

From DARWIN to this day and beyond: The WILLI-HENNIG-Symposium in Stuttgart-Hohenheim 2009

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The past year 2009 saw worldwide celebrations of CHARLES DARWIN'S 200th birthday as well as the 150th anniversary of the first publication of his seminal book "On the Origin of Species". Particularly extensive celebrations took place in Stuttgart, a city with a long-term history in evolutionary research. Fossil finds have been made regularly in the area of Stuttgart, and Palaeontology has a long tradition in Stuttgart, supported by the highest ranks in science and politics at all times. FRIEDRICH I., the first King of Württemberg, is reported to have died from a cold he caught when supervising the excavations of mammoth remains in October 1816 near Stuttgart. GEORGE CUVIER, the eminent French natural scientist, studied from 1784 to 1788 at the "Hohe Carlsschule" in Stuttgart, an elite school for higher education. Here, CUVIER received his first training in dissection methods and, most likely, also encountered his first fossils in the natural history collection of the Duke. This collection, which later became the Museum of Natural History (Staatliches Museum für Naturkunde Stuttgart), houses one of the finest palaeontological collections worldwide, including the 250–300,000 year old Steinheimer Schädel (Steinheim Skull) found in the area in 1933. WILLI HENNIG, the founding father of phylogenetics, from 1963 until his death in 1976 headed the Department for Phylogenetic Research, which was established especially for him at the Stuttgart museum. In Tübingen, only a few kilometers south of Stuttgart, FRANZ HILGENDORF obtained his doctoral degree in 1863 with a thesis on the phylogeny of fossilized water snails collected in the area, a study considered the first palaeontological demonstration of DARWIN'S theory, only four years after the publication of "The Origin of species".

The events celebrating evolutionary biology in Stuttgart, in most cases jointly organized by the Museum of Natural History, and the two Stuttgart Universities (Universität Hohenheim, Universität Stuttgart), comprised a six months exhibit on Evolution ("Fluss des Lebens; Flow of Life") at the Museum of Natural History, a series of public lectures at Hohenheim ("DARWIN reloaded") and Stuttgart Universities and at the Museum, a summer school on Evolutionary Biology, and the 3-day WILLI-HENNIG-Symposium. The present issue of "Palaeodiversity" presents the epilogue of the activities from all the DARWIN-activities 2009 in Stuttgart: In 13 chapters, it contains the essence of some of the most impressive talks at the WILLI-HENNIG-Symposium.

The rapid development of evolutionary biology caused by powerful new methods and theoretical approaches has yielded fascinating results and novel insights into various aspects of evolutionary biology, for example phylogenetics, speciation (allopatric, sympatric, hybrid), origin of modern-day mammals (super-trees), and phyletic origin of organs such as vision (master gene concept), to name but a few. Not unexpectedly, however, this progress also caused different views and conclusions and some of the new concepts remain controversial within the scientific community. Thus, the aim of the WILLI-HENNIG-Symposium was to bring together scientists in the symposium which express opposing views, with the clear intention to demonstrate the hypothesis-driven scientific approach to investigate open questions. We invited scientists working on all different facets of modern evolutionary biology, including phylogeneticists, taxonomists, palaeontologists, geneticists, evolutionary anthropologists, and embryologists. Although working on the same topic, the evolution of life, scientists from these diverse fields do not meet regularly at the same conferences. It is our deep belief, however, that interactions between active scientists working in the different fields are much needed, to secure a lively dispute and to go on to explore the next frontiers of evolutionary science.

A further requirement for events such as the WILLI-HENNIG-Symposium is represented by the impact of evolution on human society and politics. Public discussions on evolutionary biology can not be avoided, especially as non-scientific ideologists with missionary tendencies increase their efforts to spread ideas on so-called "creationism" and "intelligent design" and the society and its political representatives need to be kept informed about state-of-the-art evolutionary biology. While most groups in society and politics in Germany acknowledge the importance of evolution for human society, the level of information in many cases is poor. Evolutionary biology is of utmost relevance for human society, particularly with respect to medicine, protection of the environment, health and educational politics and provides numerous direct benefits, for example the development of new medical therapies and technical advancements. It is therefore necessary to take a firm stand against non-scientific attempts to challenge the theory of evolutionary descent, which lately seem to take ground in Germany as well. Our clear position as scientists

has to remain that evolution is a science and uses scientific terminology and methods, i. e. puts up hypothesis and experimental approaches. Therefore, while the symposium primarily served academic purposes, two evening lectures at the museum were meant to reach out and make evolutionary biology visible to the general public.

The main themes chosen for the Symposium and the review articles united in this issue reflect the important and controversial topics in current Evolutionary Biology. The Symposium started with a session on **Origin of Life**, which still seems to represent an enigma in evolutionary biology. The many opponents to evolution as a science pinpoint this as a major weakness that cannot be explained without invoking supernatural powers. Speakers in the symposium presented some of the most up-to-date concepts of how reproducible systems can arise from inorganic materials and outlined directions of future research in this area (see STRASDEIT, this issue).

WILLI HENNIG, the name patron of the symposium, was the most influential protagonist of **phylogenetic research** worldwide (see SCHMITT, this issue). Since then, phylogenetics has witnessed dramatic changes due to the advances of molecular techniques and particularly the increasing amount of genomic data. This has led to considerable revisions of textbook knowledge on the tree of life in the last decade, although changes have not been universally accepted. On the other hand, it is becoming increasingly clear that molecular data always have to be sensibly considered in the context of classical morphology and anatomy, particularly when issues such as speciation are discussed. The chapters by STOECK & STOCK, NIELSEN, and BININDA-EMONDS illuminate this conflict between classical and molecular evidence from all different angles. The relevance for this subject stems not the least from a need to train undergraduates about how phylogenies are built and how to reach a scientific consensus about phylogeny. In addition, it offers the opportunity to present evolutionary biology as a modern and dynamic field of science. The **mechanisms of speciation** are at the heart of modern evolutionary biology, just as in DARWIN's days (see SUDHAUS, this issue). The current discussion centres around the definition of species and the relevance of sympatric mechanisms for speciation. As species definition is the prereq-

uisite for phylogeny, this discussion has a wide impact on evolutionary biology in general. The Symposium was attended by some of the most prominent representatives of present day research on speciation (ROSEMARY and PETER GRANT, AXEL MEYER). The lively discussions demonstrated the fascination of evolutionary science to the young attendees of the symposium.

Recent years have seen a plethora of discoveries in evolutionary biology by the study of developmental processes, made in the new discipline of **EvoDevo (Evolution of Developmental Processes)**. What was clear to DARWIN but too complex to be addressed has seen an enormously rapid advance due to modern molecular and embryological technology. The evolution of body plans and their phylogeny has become accessible by studying the evolution of the respective embryological programs (see AVEROF, this issue; TECHNAU, this issue; VICK & BLUM, this issue). More recently, progress has also been made in the understanding of microevolutionary changes, for example the variation of beak morphology in Darwin finches. As the field of EvoDevo has been one of the most productive in recent years, researchers from other areas of evolutionary biology will profit a great deal from being exposed to these new concepts and their potentials (see GEHRING, this issue).

We are happy that this issue not only features review chapters from the symposium but also original work from BECHLY on fossil insects, from SCHRALLHAMMER et al. on the distribution of a trait in protists and its proximate versus ultimate causes, previously unpublished data from VICK & BLUM on crustacean development, and from SCHMITT on WILLI HENNIG's scientific style.

At the end of this three day gathering there was a broad consensus that the conference was profitable to all attendees, be it accomplished internationally renowned scientists or students just about to decide which direction of biology to choose for their own future career. Everybody felt that events like the WILLI-HENNIG-Symposium are much needed to present the fascinating width and depth of modern-day evolutionary biology to peers and laymen alike, and that a second WILLI-HENNIG-Symposium in 2013 on the occasion of HENNIG's 100th birthday would present a welcomed opportunity to renew and further this idea.

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