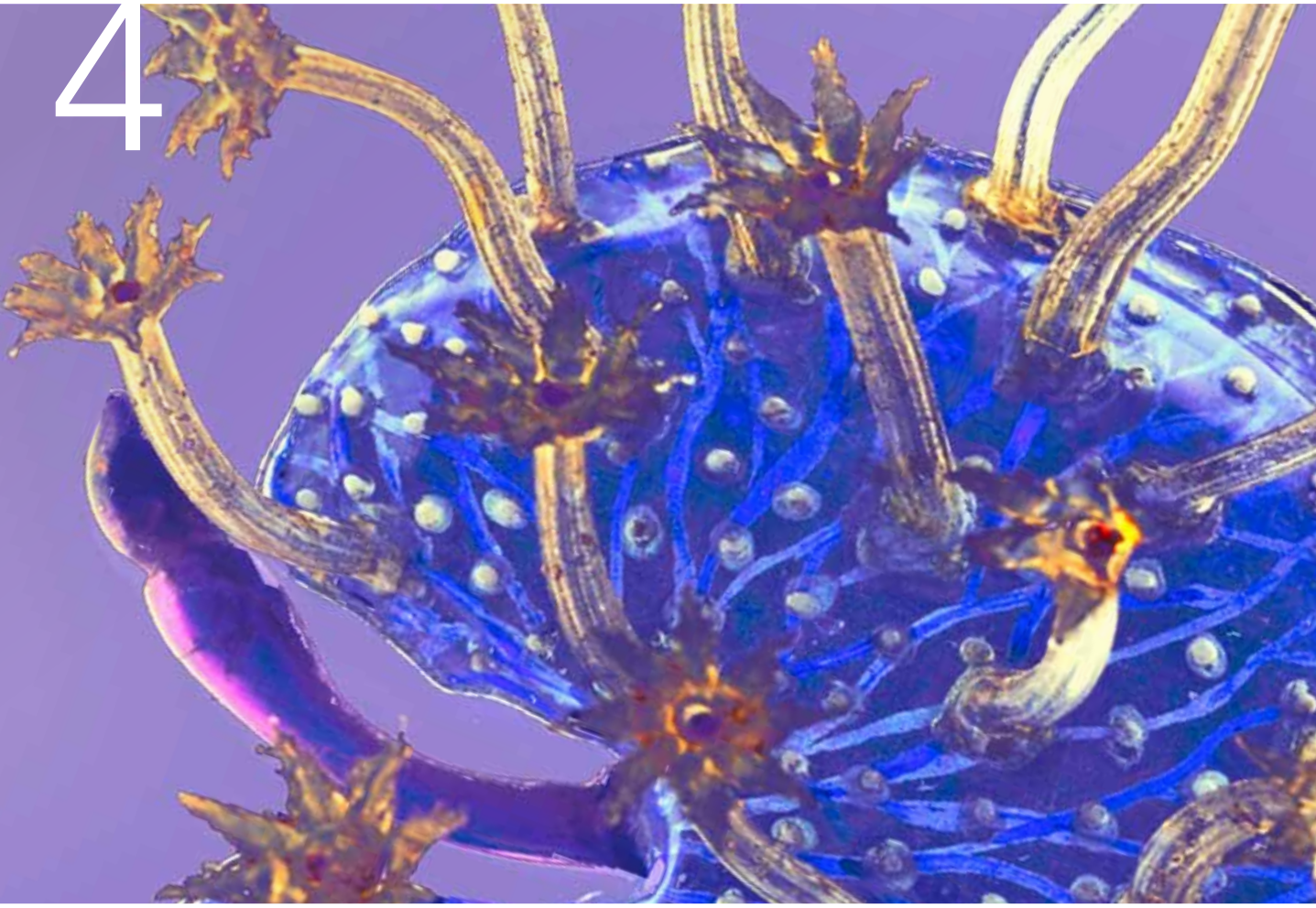
LEE ALTENBERG
KLI Klosterneuburg
Understandability and Incomprehensibility in the Products of Evolution

GASPER TKACIK
IST Austria
Efficient Representation as a Predictive Principle for Signaling Networks

ARGYRIS ARNELLOS
KLI Klosterneuburg
Multicellular Organisms: An Organizational View

Publications

4



Scientific publications and presentations of fellows and staff members of the KLI in 2015.

4.1 Professional Papers and Books

ALTENBERG L.
Evolutionary Computation
The Elsevier Encyclopedia of Evolutionary Biology

ALTENBERG L.
Fundamental Properties of the Evolution of Mutational Robustness
http://arxiv.org/abs/1508.07866

ALTENBERG L.
Statistical Problems in a Paper on Variation in Cancer Risk Among Tissues, and New Discoveries
http://arxiv.org/abs/1501.04605

ARNELLOS A, MORENO A.
Multicellular Agency: An Organizational View
Biology and Philosophy 30: 333-357

BARWICH AS, CHANG H.
Sensory Measurements: Coordination and Standardization
Biological Theory 10: 200-211

BARWICH AS.
Bending Molecules or Bending the Rules? The Application of Theoretical Models in Fragrance Chemistry
Perspectives on Science. doi:10.1162/POSC_a_00183

BARWICH AS.
Astrid Schwarz. Experiments in Practice (History and Philosophy of Technoscience, 2)
Isis 106: 898-899

BONIOLO G.
In Memoriam Werner Callebaut
History and Philosophy of the Life Sciences 37: 474-476

CHARBONNEAU M.
All Innovations are Equal, but Some More than Others: (Re)integrating Modification Processes to the Origins of Cumulative Culture
Biological Theory 10: 322-335

CHARBONNEAU M.
Mapping Complex Social Transmission: Technical Constraints on the Evolution of Cultures
Biology & Philosophy 30: 527-546

FAVÉ MJ, JOHNSON RA, COVER S, HANDSCHUH S, METSCHER BD, MÜLLER GB, GOPALA S, ABOUHEIF E.
Past Climate Change on Sky Islands Drives Novelty in a Core Developmental Gene Network and Its Phenotype
BMC Evolutionary Biology 15: 183

FISCHER B, MITTEROECKER P.
Reply to Underdown and Oppenheimer: Roles of Selection, Plasticity, and Genetics in the Integration of Human Pelvis Shape and Head Size
Proceedings of the National Academy of Sciences 13: E259

HALSMAYER V.
Modeling, Measuring, and Designing Economic Growth. The Neoclassical Growth Model as a Historical Artifact
Doctoral Thesis, University of Vienna

HERNÁNDEZ CHÁVEZ P.
Obituario a Werner Callebaut (1952–2014)
Centro de Estudios Filosoficos, Politicos y Sociales, Vincente Lombardo Toledano, http://www.centrolombardo.edu.mx/

JAEGER J, MONK N.
Everything Flows: A Process Perspective on Life
EMBO Reports 16:1064-1067

KEIJZER FA.
Moving and Sensing Without Input and Output: Early Nervous Systems and the Origins of the Animal Sensorimotor Organization
Biology & Philosophy 30: 311-331

KONSTANTINIDIS P, WARTH P, NAUMANN B, METSCHER B, HILTON EJ, OLSSON L.
The Developmental Pattern of the Musculature Associated with the Mandibular and Hyoid Arches in the Longnose gar, *Lepisosteus osseus* (Actinopterygii, Ginglymodi, Lepososteiformes)
Copeia 103: 920-932

LALAND KN, ULLER T, FELDMAN MW, STERELNY K, MÜLLER GB, MOCZEK A, JABLONKA E, ODLING-SMEE J.
The Extended Evolutionary Synthesis: Its Structure, Assumptions and Predictions
Proceedings of the Royal Society B 282: 2015.1019

MATUSZEWSKI S, HERMISSON J, KOPP M.
Catch Me if You Can: Adaptation from Standing Genetic Variation to a Moving Phenotypic Optimum
Genetics 200: 1255–1274

McLOONE B.
Some Criticism of the Contextual Approach, and a Few Proposals
Biological Theory 10: 116–124

MITTEROECKER P, WINDHAGER S, MÜLLER GB, SCHAEFER K.
The Morphometrics of "Masculinity" in Human Faces
PLoS One 10(2):e0118374

MORIN O.
Cultural Transmission: How Traditions Live and Die
New York: Oxford University Press

MÜLLER GB.
Liberté, Egalité, Modularité: In Memory of Werner Callebaut (1952–2014)
Biological Theory 10: 1–4

MÜLLER GB, NEMESCHKAL HL.
Zoologie im Hauch der Moderne: Vom Typus zum offenen System
In: Reflexive Innensichten aus der Universität Wien: Wiener Disziplingeschichten zwischen Wissenschaft, Gesellschaft und Politik (Fröschl KA, Müller GB, Olechowksi T, Schmidt-Lauber B, eds), pp 355-369
Vienna: V&R Vienna University Press

NANJUNDIAH V, MORANGE M.
Aging, Sex Ratio, and Genomic Imprinting: Functional and Evolutionary Explanations in Biology
Biological Theory 10: 125-133

RAO V.
J.B.S. Haldane, an Indian Scientist of British Origin
Current Science 109: 634–638

RASSKIN-GUTMAN D.
Russell´s Turkey and the Death of a Thinker
JOT DOWN – A Contemporary Culture Mag

SARTO-JACKSON I, RICHARDS RJ, NELSON RR.
Quality & Quantity: Limits of Quantification in the Sciences
Biological Theory 10: 183–187

SARTO-JACKSON I.
Overcoming the Limits of Quantification by Visualization
Biological Theory 10: 253–262

VAN SOLDT BJ, METSCHER BD, POELMANN RE, VERVUST B, VONK FJ, MÜLLER GB, RICHARDSON MK.
Heterochrony and Early Left-Right Asymmetry in the Development of the Cardiorespiratory System of Snakes
PloS One, DOI:10.1371/journal.pone.0116416.

VERD B.
EvoDevo in Phase Space: The Dynamics of Gap Gene Expression
Doctoral Thesis, Centre for Genomic Regulation, Pompeu Fabra University, Barcelona

DENIS M. WALSH
Organisms, Agency, and Evolution
New York: Cambridge University Press

XENAKIS I, ARNELLOS A.
Aesthetics as an Emotional Activity that Facilitates Sense-Making: Towards an Enactive Approach to Aesthetic Experience
In: Aesthetics and the Embodied Mind: Beyond Art Theory and the Cartesian Mind-Body Dichotomy (Scarinzi A, ed).
Contributions to Phenomenology 73, pp. 245-279;
Dordrecht: Springer

4.2 Forthcoming Publications

ARNELLOS A, MORENO A.
Integrating Constitution and Interaction in the Transition from Unicellular to Multicellular Organisms
In: Multicellularity: Origins and Evolution (Niklas K, Newman S, eds)
Cambridge, MA: MIT Press

ARNELLOS A.
Biological Autonomy: Can a Universal and Gradable Conception be Operationalized?
Biological Theory

ARNELLOS A, KEIJZER F.
The Animal Sensorimotor Organization. A Challenge for the Environmental Complexity Thesis
Biology & Philosophy (Special Issue: Revisiting 20 Years of Peter Godfrey Smith's Environmental Complexity Thesis)

ARNELLOS A.
From Processes to Organisms and Other Biological Individuals
In: Process Philosophy of Biology (Nicholson D, Dupre J, eds)
New York: Oxford University Press

ARNELLOS A, EL-HANI C.
Emergence, Downward Determination, and Brute Facts in Biological Systems
In: Brute Facts Anthology (Vintiadis E, Mekios C, eds)
New York: Oxford University Press

BARWICH AS.
What Is so Special about Smell? Olfaction as a Model System in Neurobiology
Postgraduate Medical Journal/BMJ Journals

CROMBACH A, WOTTON KR, JIMÉNEZ-GURI E, JAEGER J.
Gap Gene Regulatory Dynamics Evolve Along a Genotype Network
Molecular Biology and Evolution

DiFRISCO J.
Biological Processes: Individuation, Criteria of Identity, and Persistence
In: Process Philosophy of Biology (Nicholson D, Dupre J, eds)
New York: Oxford University Press

FERRARIO CE.
The Role of Imitation in Hominin Evolution: Time for a Reappraisal
PhD Thesis, Victoria University of Wellington

FRAIRE-ZAMORA JJ, JAEGER J, SOLON J.
Dual Microtubule-based Epithelial Seaming Mediates Dorsal Closure in the Scuttle Fly *Megaselia abdita*
eLIFE

GONZALEZ-CABRERA ID.
Sharing our Normative Worlds: A Theory of Normative Thinking
PhD Thesis, Australian National University, Canberra

HANSSON TH, FISCHER B, MAZZARELLA AB, VOJE KL, VØLLESTAD LA.
Lateral Plate Number in Low-Plated Threespine Stickleback: A Study of Plasticity and Heritability
Ecology and Evolution

HOERMANN A, CICIN-SAIN D, JAEGER J.
A Quantitative Validated Model Reveals Two Phases of Transcriptional Regulation for the Gap Gene Giant in Drosophila
Developmental Biology

HORDIJK W.
Life: It's chemistry!
The Naked Scientist

HORDIJK W.
How a Game of Billiards Solved a Queueing Problem
Plus Magazine

HORDIJK W.
Preserving Species in the Face of Climate Change
Plus Magazine

LARSON DO, SARTO-JACKSON I, CALLEBAUT W.
Culture, Neurobiology and Human Behavior: New Perspectives in Anthropology
Biology & Philosophy

MORIN O.
„L'alliance et le don dans l'évolution sociale"
In: Morale et cognition: Actes du colloque de Cerisy (Heintz M, Rivoal I, eds)
Paris: CNRS éditions

MORIN O.
The Disunity of "Cultural Group Selection": A comment on Richerson et al.´s "Cultural Group Selection Plays an Essential Role in Explaining Human Cooperation"
Behavioral and Brain Sciences

NIKLAS KJ, NEWMAN SA.
Multicellularity: Origins and Evolution
Cambridge, MA: MIT Press (Vienna Series)

OLLER KD, DALE R, GRIEBEL U.
New Frontiers in Language Evolution and Development
TopiCS

OLSSON L.
The History of EvoDevo and the Influence of the 1981 Dahlem Workshop on Evolution and Development
Review of "Conceptual Change in Biology: Scientific and Philosophical Perspectives on Evolution and Development" (Love AC, ed)
Biological Theory

PETERSON T, MÜLLER GB.
Phenotypic Novelty in EvoDevo: The Distinction Between Continuous and Discontinuous Variation and Its Importance in Evolutionary Theory
Evolutionary Biology

PETERSON T, MÜLLER GB.
Developmental Finite Element Analysis (devFEA): A Quantifying Tool for the Study of Developmental Biomechanics Using Cichlid Pharyngeal Jaws
BMC Developmental Biology

50 PETERSON T, MÜLLER GB.
The Basipharyngeal Joint of Cichlids: Finite Element Analysis and Simulation of an Evolutionary Novelty
Development & Evolution

SARTO-JACKSON I, TOMASKA L.
How to *B*ake a Brain: Yeast as a Model Neuron
Current Genetics

SARTO-JACKSON I, MACLEOD M, HANDSCHUH S, FRISCHER C, LANG J, SCHLUMPP M, CALLEBAUT W.
A Piecewise Aggregation of (Some) Philosophers' and Biologists' Perspectives
Review Essay on William C. Wimsatt: Re-Engineering Philosophy for Limited Beings: Piecewise Approximations to Reality
Biological Theory

TURNER D.
Paleobiology's Uneasy Relationship with the Darwinian Tradition
In: The Darwinian Tradition in Context: Research Programs in Twentieth Century Evolutionary Biology (Delisle R, ed)
Dordrecht: Springer

TURNER D.
Historical Science
In: The Routledge Handbook of Scientific Realism (Saatsi J, ed)
New York: Routledge

TURNER D.
Artificial Species Selection
Special issue: Philosophy and Technology (Powell R, ed)

4.3 Journal *Biological Theory*

Volume 10, Issue 1:

MÜLLER GB.
Liberté, Egalité, Modularité: In Memory of Werner Callebaut (1952–2014)

O´MALLEY MA, SOYER OS, SIEGAL ML.
A Philosophical Perspective on Evolutionary Systems Biology

GREEN S, FAGAN M, JAEGER J.
Explanatory Integration Challenges in Evolutionary Systems Biology

JAEGER J, LAUBICHLER M, CALLEBAUT W.
The Comet Cometh: Evolving Developmental Systems

CALCOTT B, LEVY A, SIEGAL ML, SOYER OS, WAGNER A.
Enigneering and Biology: Counsel for a Continued Relationship

BALARI S, LORENZO G.
The End of Development

HODGSON D, VERPOOTEN J.
The Evolutionary Significance of the Arts: Exploring the By-product Hypothesis in the Context of Ritual, Precursors, and Cultural Evolution

TRESTMAN M.
Clever Hans, Alex the Parrot, and Kanzi: What can Exceptional Animal Learning Teach us About Human Cognitive Evolution?

 Volume 10, Issue 2:

Volume 10, Issue 3:

4.4 Scientific Presentations

ALTENBERG L.
Science As a Self-Corrective Process---Live
Lab Excursion of the Cognitive Science Master Students of the University of Vienna; KLI Klosterneuburg

ALTENBERG L.
The Mathematical Interaction of "Flop" and "Wear-and-Tear" (Morin 2011)
KLI Klosterneuburg

ALTENBERG L.
The Dynamics of the Genome-as-Population and the Evolution of Evolvability
COSB Colloquium, University of Vienna

ALTENBERG L.
The Dynamics of the Genome-as-Population and the Evolution of Evolvability
Institut d'Histoire et de Philosophie des Sciences et des Techniques, CNRS/Université, Paris I Sorbonne

ALTENBERG L.
Spectral Landscape Theory: Some Color from Infinite Population Analysis
Dagstuhl Seminar 15211, Theory of Evolutionary Algorithms
Schloss Dagstuhl, Wadern

ALTENBERG L.
The Dynamics of the Genome-as-Population and the Evolution of Evolvability
EvoLunch, IST Austria, Klosterneuburg

ALTENBERG L.
Fundamental Properties of the Evolution of Mutational Robustness
Arbeitsgemeinschaft Biomathematik, University of Vienna

ALTENBERG L.
Fundamental Properties of the Evolution of Mutational Robustness
Mathematical Models in Ecology and Evolution, Paris

56 ALTENBERG L.

The Place of De Novo Gene Origin in the Evolutionary Dynamics of the Genome-as-Population

Symposium on the Origins and Evolution of Molecular Innovation, Society for Molecular Biology and Evolution, Vienna

ALTENBERG L.

The Role of Gene Origin in the Evolution of Evolvability

Evolution of Evolution FP7 European Project, ECAL conference, York

ALTENBERG L.

How Might Evolutionary Theory Inform Research on Information Processing in Cells and Tissues?

Information Processing in Cells and Tissues, IPCAT 2015, San Diego, CA

ALTENBERG L.

Fundamental Properties of the Evolution of Mutational Robustness

INRIA Lyon, Villeurbanne

ARNELLOS A.

Constitutive Self-Determination in the Transition from Uni- to Multi-Cellularity

International Workshop on Autonomy and Identity in the Biomedical Sciences, University of the Basque Country, San Sebastian

ARNELLOS A.

When and Why Should a Collection of Cells be Considered an Individual Organism?

University of Groningen, Groningen

ARNELLOS A.

Conceptual Challenges in the Transition from Uni- to Multi-Cellularity

Lab Excursion of the Cognitive Science Master Students of the University of Vienna; KLI Klosterneuburg

ARNELLOS A.

Multicellularity and the Type of Functional Integration for Organismal Interaction

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

ARNELLOS A.
From Processes to Individual Organisms: An Organizational Perspective
Society for Experimental Biology (SEB), Prague

ARNELLOS A.
Multicellularity and Organismal Integration: An Organizational Approach
Department of Philosophy, Leibniz Universität, Hannover

BURNSTON D.
Data Graphs, Explanatory Relations, and Mechanistic Explanation
Society for Philosophy of Science in Practice, Aarhus

BURNSTON D.
Multi-Modality and Defining the Senses
Ecological Perception: Amodal and Multi-Modal Trends, Edinburgh

DiFRISCO J.
Physicalism and Functional Individuation
Research Colloquium in Theoretical Analytical Philosophy, Aarhus University

HALSMAYER V.
Geschichte der Sozialwissenschaften im 19. und 20. Jahrhundert. Organisation – Idiome – Praktiken
Kulturwissenschaftliches Institut Essen

CHARBONNEAU M.
Technical Constraints on Cumulative Cultural Change
Lab Excursion of the Cognitive Science Master Students of the University of Vienna; KLI Klosterneuburg

HALSMAYER V.
Modeling, Measuring, and Designing Economic Growth. The Construction, Manipulation, and Circulation of the Neoclassical Growth Model
Lab Excursion of the Cognitive Science Master Students of the University of Vienna; KLI Klosterneuburg

JAEGER J.
Biological Structuralism/Evolutionary Systems Biology/ Dynamical Modelling
EvoDevo Summer School, Venice

58 JAEGER J.
Shift Happens: The Evolutionary Dynamics of the Gap Gene Network
EvoLunch Seminar, IST Austria, Klosterneuburg

JAEGER J.
The Konrad Lorenz Institute for Evolution and Cognition Research
Complexity Colloquium, University of Southern Bohemia, Nové Hrady

MORIN O.
Retour sur une thèse piagetienne: le réalisme des conventions
Jean Piaget Archives special seminar, University of Geneva

MORIN O.
What´s in a Letter?
Lab Excursion of the Cognitive Science Master Students of the University of Vienna; KLI Klosterneuburg

MÜLLER GB.
Im Spannungsfeld von Evolution und Entwicklung: Musterbildung in evolutionären Prozessen
Die Kunst der Innovation. München

MÜLLER GB.
EvoDevo and the Extended Synthesis
4th European Summer School in EvoDevo, Istituto Veneto di Scienze, Lettere ed Arti, Venezia

MÜLLER GB.
Do We Need a New Evolutionary Synthesis?
Biological Thursdays at Vinicna, Charles University, Prague

SARTO-JACKSON I.
Intrinsic Hidden Constraints in Data-Intensive Biology
International Society of the History, Philosophy, and Social Studies of Biology, Montreal

SARTO-JACKSON I.
Welcome & Introduction to the KLI
Lab Excursion of the Cognitive Science Master Students of the University of Vienna; KLI Klosterneuburg

VERD B.

A Damped Oscillator Governs Posterior Gap Gene Patterning in *Drosophila melanogaster*

Biological Oscillations: Design, Mechanism, Function, EMBL The European Molecular Biology Laboratory, Heidelberg

XENAKIS I, ARNELLOS A.

Feelings and the Construction of Perceptual Content

7th Interactivist Summer Institute (ISI), Bilkent University, Ankara

Further Activities

5

Many activities of the KLI exceed the scientific core agenda. Some representative activities are listed here.

5.1 Opening Celebration of the New KLI Building

In June 2015, the KLI celebrated the official opening of the new institute building together with 140 friends, collaboration partners, and Klosterneuburg neighbors. The distinguished Auryn Quartett regaled guests with an excellent music for strings performance. The architects Walter Grohe and Christian Jabornegg gave insights into the architectural trajectories of the construction work of the new building. Eörs Szathmáry, Director of the Parmenides Center and Advisory Board Member of the KLI brought the importance of non-university research centers to the guests´ attention and emphasized that Gerd Müller´s tireless effort has made the KLI the internationally renowned center it is today. The mayor of Klosterneuburg highlighted the role of the KLI in further strengthening the city as a well-established research location.

62

Program of the Opening Celebration

Auryn Quartett
Joseph Haydn: Streichquartett op. 54,1, G-Dur

GERD MÜLLER
Das KLI Institut

WALTER GROHE
Ein Ort für die Wissenschaft

CHRISTIAN JABORNEGG
Architektur im historischen Kontext

EÖRS SZATHMÁRY
Die Funktion außeruniversitärer Wissenschaftsinstitutionen

Bürgermeister STEFAN SCHMUCKENSCHLAGER
Wissenschaft in Klosterneuburg

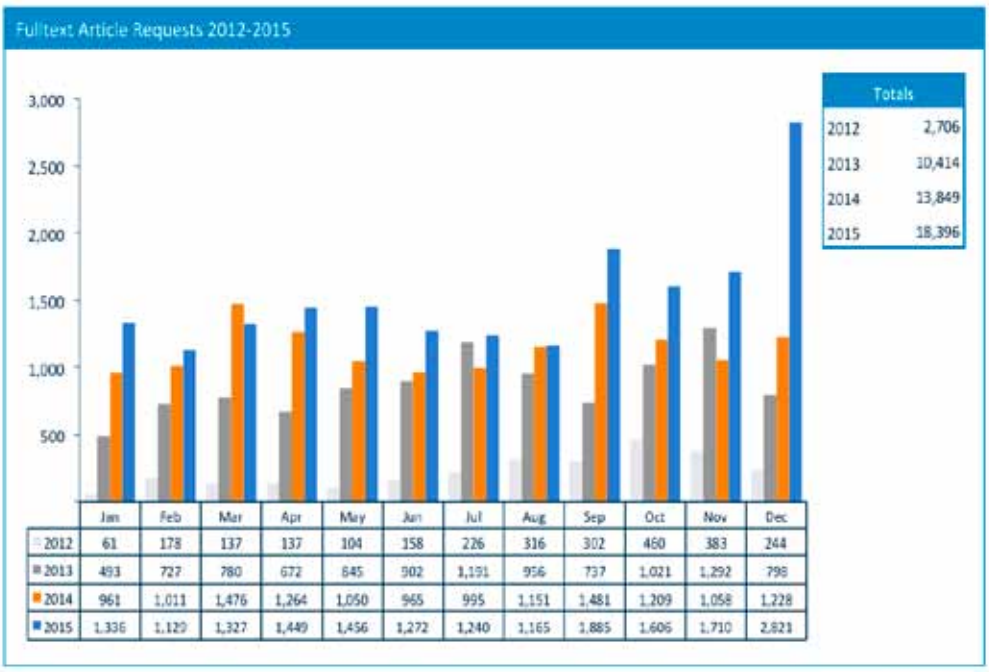
JOHANN HEURAS
Eröffnung

Auryn-Quartett
Juan Crisóstomo de Arriaga: Streichquartett Nr. 3, Es-Dur

Impressions of the New KLI Building

5.2 *Biological Theory*

Biological Theory, the KLI´s international, peer-reviewed journal that is published together with Springer (since 2011) is now available in 6.200 institutions as part of online deals. In 2015, more than 18.000 full-texts articles of the journal were downloaded. Readers of *Biological Theory* come from all over the world: in particular the U.S.; the UK; Canada; Australia; and many other European, Asian, and Latin American countries.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2012	61	178	137	137	104	158	226	316	302	460	383	244
2013	493	727	780	672	845	902	1,191	956	737	1,021	1,292	798
2014	961	1,011	1,476	1,264	1,050	965	995	1,151	1,481	1,209	1,058	1,228
2015	1,336	1,120	1,327	1,449	1,456	1,272	1,240	1,165	1,885	1,606	1,710	2,821

(Source: SpringerLink)

5.3 Public Outreach Activities

European Researchers' Night 25th September 2015

Aula der Wissenschaften, Wien

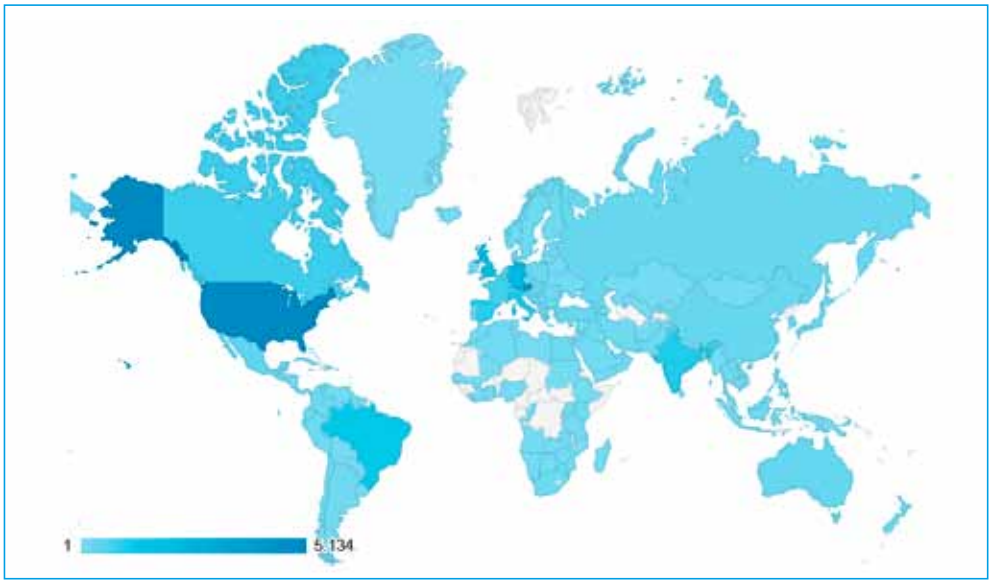
Organization: State Government of Lower Austria

The KLI participated in the European Researchers´ Night 2015 that was organized by the Office of the State Government of Lower Austria. The European Researchers´ Night is a Europe-wide public event dedicated to popular science and fun learning. At the Aula der Wissenschaften in Vienna, 100 researchers at 50 stations welcomed more than 2500 attendees informing them about what research does for society and promoting research in Austria.

5.4 KLI Website Traffic

In 2015, 27.000 people – 20.000 new and 7.000 returning guests – have visited the KLI Website. Of the 27.000, about 5.000 visitors were from the United States and Austria, each; 2.000 from Germany; 1.600 from the United Kingdom; and around 1000 from Brazil, Italy, India, Spain, Canada, and France, each. Other visitors came from various countries in Europe, Latin America, and Asia. The main pages of interest were the webpages about people (fellows, staff, board of directors, external faculty, and advisory board); the KLI events; the KLI´s introduction page; and information about KLI fellowships.

Visitors on the KLI Website



5.5 Acknowledgment

The KLI is grateful to the Office of the State Government of Lower Austria, Division for Science and Research for additional financial support that contributed to the pursuit of the KLI´s scientific endeavors.