

# The Systematist

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## Editorial

### Back from a long absence

Dear Members ,

It will not have escaped your notice that our newsletter, *The Systematist*, has been conspicuously absent from our mailings to you for over a year. This unfortunate situation was the result of a host of unforeseen circumstances, and we sincerely apologize for the inconvenience. The Council of the Systematics Association is grateful for your patience and your continuing support. We know that receiving *The Systematist* is a valued bonus of being a member of the Systematics Association. We are therefore happy to now resume the publication of *The Systematist* with this new issue.

This issue of our newsletter is the first one to be published under the rule of our new President, Juliet Brodie, research phycologist



Juliet Brodie

at the Natural History Museum in London. As we welcome Juliet in her new role, we say goodbye to our past President Richard Bateman. Richard has been actively involved in the Association for many years, and as President for the past three years. We want to thank Richard for his strong leadership and we wish him all the best in his future endeavours.

Another recent development has

been a change of publisher for the Systematics Association Special Volumes. All our recent volumes have been published by CRC Press. (visit [www.crcpress.com](http://www.crcpress.com) for ordering information). Our upcoming volumes, however, will be published by Cambridge University Press ([www.cambridge.org](http://www.cambridge.org)). Some of the titles that you can look forward to in the near future are:

- *Palaeogeography and palaeobiogeography: biodiversity in space and time*
- *Climate change, ecology and systematics*
- *Descriptive taxonomy: the foundation of biodiversity research*
- *Evolution of plant pollinator interactions*
- *The importance of being small: does size matter in biogeography?*
- *Flowers on the tree of life*
- *The past, present and future of Southeast Asian biodiversity*

As with our published CRC volumes, members of the association can get a 25% discount on the volumes published by CUP. We will inform you on how to claim your discount when the first CUP volume will be published. Please visit our website if you have an idea for a conference and/or a book, and would like to apply for support from the SA.

**Details of the SA research grants, conference bursaries and funding for the organisation of meetings can be found at:**  
**[www.systass.org](http://www.systass.org)**

Cover illustrations: The late Chris Humpries (top photo; with permission from Dick Vane-Wright), and Olaf Bininda-Emonds, our *Inspirations* interviewee (bottom photo; copyright Olaf-Bininda-Emonds).

### The Systematics

**Association** is committed to furthering all aspects of Systematic biology. It organises a vigorous programme of international conferences on key themes in Systematics, including a series of major biennial conferences launched in 1997. The association also supports a variety of training courses in systematics and awards grants in support of systematics research.

Membership is open to amateurs and professionals with interests in any branch of biology, including microbiology and palaeontology. Members are generally entitled to attend the conferences at a reduced registration rate, to apply for grants from the Association and to receive the Associations newsletter, *The Systematist* and mailings of information.

For information on membership, contact the Membership Secretary, Dr Jon Bennett ([membership@systass.org](mailto:membership@systass.org)), St Pauls School, Lonsdale Road, London SW13 9JT, U.K.

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## In Memoriam

# Professor Christopher J. Humphries, 1947-2009

By Richard Bateman

It is often the sad task of a President to report the death of a past-President, but it is rare that the two incumbencies in question are separated by as little as three years. The fact that Chris Humphries had been ailing for some time, suffering from heart problems and having survived (barely) a liver transplant, in no way lessened the blow of his death on July 31st 2009, at the ridiculously young age of 62. The recent publication by Chris's long-time colleagues at the Natural History Museum, David Williams and Charlie Jarvis, of an excellent factual obituary for Chris (<http://www.telegraph.co.uk/news/obituaries/science-obituaries/6039183/Chris-Humphries.html>) leaves me free to pen a more personal valediction.

I first met Chris in the early 1980s, when he was arguably at the height of his very considerable powers. During the previous decade he had played a key role in catalysing the cladistics revolution, alongside such luminaries as Colin Patterson. Together with Kåre Bremer and Vicki Funk, he had successfully promoted new-fangled cladistic methods of phylogeny reconstruction within the botanical community. Having laid these essential foundations, he then explored the full range of biologically relevant applications to which parsimony could be applied, rattling off in short order co-authored or edited volumes on ontogeny, biogeography and conservation prioritisation before co-authoring a classic textbook on cladistic methods. All of these



Chris Humphries (photography courtesy of Dick Vane-Wright)

books justly became classics. Supported by numerous well-cited peer-reviewed papers and conference talks across the globe, these outputs undoubtedly had a profound impact throughout systematic biology.

Plaudits for Chris's pioneering intellect came relatively rapidly within the expanding cladistics field, leading to extensive citation and the Presidency of the Willi Hennig Society in 1989–91. However, bouquets arrived rather more slowly from the wider systematics/taxonomic community, which was not entirely certain that it wished to entertain this growing cadre of fractious young(ish) whippersnappers with their logical rigour, complex terminology and often aggressive proselytising. Nevertheless, Chris was soon warmly regarded in both the Linnean Society and the Systematics Association. His Vice-Presidency of the Linnean Society

(1994–8) was followed by the Presidency of the Systematics Association (2000–3) and the award of the Linnean Gold Medal (2001), together reflecting the mutually beneficial symbiosis that existed between Chris and both organisations. He was also awarded a visiting Chair and Individual Merit status by BBSRC. Many of us felt that Fellowship of the Royal Society would have been just reward for his earlier innovations, but this goal was probably made more difficult by Chris's admirable combination of certainty of purpose and disarming honesty (anyone doubting either quality should, for example, consult Chris's critical analysis of the SA Biennial conference over which he presided in South Kensington in 2001: *The Systematist* 18 (January 2002), pp. 1–3).

Chris was, in addition, a committed bon viveur and genuine polymath. The depth and breadth of his general knowledge was

brehtaking; it was a brave person who challenged Chris on topics as disparate as the history of science on the one hand versus modern art or jazz on the other. I used to chide Chris that the one topic for which he rarely found sufficient time was botany itself, but in truth, he viewed educating people as a higher calling. He would boldly inform senior (sometimes dangerously senior) colleagues of the error of their ways if they had not yet subscribed to hard-core cladistics. The roll-call of junior colleagues who benefited considerably from Chris's boundless advice and encouragement is long and ultimately prestigious – like Miss Jean Brodie, Chris had the ability and charisma to acquire many life-long protégés. Moreover, unlike Miss Jean Brodie, Chris was happy to interact with the wider populus; the tower in which he resided in later years at the Natural History Museum was certainly not built of ivory.

So, I return full circle to recount my earliest meetings with Chris, which occurred when I was a part-time undergraduate (and committed pheneticist) determined on pursuing a career in sedimentary geology. The encounters did not take place in pubs or involve drafting indecipherable diagrams on the backs of beer mats – that came later. No, I first met Chris in the herbarium of the Natural History Museum at its centenary exhibition in 1981. Bracketed by expositions of phenetics and authoritarian evolutionary scenarios, Chris was selling cladistic methods with the style and vigour of a Pettycoat Lane stallholder. Once lured to his stall Chris treated me to a thick wad of photocopied articles from *Nature* detailing the furore caused by the Museum's recent switch to cladistics-dominated exhibits. Scratching my head over these peculiar articles on the train back to St Albans, I decided that I wanted to know more. Thus, the scene moved to the Friends Meeting House in

Hemel Hempstead, one Saturday afternoon several months later, where Chris had kindly agreed to lecture the heterogeneous membership of the Hertfordshire Natural History Society on the importance of recognising that the lungfish and the cow are more closely related to each other than either is to the salmon.

Few authorities of Chris's calibre would have wasted their valuable time on such a parochial gathering, yet his enthusiasm and commitment shone through and thereby nudged my professional life in a subtly different, yet irrevocable, direction. I am confident that Chris's influence on both systematics and systematists was – and remains – profound.

**Richard Bateman** was President of the Systematics Association from December 2006 to December 2009.

## Reports from the 2009 Biennial

### Asking the right questions: a personal account of the Leiden Biennial

As one of relatively few UK-based delegates (only 35 out of 260, in part a reflection of these credit-crunch times), and one of the few people who have attended all seven SA Biennials to date, I felt I should pen a few comments on the recent *Systematics 2009* conference in Leiden (10–14 August, 2009). This meeting represented not only the seventh Biennial conference of the Systematics Association, but also the first meeting of *Biosyst EU*, which currently encompasses five European systematics societies, based in Austria (NOBIS), France (SFS), Germany (GfBS), Switzerland (SSS) and the UK (SA).

The Swedish society joined the consortium in Leiden, and further systematics societies are planned for Italy and for Belgium and the Netherlands combined.

Leiden is a great city: geographically central, with a first-rate travel infrastructure, a relaxed atmosphere and lots of students (the conference was held during fresher's week, so we witnessed everything from canalside mud-wrestling to slightly inebriated bicycle collisions). The sessions were located in the buildings of the Leiden University Medical Centre, in close proximity to both the central railway station and the excellent Naturalis museum. While rushing from one session to another, we rapidly grew accustomed to passing patients and ambulances en route. It was quite an intensive week, with four days (Tuesday to Friday) of symposia and contributed sessions; at one point I counted two symposia, one contributed session and a workshop running concurrently. The general format followed the tried-and-tested one of previous SA Biennials, including one innovation from the Edinburgh Biennial, the keynote "how-to" lectures, which provided an excellent start to each day throughout the conference. Keynote lectures were presented by Sebastian Shimeld (mining genomes), Henning Scholz (biodiversity heritage library for Europe), Isabel Sanmartin (statistical historical biogeography), and Mitsuyasu Hasebe (land-plant evolution).

I also attended at least parts of some very good symposia. I participated in the *Flowers on the Tree of Life* symposium, and therefore paid it the most attention; it included both students and established researchers, and was one of the best symposia in its field that I have attended in recent years. The other four conference symposia covered a wide range of highly relevant topics: *Plant-pollinator interaction*, *The importance of being*

*small, Information technology in systematics, and Evolutionary response of high-mountain biotas.*

The concurrent contributed papers sessions were usefully themed into groups, mainly in a laudable (and partly successful) attempt to confine the aforementioned dashing between auditoria to the breaks between sessions.

As at all previous Biennials, numerous student talks (both contributed and invited) represented the icing on the cake. Students do seem to give better talks than they used to ... in fact, there appeared to be no real difference in quality of talks between students and established lecturers. I don't think the advent of PowerPoint (now ubiquitous) is the only reason for this; in fact, PowerPoint can be rather formulaic, and many people fall into the trap of designing a slide as though it was a page of a book, bearing several reduced images. My impression is that, at least in the systematics community, students seem to be more aware of the broader implications of their work, and hence address better questions.

As the then current SA president, Richard Bateman [Juliet Brodie has taken over the presidency in December 2009, ed.], noted during his comments at the closing ceremony, there was a good balance of topics in keynotes, symposia and contributed sessions, with no real dominance of any one taxonomic group or research topic. However, there remains a need to attract more descriptive taxonomists, palaeontologists and prokaryote specialists, and to maintain links between high-tech molecular science and the rest of natural history, particularly in the current climate of global economic decline and environmental change. Richard's comment that our dear-departed former president Chris Humphries would have emphasised the need in future Biennials both to maintain terminological rigour and promote a reasonable measure of

controversy certainly resonated with the SA delegates present.

Each society contributed to the organisation of the meeting, especially the two largest and longest-established, SA and GfBS. The GfBS effectively managed the expanded student prize competitions for talks and posters. Peter Wilkie's stall of SA T-shirts and posters in the conference foyer proved popular. However, as usual the local organisers bore the brunt of the administrative work, and the conference ran remarkably smoothly. I look forward to being back in the UK for the eighth SA Biennial in 2011, but equally I support the intended goal of holding a second Biosyst EU meeting in 2013.

**Paula Rudall**

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## **Biennial symposium on *Flowers on the Tree of Life***

The symposium was organized by Livia Wannorp and Louis Ronse De Craene, as part of the First meeting of Biosyst EU 2009, Seventh Biennial Conference of the Systematics Association, and 11th GfBS-Jahrestagung, during August 10-14th 2009, in Leiden. The aim of this symposium was to bring together experts on flower morphology and development to highlight the importance of flower morphological studies in the age of genomics.

Scientific biological research is dominated by genetics nowadays. This field of research has led to a tremendous advance in systematic botany and evolutionary developmental genetics. Nevertheless this research has grown at the expense of more traditional approaches, such as

morphology, embryology, palynology, and cytology. Studies of flowers, especially the study of floral morphology and anatomy, have become the neglected children of systematic botany. With the successful expansion of molecular systematics, morphological evidence has been increasingly put aside as old-fashioned or shunned as a nest of homoplasies. However, with increased stability of the Angiosperm Tree of Life, the value of flower morphology becomes increasingly obvious as a worthy counterpart of molecular characters in phylogenetic studies, and as a source of data to help clarify floral evolution and the underlying mechanisms in flower development. There are still major parts of the tree that need to be explored. For example, there are angiosperm groups whose positions in the system are still unresolved and genera (even families) whose flower morphology and ontogeny is either poorly or completely unknown. This lack of knowledge is limiting our current understanding of the evolution of flowers and their structures considerably, as well as our general comprehension of the systematics of angiosperms.

A second major reason for organizing this symposium is a need to halt the continuous erosion of expertise in morphology and systematics that has been going on for several decades. Alas, morphology and general botany are increasingly scrapped from university curricula in the constricted atmosphere of 'efficient' research funding, with retiring experts not being replaced and with an increased specialization of botany on offer. This has two unfortunate consequences, first that expertise becomes gradually eroded with far fewer generalists around, and second that botany becomes downgraded as a slave to plant physiology or biochemistry. Very few universities still have a morphology-based, integrative

botany course. However, researchers in disciplines dealing with living organisms are increasingly confronted with a lack of knowledge of structures, with dire consequences for inaccurate interpretations and lack of perspective to their research. The understanding of the morphology of organisms in a broad range of taxa is essential to make links between observed patterns and helps the researcher to connect with the real world. Sadly, very few people are able to make that step nowadays and there is need for more biodiversity-centered research and education.

The symposium brought together major players in the field of flower morphology and anatomy and was built around three major themes: use of floral characters in phylogeny reconstructions, theoretical background for morphological characters, and case-studies of specific groups of angiosperms whose flower morphology is controversial, unexplored or in need of further research.

The symposium ran over a whole day and included 13 speakers. Keynote speaker was Dennis Stevenson (New York Botanic Garden) who discussed the difficulty of interpreting the gynoecium of angiosperms depending on whether the sister group of angiosperms are gnetopsids or cycads, emphasizing the value of morphology. Richard Bateman (Royal Botanic Gardens, Kew) addressed a comparable question, viz. the early origins of flowers. The answer to the question whether ancestral flowers were unisexual or bisexual remains highly ambiguous. Both presentations stressed the importance of having a reliable phylogeny, which cannot be solved by molecular studies alone because DNA cannot be extracted from fossils.

A number of presentations tackled questions of floral development, such as the significance of a

centrifugal initiation in shaping floral architecture and evolution (Paula Rudall, Royal Botanic Gardens, Kew), or the value of floral ontogeny for discussing homology (Alexander Vrijdaghs, Catholic University Leuven).

Talks by Jim Doyle (University of California, Davis) and Peter Endress (University of Zurich) focused on the early diversification of flowers in basal angiosperms and the importance of morphology for addressing the inclusion of fossils in phylogenetic studies. A better knowledge of floral development and underlying genetics can help in interpreting features of fossils via reciprocal illumination.

Reconstruction of floral evolution is possible by mapping floral characters on phylogenetic trees to infer the polarity of changes in character expression. The talk of Maria von Balthazar (Swedish Museum of Natural History Stockholm) on early floral evolution of Laurales related well with previous presentations in the description of the floral diversity in fossil taxa.

Evolution of floral characters in major groups of angiosperms was presented in a series of papers within the framework of improved molecular phylogenies. Sophie Nadot (University of Paris-Sud) used a recently published supertree of palms to reconstruct the evolution of the androecium. Merran Matthews (University of Zurich) presented floral evolution in Rhizophoraceae and relatives in the complex Malpighiales. Jürg Schönenberger (University of Stockholm) presented the potential synapomorphies of a basal clade of Ericales, comprising Balsaminaceae, Marcgraviaceae and Tetrameristaceae.

The value of comparative morphological studies of flowers was shown by Julien Bachelier (University of Zurich) in the comparison of the characters of the gynoecium of *Nitraria* and

*Peganum*, and by Alexandra Ley in the diversification of the complex flowers of Marantaceae. Louis Ronse De Craene (Royal Botanic Garden Edinburgh) presented the ontogenetic support needed for the interpretation of petals in *Napoleonaea* (Lecythidaceae). Finally, Gerhard Prenner (Royal Botanic Gardens, Kew) investigated the link of flower complexity in *Acacia celastrifolia* with evolution of flowers in Leguminosae.

This symposium has clearly demonstrated that there is a great potential to re-establish floral morphology as center-stage in botanical research and on the tree of life, putting more emphasis on the definition of sound characters that can be used to clarify relationships of plants and the intrinsic evolution of their flowers. Morphology is important because it is a synthetic science that connects and builds on information of multiple sources of botany.

As the world's flora is under increasing threats, understanding of plant structure becomes increasingly vital and experts with a global view on biodiversity become a necessary breed. Let us hope that there is room for a renaissance of morphology and that the present symposium becomes commonplace in the future.

A forthcoming book entitled "Flowers on the tree of life" and published by Cambridge University Press in collaboration with the Systematics Association, will include chapters generated by the talks and discussions of this symposium, along with a few additional chapters from extra invited specialists.

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## **Evolution of Plant-Pollinator Relationships: a symposium and a book**

A symposium dedicated to the evolution of the plant-pollinators relationships (EPPR) was a remarkable success during the last *Systematics* meeting. Inspired by the abundant literature about the Biology of Pollination (see the references below), and the last progress made in understanding evolution of both plants and pollinators (Danforth et al. 2006a,b; <http://www.mobot.org/MOBOT/research/APWeb/>), this symposium was conceived as a forum specifically dealing with varied aspects of evolution of the very particular interface between plant and animal communities that is pollination.

The increasing attention devoted to pollinators can be considered as the consequence of (i) the importance of the ecological service they are providing and (ii) the threats weighing on many of their populations worldwide (Kearns et al. 1998; Kremen & Ricketts 2000; Aizen et al., 2009; Quintero et al. 2009; *Apidologie* 40(3); <http://www.internationalpollinatorsinitiative.org>). The economic value of pollination by insects -recently estimated at 150+ billion €/year (approximately the fortune of the 5 World Richest People)- is central in the focus set on pollinators and pollination (Gallai et al., 2009). Moreover, the observations of global population regressions and diversity erosion, under the action of the varied factors usually associated with global change are increasing the urgency of better conservation measures -and thus better supporting knowledge- for pollinators.

In addition to this econocentric interest, pollinators, pollinated plants and more broadly the pollination systems also emerge as

wonderful models for the study of adaptation, co-phylogeny and speciation (e.g.), topics in which a wealth of questions are continuously puzzling the scientific community. Regarding these multiple interests of pollination and pollinators in very distinct contexts, improvement of the understanding of the evolution of the interactions between pollinators and pollinated plants within their ecological webs, as well as renewed models for evolution of pollination in space and time, are highly desirable.

However, despite the intense research effort produced in some research groups, the understanding of the (somehow) parallel evolution between pollinators and pollinated plants remains largely sketchy, as is this of the different interacting groups. In such a context, the syntheses formerly published (Waser & Ollerton 2006; Harder & Barrett 2007; Dafni et al. 2005; Chittka & Thomson, 2001; Proctor et al. 1997), and like, hopefully, the EPPR book in preparation, are major stepping stones of the realized progress on which further reflection can be built. The scope of the book in preparation -following the EPPR symposium through the contributions of several of the speakers - will aim at bringing together the contributions from a large panel of top level specialists (or research groups) who have explored the evolution of the pollinator-pollinated plants relationships through an array of different approaches.

The link between systematics and the pollination questions can be not intuitive. There is however, in any evolutionary approach of this problem, a strong systematic component, which makes a natural link between the topics presented during the EPPR symposium and the defined scope of *Systematics 2009*. Presenting a symposium and a book project focusing on pollination in the framework of a systematics conference was a deliberate choice

of putting a special focus on the systematic/evolutionary aspects of the pollination questions.

The talks presented during the symposium and the contributing chapters of the EPPR book project can be subdivided into 3 broad sections: (i) Evolution of the pollination webs; (ii) Phylogenetic approach of the evolution of pollination; (iii) Evolution of pollination, perception and cognition.

The questions related to evolution of the pollination webs are tightly related to the conservation issues outlined above. The methods and the investigation in this very integrative field are naturally complex regarding the multidimensional-multifactor nature of interactions within webs of species. Studying pollination webs implies the study of not one isolated well known species of pollinators, but study of multiple, variably well characterized, interacting species, which can compete for niches and resources within niches. The niches themselves are also complex, due to the plant-diversity, the multiplicity of the micro-ecological conditions, the geographical gradients, etc. The contributions in both the symposium and the book in preparation pinpoint together the theoretical aspects of pollination evolution and varied study cases. A particular focus has been set on evolution of the plant sex systems, emergence of unusual floral rewards, and relationships between herbivory and pollination. At the same time, examples of pollination webs in South Africa and South-America are exposed. This topic dedicated to evolution of the pollination webs is surely one of the most debated in literature. It is important to (i) add a new update to this very complex area, and (ii) start with these questions in order to outline the framework in which the questions of both subsequent topics are addressed.

The importance of phylogenies and phylogenetic methods for the

description and understanding of pollination evolution has been one of the motivations behind the proposition of the EPPR symposium. Independent from the questions addressed, a clear view of the evolutionary relationships within the considered groups of plants and animals, as well as between them, is necessary to deal with the problem of evolution of the relationships between plants and their pollinators. Phylogenetics is thus central in studying the evolution of pollination, and the methods for to comparing phylogenies, dating clades using molecular clocks, tracing evolution of characters over trees, etc., are strongly broadening the field of phylogenetics in evolutionary pollination biology. Surprisingly, despite this importance of phylogenetics, very few specific methods have been developed so far for the study of pollination as has, for example, been the case for biogeography (Ree & Sanmartin 2009). Evolutionary pollination biology has so far mostly benefited from the general progress made in phylogenetics. Phylogenetic methods, issues and perspectives are developed in the second section of the book.

For a long time attention has been paid to (i) the ways in which pollinators can detect their feeding sources and (ii) the evolutionary strategies developed by plants to increase the relative interest they receive from their favourite pollinators. The concept of the pollination syndrome was developed to circumscribe these questions (Faegri and van der Pijl 1979; Proctor et al. 1997). With the increased ease of access to plant and animal genomes, transcriptomes, and physiology, a wealth of new directions for investigation have been opened wide in this part of pollination biology. Our understanding of the ways in which pollinators perceive their environment, and of their feeding (and non feeding) substrates is

constantly improving. In addition to being of interest in ethology, physiology, and neurobiology, these domains are providing a huge quantity of data of a new kind, providing many valuable insights to be used in the approach of the systematic questions. These topics will be extensively developed in the third closing section of the EPPR book.

The EPPR book largely based on the contributions of numerous scientists in the EPPR symposium presented in the framework of *Systematics 2009* should be a reference for questions concerning the evolution of pollination systems in varied contexts. It should also document the ways and the means in which information from pollination biology and related behavioural sciences (sensu lato) could be used to address issues in systematics and evolutionary Biology.

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## BioSyst symposium on the *The importance of being small: does size matter in biogeography?*

This was a one-day symposium at *Systematics 2009*, the First BioSyst conference – Leiden, The Netherlands, August 13th 2009.

Biogeography is nowadays an established branch of ecology, with its rules and statistical analyses. Methods incorporating historical and ecological biogeography can, in principle, disentangle the relative contribution of dispersal and vicariance as the main drivers shaping the patterns of distribution of animals and plants we observe worldwide. So far, so good, but it may not be so easy. One problem is



that for many organisms we do not even know their patterns of distribution, so how can we even try to approach the study of the underlying ecological and historical processes? This is especially true for organisms smaller than 2 mm, for which the biogeographic debate is not about dispersal versus vicariance, as for larger organisms, but about whether biogeography exists or not.

The potential lack of biogeography for micro-organisms is an old idea, going back to Beijerinck (1913) and Baas-Becking (1934), and is known as the 'everything is everywhere' (EisE) hypothesis. Small size and an ability to enter dormancy, and thus to produce dormant propagules might explain why prokaryotes and some microscopic eukaryotes have acquired global distributions. The recent debate on the EisE hypothesis re-originated after the contributions by Fenchel and Finlay (e.g. Finlay & Clarke 1999; Fenchel & Finlay 2004), and currently different research groups are trying to test its reliability on different model organisms. Thus, it was considered timely to organize a full-day symposium on this topic, and that was held during the BioSyst meeting in Leiden, a joint conference of all the European systematics associations.

Why a symposium on biogeography during a systematics meeting? The current debate on the EisE hypothesis divides scientists into two major groups (Whitfield 2005). One group follows the EisE hypothesis in its original form, assuming that species differences in samples from different areas occur because of environmental differences, and not because of restricted dispersal. The other group proposes that traditional taxonomy of microscopic organisms based on morphological characters only is not able to determine their actual diversity, and cosmopolitan ranges therefore result from

misidentification and the lumping of spatially isolated lineages. Thus, the reliability of the results of the everyday job of systematists and taxonomists is at the center of the debate.

The way species of micro-organisms are identified can completely change the scenario. The EisE hypothesis often holds true when species are defined using traditional taxonomy based on morphological characters; however, micro-organisms often do not have many morphological characters. Moreover, molecular evidence is revealing a high degree of cryptic diversity, restricted dispersal and phylogeographic patterns in a variety of microscopic organisms, including both prokaryotes and eukaryotes (e.g. Martiny et al. 2006; Green et al. 2008), challenging the EisE hypothesis.

During the symposium we had an overview of current knowledge of the biogeographic patterns of different taxa, including thermophilic bacteria, ciliates, amoeboid protists, diatoms, green algae, cacti-associated yeasts, macro-fungi and microscopic animals. We also had a review of the variety of methods currently used to obtain large amounts of additional empirical evidence, especially performing Next Generation Sequencing of environmental samples. All the talks at the symposium provided increasing evidence that microorganisms have distinct distributions and hence biogeographies.

The issue now is whether we can have a strong theoretical framework to understand the large-scale spatial patterns in microorganisms. Part of the symposium was dedicated to the analysis and discussion of the available data, in an attempt to put the empirical evidence into such a unifying framework. Different theoretical approaches, derived from the biological properties shared between micro-organisms and from

simulations, were presented, deepening our understanding of the processes involved but with a caveat: similar patterns may mask very different processes.

On the one hand, one of the main messages from the symposium is that it is possible to find spatially limited as well as cosmopolitan microorganisms. These organisms are clearly more easily dispersed than macro-organisms, but there is a gradient in the differences and not a sharp biogeographical threshold between small and large organisms. On the other hand, generalizations may be dangerous and misleading, as different taxa respond in different ways to the same habitat. Biological properties other than size indeed influence the patterns of distribution of micro-organisms. Thus, further work needs to be undertaken by taxonomists to gather more data, using both traditional morphological approaches and modern molecular phylogenetic and phylogeographic analyses.

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## Other Meeting Reports

### Late Triassic Terrestrial Biotas and the Rise of Dinosaurs

With support from *The Systematics Association*, Randall Irmis (University of Utah), Max Langer (Universidade de São Paulo) and I convened a half-day symposium on *Late Triassic Terrestrial Biotas and the Rise of Dinosaurs* as part of the 69th Annual Meeting of the Society of Vertebrate Paleontology (University of Bristol, Bristol, 23rd-26th September 2009). More than 1000 attendees were present at the meeting, and our symposium was very well-attended (probably around 200 individuals at any one time) despite running concurrently with three other sessions.

The Triassic Period is crucial to understanding the evolution of the modern vertebrate fauna. It began with impoverished diversity levels following the end-Permian mass extinction, and ended with a diverse fauna of terrestrial tetrapods that includes the first stem representatives of the turtle, mammal, lepidosaur, and crocodylian lineages, as well as the first radiation of dinosaurs. Dinosaurs subsequently dominated

large bodied terrestrial faunas for the next 135 million years. Our symposium focused specifically on the topics of dinosaur origins and Late Triassic biotic turnover. Sixteen invited speakers, each a leading researcher in the field, from four continents and seven countries (UK, Germany, Poland, the USA, Brazil, Argentina, South Africa) spoke on a range of interrelated topics. These included talks that presented fundamental new systematic data (descriptions of new fossil assemblages, taxonomic revisions, new large-scale phylogenetic analyses, quantification of agreement/disagreement in existing phylogenies) and new geological data (e.g. constraints on the dating of fossil assemblages), as well as a number of talks that attempted to combine these systematic and geological data to examine macroevolutionary patterns (e.g. diversity patterns, rates of character evolution, temporal variation in morphospace occupation, biogeography).

Judging from the responses of the participants and the audience, the symposium achieved its goals of presenting the latest and most significant research in the field and stimulating further research and collaboration. We are currently preparing proceedings papers for a special volume of *Earth and Environmental Science Transactions of the Royal Society of Edinburgh*. The grant of £500 from The Systematics Association was used to partially support the travel of two of our overseas speakers who lacked institutional funds to travel to the meeting. William Parker, of Petrified Forest National Park (Arizona, USA), spoke about revisions to the stratigraphy of the Late Triassic of the southwestern USA, and how, when carefully combined with new systematic data, this may yield new insights into Triassic faunal change. Fernando Novas, of the Museo Argentino de

Ciencias Naturales “Bernardino Rivodavia” (Buenos Aires, Argentina), spoke about the systematics of an important new fauna of Late Triassic dinosaurs from India. Both speakers gave excellent presentations, and their contributions may not have been possible without the support of The Systematics Association. On behalf of my co-conveners, Randall Irmis and Max Langer, as well as our speakers William Parker and Fernando Novas, I would like to thank The Systematics Association for their much-appreciated and generous support of our symposium.

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### Xth Symposium of the International Organization of Plant Biosystematists (IAPT interest group)

The meeting was held in the Vysoké Tatry Mountains in Slovakia, 2-4 July 2008. The International Organization of Plant Biosystematists (IOPB) was established in 1960, first as a Committee on Biosystematic Terminology of the International Association for Plant Taxonomy (IAPT), which became in 1961 an autonomous organisation, named IOPB, within the IAPT. Á. Löve, T. W. Böcher, V. H. Heywood, C. Favarger, W. Gajewski, H. Lewis, B. Lövkvist, H. Merxmüller and D. H. Valentine, were among the first members of its executive. At that time the focus of IAPT was mostly on taxonomy in the more strict sense and nomenclature in particular, while the scope of the new organisation is on experimental taxonomy, cytotoxicology,

cytogeography, genecology, biometry, microevolutionary studies and speciation. In 1983 IOPB became independent from the IAPT.

IOPB organises regular symposia and after the Montreal one in 1983 has started to publish also its own newsletter. Considerable focus was on publishing chromosome number reports. The hundred part series *IOPB Chromosome Number Reports* (called *Chromosome Number Reports* from the 67th part onwards), edited first by O. T. Solbrig and Á. Löve and later by Á. Löve only, was published in *TAXON* from 1964 to 1988. Under the editorship of C. A. Stace, this activity continued in the IOPB Newsletter, where eighteen issues parts of the *IOPB Chromosome Data* were published from 1989 to 2002. Since 2006 chromosome number records are published under the heading *IAPT/IOPB Chromosome Data* again in *TAXON*, with six parts already published (available online also from the web page [www.iopb.org](http://www.iopb.org)). Regular symposia were devoted to particular topics, just to mention some of the last few ones: *Plant evolution in man-made habitats* (Amsterdam, 1998), *The origin and biology of desert flora* (Albuquerque, 2001), *Plant evolution in Mediterranean climate zones* (Valencia, 2004).

After the Valencia symposium in 2004 it was acknowledged that the main reasons for the split of IOPB and IAPT disappeared and there was no particular reason to keep these two organisations separated. It was decided that IOPB should become an interest group of the IAPT and instead of publishing a newsletter, it has now its own column in *TAXON*. The organisation of regular meetings still is one of the main activities of this organisation. With this in mind, the Xth symposium of the International Organization of Plant Biosystematists was held in the Vysoké Tatry Mountains in Slovakia, and devoted to the

#### *Evolution of plants in mountainous and alpine habitats.*

The meeting in the Tatry Mts. was organised jointly by the Institute of Botany of the Slovak Academy of Sciences, Bratislava, Slovakia, Slovak National Taxonomic Facility, and the Department of Botany of the Charles University in Prague, Czech Republic. The International Association for Plant Taxonomy provided generous support for the meeting and the Systematics Association supported several participants from developing countries. Lectures were divided into sections devoted to phylogeography, biogeography, evolutionary processes in European and other mountain ranges, polyploidy, apomixis, molecular approaches in plant evolution, and ecological factors in plant evolution. A poster session was held as well. The 151 symposium participants represented 28 countries and they contributed 46 oral presentations and 52 posters.

The meeting started with the welcoming remarks by Gonzalo Nieto Feliner, IOPB President, Ivan Zahradník, vice-president of the Slovak Academy of Sciences, and Lubomír Hrouda, Head of the Department of Botany of the Charles University in Prague and the representative of the Tatry National Park.

A considerable amount of attention was paid to polyploidy, which was addressed by the largest amount of speakers. This reflects the considerable advancement of knowledge on this phenomenon. Peter Schönswetter (Vienna) reported on polyploid evolution and ecological differentiation in *Senecio carniolicus* (Asteraceae), a frequent element of acidophilic alpine meadows of the Eastern Alps and the Carpathians. The existence of three main cytotypes (diploid, tetraploid and hexaploid cytotypes) was discovered within its distribution area in the Eastern Alps together with frequent cytotype-

mixture within populations. Detailed study of diploids and hexaploids suggested a narrow altitudinal range of the hexaploid cytotype in the low-alpine belt and a much wider range of the diploid one, spanning both low-alpine and high alpine zones. Jan Suda (Prague) demonstrated the power of flow cytometry (FCM) in studies of polyploids. Estimating differences in nuclear DNA content, FCM offers many advantages over other methods, high speed and reliability in particular, which paves the way for large-scale surveys at the landscape, population, individual, and tissue levels. Suda showed in several example studies that representative samples yielded novel insights into the extent of intra- and inter-population ploidy variation, niche differentiation, and ecological preferences of particular cytotypes. Tod Stuessy (Vienna) presented a study of the white-rayed complex of *Melampodium* (Asteraceae) distributed in the southwestern U.S.A. and adjacent Mexico. Individuals analysed for AFLPs and cpDNA haplotypes have also been examined for ploidy level, which enabled formulation of hypotheses on the evolutionary origin of polyploids. In *M. leucanthum* and *M. cinereum*, diploids prevail in the western portions of their ranges and tetraploids in the eastern parts. The hexaploid, *M. argophyllum*, appears to be an allopolyploid, with *M. cinereum* being the paternal and *M. leucanthum* the maternal parent.

Biogeography and phylogeography represented other important topics of the symposium. Christian Brochmann (Oslo) reported on recent progress in the phylogeography of arctic and alpine plants. He showed that of particular importance for current arctic-alpine phylogeography will be the development of stronger links with the paleoecological community and groups working on predictive species distribution modelling and

GIS-based approaches to analyses of genetic data, as well as the development of new molecular tools based on pyrosequencing technology. Magnus Popp (Oslo) reported on the Afro-alpine region in Eastern Africa, which consists of isolated high mountains that act as biological 'sky islands', and which offer a particularly interesting system to address questions such as the relative importance of random long-distance dispersal versus gradual expansion via montane forest bridges during humid interglacials. Michał Ronikier (Kraków) presented results of the comparative phylogeographic study of alpine plants in the Carpathian mountain range that partly resulted from the international 6th EU Framework Programme project INTRABIODIV. Most species were characterized by a significant phylogeographical structure in the Carpathians and several well-supported regional groups were detected. A main genetic break supported by results from most taxa separated the Western and South-Eastern Carpathians, following the well-known phytogeographical boundary. Judita Lihová (Bratislava) reported on contrasting phylogeographic histories of two European *Cardamine* taxa. In the snow-bed species *C. alpina* two strongly divergent lineages were resolved, one Alpine and one Pyrenean, possibly representing cryptic species. While multiple glacial refugia were invoked in the Pyrenees, only a single one was inferred in the Maritime Alps - from which postglacial colonization of the entire Alps occurred, accompanied by a strong founder effect. In *C. resedifolia* the genetic structuring was rather weak and did not correspond to the main geographic disjunctions. The conspicuously different histories of these two species are likely associated with their different ecologies. Andreas Tribsch (Salzburg) addressed the importance

of refugia for evolution and biogeography of alpine and arctic-alpine plants. He stressed that potential refugia, where organisms were potentially able to survive climatic changes should be discriminated from realized refugia that are supported by biological data. Knowing the location of such realized refugia holds a key for understanding many (intraspecific) phylogeographic patterns.

The role of apomixis in plant evolution, with particular emphasis on the alpine plants represented another topic widely presented and discussed at the symposium. František Krahulec (Průhonice) compared the structure of the *Pilosella* agamic complexes in two Central European mountain ranges. The basic set of species in both areas is almost identical, but the set of hybridogenous species and recent hybrids resulting from hybridizations is different. Evidently, some rare events in the past triggered further evolution. Patrik Mráz (Fribourg) presented results of the study of *Hieracium alpinum*. While sexually reproducing diploids occur solely in the Eastern and Southern Carpathians, apomictic triploids cover the rest of the range of this species. AFLP data suggest polytopic origin of triploid apomicts with almost no genetic relatedness to the recent diploids. It seems that they are remnants of extinct diploid lineages. As presented by Anne-Caroline Cosendai (Vienna), of the three ploidy levels known ( $2n = 2x$ ,  $3x$  and  $4x$ ) in *Ranunculus kuepferi*, the diploids occur only in the Alps Maritimes on the western border and are sexual, whereas the tetraploid apomicts are more widespread and occur also in previously glaciated areas. AFLP data show as much genetic variation within the tetraploid populations as within the diploids, but each population has its own gene pool, suggesting founder events. Apomicts have superior colonizing

abilities and grow in a broader range of altitudes than the sexuals.

Abstracts of all presentations from the symposium are available on the IOPB webpage ([www.iopb.org](http://www.iopb.org)). Papers solicited for the symposium volume will be published in the IAPT series Regnum Vegetabile. The Next IOPB symposium will be held in Indian Aurangabad (Maharashtra State) in September of 2010 and will be devoted to the Evolution of plants from tropical to high mountain ecosystems, with a focus on Asia (further information can be received from the current IOPB president, Karol Marhold, [karol.marhold@savba.sk](mailto:karol.marhold@savba.sk), and local organiser Arvind Dhabe, [asdhabe2006@yahoo.co.in](mailto:asdhabe2006@yahoo.co.in)).

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## SRF Report

Local people asked us: "Where and why are you going that way?" "To get some fish", we answered. "But fishing is supposed to be with fishing-rods on the river bank, rather than with spades up on the mountain!" They were very surprised to learn that 40 million years ago the Caucasus mountains had been the bottom of the Tethys Ocean.

Why is this locality of fossil fishes near the Gorny Luch farmstead in the North Caucasus so important that we got a Systematic Research Fund grant? Because it is unique in both its age (latest Middle Eocene) and because of the high diversity of fish species collected here. The other European marine fish localities of the same (Bartonian) age yield very few fish

specimens, which are only fragmentary preserved.

The first step of our field season was the removal of soil at the site by using the spades. Then we took large blocks of the Eocene rock using the picks, and split these by knives into layers as thin as possible; the higher the number of splits, the better the chance of discovering imprints of fish skeletons. After reaching the level of fresh (not eroded) rock, it became too hard to get the large blocks using the picks only, and so we had to resort to using the mechanical saw for the first time.

The results of the field season of 2008 that was sponsored by the SRF grant were quite exciting. There were 179 discoveries of Eocene bony fishes in addition to 14 shark teeth (one of which was the biggest ever found there), 6 bugs, and 3 plant remains. Among others, the

relatives of billfishes *Palaeorhynchus parini*, 6 acropomatid perciforms *Synagropoides steparenkorum*, 5 specimens of bigeyes representing two different species, and 3 acronurus larvae of surgeonfishes *Caprovesposus* cf. *C. parvus*. The total number of bony fish taxa found in 2008 is at least 30. Among the unique discoveries there are four different perciforms, each of them representing taxa new to science, and a skull of a lophotid crestfish.

It is possible to reconstruct the paleoenvironment of the Gorny Luch locality as a deep marine basin with a stratified water column and anoxic conditions on the bottom, situated relatively close to the islands. Among the fishes small codlets predominated (most of the other fishes definitely fed on these). Herrings, tarpon-like fishes, scabbardfishes, lightfishes, as well

were made for the first time at the Pshekha River.

In conclusion, the field excavations in the North Caucasus carried out in 2008 thanks to the financial support of the SRF grant were highly successful.

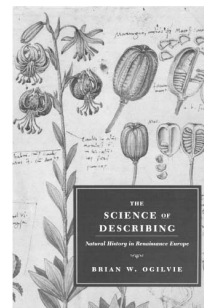
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## Book Reviews

### Erratum *The Systematist* 30

The names of the book reviewers in the last issue of *The Systematist* were accidentally omitted. John Stiller reviewed *Unraveling the algae: the past, present, and future of algal systematics*; Katja Peijnenburg and Stefano Mariani reviewed *Biogeography in a changing world*; Volker Buchbender reviewed *Pleurocarpus mosses: systematics and evolution*; Ronald Jenner reviewed *The regulatory genome: gene regulatory networks in development and evolution*.

### The science of describing: natural history in Renaissance Europe



Ogilvie BW. 2006. The University of Chicago Press, Chicago. ISBN 9780226620879 (hardback), US\$45; ISBN 9780226620886 (paperback),

US\$27.

It is quite astonishing to realize how very different times once were, looking out from our modern perspective as the involuntary but



Fishing by cracking rocks in the Caucasus mountains

bony fish remains include 29 imprints of the small codlet *Bregmaceros* cf. *B. filamentosus*, 2 fragments of big tarpon-like *Lyrolepis caucasica*, 22 imprints of a herring “*Sardinella*” sp., 16 complete and incomplete skeletons of a scabbardfish *Anenchelum paucivertebrale*, 13 fossil relatives of snake mackerels *Palimphyes pshekhaensis*, 12 lightfishes *Primaevistomias weitzmani*, 9 fossil

as fossil relatives of extant snake mackerels and billfishes were also common. The genus *Bregmaceros* indicates that the climatic conditions were close to tropical.

During brief journeys to neighbouring fish localities, which are of a younger age (Oligocene and Miocene), a number of fish and plant remains were also collected. Moreover, discoveries of Miocene centracanthid and carangid fishes

inevitable stewards of the planet's endangered biodiversity. Imagine that you would have found yourself to be a young lad or lady living in Northern Europe in the late fifteenth century, and possessed of a burgeoning interest in nature's bounteous productions. Where would you have gone for guidance, say to identify plants and animals in the field? Natural history didn't yet exist as an autonomous discipline, so you would have had to resort to self-study. Unfortunately, because moveable type hadn't been around for very long, printed books were scarce. Resorting to manuscripts, you either would be limited to the classical works of ancient Greek and Roman writers of many centuries old, or you would have had to rely on medieval herbals and bestiaries filled with folklore and symbolism. As Olgivie (p. 102) writes: "If bestiaries' readers learned a few facts about animals, that was incidental." Perhaps a visit to a botanical garden then? You would have had to be patient because the first botanical gardens lay several decades into the future still. In fact, in the preceding Middle Ages, the clutches of theology and superstition discouraged any penetrating study into nature's details. Medieval theologians considered such study as reprehensible and wicked behaviour. A superficial study of nature was allowed, but first and foremost to function as a mirror of ourselves. Nature could be probed for moral and spiritual guidance, not for the details *an sich*. As Olgivie points out, it was only after two developments in the fifteenth century that this situation was poised for change. First, an epistemological move away from essentialism and the search for eternal verities to focus instead on the individual and the particular. Second, the development of an aesthetic of the particular that connected the appreciation of beauty with that of knowledge of that

which is observed.

In this very learned book, Olgivie presents a meticulous, methodical and exhaustive study of the birth of natural history as an autonomous discipline. In the period between 1490 and 1630 natural history developed from a relatively inconspicuous if vital role as a handmaiden to medicine, agriculture and natural philosophy, to a discipline with its own goals and methods, and supported by a growing cadre of dedicated workers spread throughout Europe. Olgivie organizes his story chronologically, covering the period from around 1490 to 1630, and tracing the crucial steps in the individualization of natural history as a discipline bound by a unique set of study objects, research goals, methods of study, and standards of reporting and communication. The main body of the book is animated by perceptive analyses of the career-defining works of the most important practitioners in each time segment of natural history's gestation period. The gradual development of natural history into

history through the activities of North Italian humanists and physicians. The great naturalist Louis Agassiz famously remarked: "study nature not books." Yet, given the overwhelming Renaissance movement to go back to original sources of knowledge, this first generation of naturalists defied this future motto as they took it as their most important task to recover the lost and mutilated knowledge of the ancient Greek and Roman writers. These first natural historians were intent on establishing the veracity and value of the ancient manuscripts that described the diversity and medicinal uses of plants by sifting out textual impurities introduced by careless or overly creative translators (manuscripts could have gone through various rounds of translation from the original Greek to Arabic to Latin back to Greek), and by identifying the plants recorded in these works in the wild. The mended works would then be used as the basis for reforming medical education, principally forming the basis of *materia medica*.

**The aim of the new naturalists was not discovering nature's universal truths, as had been the goal from ancient through medieval times, but the detailed description and cataloguing of nature's variety**

an independent discipline is practically coincident with the emergence of botany as an autonomous specialty. Zoology's development, which went through quite similar stages as botany, generally lagged behind botany until the end of the period covered in Olgivie's book. This is partly explained by the fact that zoology was not as firmly embedded in the study of medicine as the foundation of *materia medica*.

Olgivie distinguishes four successive periods in the development of natural history. The first period from 1490 to 1530 saw the origin of Renaissance natural

The work of one ancient herbalist was the focus of particular veneration and scrutiny: the Greek surgeon Dioscorides (c. 40 AD- c. 90 AD). The five books that make up Dioscorides' *De materia medica* represented the pinnacle of ancient descriptive botany, and sixteenth century naturalists used *De materia medica* as their model for writing natural history. There are several reasons why Dioscorides, rather than say the contemporary Roman encyclopaedist Pliny the elder, who was author of the important work *Natural history (Naturalis historia)*, was singled out as a model. First, Dioscorides was widely considered

the most reliable ancient writer. As described in some detail by Ogilvie, Pliny's work was the subject of considerable controversy between humanist scholars who were concerned both with weeding out errors introduced by medieval scribes and lapses of judgement by the great encyclopaedist himself. For example, the Venetian humanist Ermolao Barbaro (1454-1493) wrote a massive philological correction of Pliny, while his contemporary, the Italian humanist and physician Niccolò Leonicensi (1428-1524) attempted a biological correction of Pliny through the observation of plants. It is worth noting that Leonicensi also used the writings of Dioscorides to correct certain errors in Pliny's work.

Second, in contrast to Pliny's work, the focus of Dioscorides' *De materia medica* was medical, providing for each plant a name, description (this in contrast, for example, to Galen who just listed names of plants in his work) and pharmacological properties, a format of presentation followed in later works. It is perhaps ironic that the more explicitly medical text of Dioscorides was chosen as a template for later work in natural history rather than the more broadly ranging *Natural history* of Pliny, but this focus was more in line with the interests of authors such as Niccolò Leonicensi who charged themselves with reformulating the medical curriculum.

Third, although Renaissance naturalists considered them in their historical accounts of natural history, important work by Aristotle (*History of Animals*) and the father of botany Theophrastus (*History of Plants*) were too philosophical to be useful as models. The aim of the new naturalists was not discovering nature's universal truths, as had been the goal from ancient through medieval times, but the detailed description and cataloguing of nature's variety, with a consequent focus on the particular rather than

the general. This attention to the particular was the epistemological hallmark of Renaissance humanism, and which the humanistically educated naturalists applied with equal conviction in the realm of natural history description.

The second generation of naturalists (1530-1560) recognized by Ogilvie was the first international community of natural historians bound in a shared recognition of authoritative texts, techniques of observation, reporting, and communication. It had by then become clear that the several hundred species of plants described by the ancients did not cover observed diversity. Consequently, there was a move away from the exclusivity of ancient texts as members of the now international community of naturalists discovered and described plants that were not described by the ancients, in particular plants from the north of Europe. Considering the fact that plants formed the empirical basis of *materia medica*, it is not surprising that both physicians and apothecaries had active interests in natural history alongside humanists with a more personal interest in natural history. The leaders in this period merit the label of being the first true phytographers, and they include Otto Brunfels, Hieronymus Bock, and Leonhart Fuchs, all of whom wrote new herbals to replace the popular medieval herbals. Whereas the work of Brunfels can be singled out for the excellent and innovative woodcut illustrations produced by Hans Weiditz, which showed the details of individual plants such as one would find them in the wild, Bock distinguished himself by producing the most meticulous descriptions of the time. Although the influence of the ancients still loomed large, as is reflected by the fact that Pietro Andrea Mattioli's commentary on Dioscorides became the standard herbal of the sixteenth century, Bock's work marked a new

emphasis on the cataloguing of new species, and the concomitant importance of travelling to new places to discover the forms not covered in the works of the ancients.

This focus on cataloguing and collecting characterized the work done by the likes of Rembert Dodoens and Carolus Clusius during the third generation of natural history (1560-1590). Even though natural history remained important for medicine, the latter defined it no longer intellectually or professionally. For some enthusiasts the collections, especially of curiosities and rare and exotic species were an end in and of itself. For others, such as Clusius, collecting was merely a means to an end. The ultimate goal was to possess knowledge of nature's diversity, to own it intellectually rather than just materially. Natural history in this generation comprised a community containing a diversity of enthusiasts, including physicians, medical students, apothecaries, humanists, collectors, gardeners, and illustrators. Inevitably, having such a diverse community led to divergence of their interests, and collectors and naturalists started to diverge, both in their methods, their goals, and their literatures. For example, whereas Euricius Cordus' *Botanologicon* from 1531 presented the adventure of a botanizing trip in dialogue form, the works of the next generation of natural historians increasingly distinguished themselves by their dry and concise prose, and their focus on presenting detailed observations rather than the joy of botanizing trips. A certain standard of reporting was developed that included precise descriptions that allowed species and varieties to be distinguished, and the use of illustrations to give an overall impression of the plant's habitus to unfamiliar readers. Contextual non-morphological information that was central to folk biology, such as information about ecology, and

information about the medicinal properties of plants were increasingly de-emphasized. At the same time an independent literature took root that catered to the blossoming population of amateur lovers of plants and flowers. Florilegia became the coffee table books of the seventeenth century. They were picture books with detailed copperplate engravings or etchings of plants and flowers. Engraved pictures could show much more details than the woodcuts previously used. The emphasis in florilegia came heavily to rest on the illustrations, so that the text withered down to the bare essentials of practical information of interest to gardeners, leaving out scholarly controversies and details about the places and times of the collected species.

The final period discussed in Ogilvie's book is from 1590 to 1620, and this was the period of the systematizers. The number of newly described plants became so large that naturalists were now forced to concern themselves with efficiently organizing their data. They needed to be able to classify the known species of plants (the number increased from hundreds in the mid sixteenth century to thousands a few decades later), but also accommodate the unstoppable flood of new species. Consequently, simply adopting a kind of folk taxonomy, such as the Theophrastean categories of trees, shrubs, bushes, and herbs, was no longer sufficient. It is here that we encounter the very foundations of modern scientific systematics. The work of Andrea Cesalpino looms large as the forerunner of the later Linnaean system, and the work of Adam Zaluzianski is noteworthy as a first attempt to introduce classification as a pedagogical or practical tool.

In short, Ogilvie's study shows how with a minimum of intermediate stepping stones the ancient knowledge of plants and

animals as recorded in the works of Aristotle and Theophrastus (BC), and Pliny and Dioscorides (AD) came to form the foundational canon of Renaissance natural history. In the hands of the humanistically educated Renaissance naturalists these works formed the basis of a monumental change in the scholarly attitude towards nature's variety, replacing an earlier natural philosophical approach to animals and plants that was aimed at distilling universal truths, with a new and explicitly descriptive tradition that charged itself with producing a complete inventory of all nature's particulars. It was when the number of known and described species started to outstrip the individual scholar's capacity to keep them all apart, that we find the cradle of modern systematics. Ogilvie's book is so rich in detail that it deserves prolonged study after an initial reading. Because of its almost exclusive focus on botany, the reader is left with enough food for thought, for example how developments in the nascent discipline of zoology mirrored or differed from those observed in botany, and how the new focus on accurate and comprehensive description in natural history dovetailed with similar concerns in the visual arts.

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### **Biodiversity Databases: Techniques, Politics, and Applications**



Curry GB, Humphries CJ (eds.) 2007. Systematics Association Special Volume 73. CRC Press, Taylor & Francis Group,

Boca Raton. ISBN: 9780415332903 (Hardcover). US\$89.95.

This concise volume of ten contributed chapters is based on papers presented during the 4th Biennial Conference of the Systematics Association held in Dublin from August 18-22, 2003 (see Humphries 2003). The field of biodiversity informatics is moving forward at a fast pace, facing on one side a vast amount of heterogeneous legacy data and on the other side a somewhat amorphous, but increasingly demanding, user community. To make it all work we need potent ideas and technologies at the center, along with a "new spirit of collaboration" (Holsinger et al. 2007). For those who struggle to keep up with the latest in cybertaxonomy, a compilation of papers by leading experts is certainly welcome. Nevertheless, the scope of *Biodiversity Databases* is more modest in comparison to relevant predecessors such as Fortuner (1993) or the excellent series *Taxonomy for the Twenty-First Century* (*Phil. Trans. Royal Soc. B* 359: 559-739). Most chapters emphasize conceptual and technical improvements within the European Network of Biodiversity Information (ENBI), where more than half of all described species and type specimens are located. I will first offer a brief overview of each chapter [1, 2, etc.], and then close with general comments.

Lane & Edwards [1] give a three-page summary of the mission of the Global Biodiversity Information Facility (GBIF). Los & Hof [2] describe how this mission is being implemented at the level of ENBI. The number of relevant projects (and corresponding acronyms!) is impressive, spanning from species name checklists, initiatives to virtually access specimen records and molecular sequences, to standardized information resources on European plant communities. The authors then list activities aimed at improving the Network in



terms of database integration, analytical tools, and web-based platforms for users. More than 20 relevant WWW resources are cited at the end, a useful convention that was adopted in several other chapters.

Berendsohn & Geoffroy [3] review a salient proposal to improve semantic integration between databases using the taxonomic concept approach (see Kennedy et al. 2006; Franz et al. 2008). The idea to employ taxonomic concepts – names used explicitly and exclusively in the context of a

empirical comparison of two approaches that use morphometric information to produce automated species identifications, viz. linear discriminant analysis and artificial neural networks. Both methods are tested on a set of foraminiferal species. Although the former performed slightly better, the latter is more generally applicable and less time consuming, leading to a nuanced call for exploiting these complementary properties to maximize the potential for automation. The authors finish with a wide ranging defense of

distributions, and other relevant data. Jones [7] introduces the notion of a biodiversity Grid – a distributed infrastructure that facilitates high-performance computing to model climate change, future species distributions, and similar data- and algorithm-intensive analyses (see also Jones et al. 2006). In addition to outlining the architectural needs for such a Grid, the author stresses the importance of establishing a stable biodiversity ontology in order to run workflows involving heterogeneous datasets. The BiodiversityWorld project has made progress towards these goals.

Triebel et al. [8] provide an update on LIAS, a global information system for lichenized and non-lichenized ascomycetes. Originally based on the DELTA format (<http://delta-intkey.com/>), LIAS now has a networked database and on-line portal offering taxonomic and descriptive information on more than 2700 taxa, identification keys, and regional checklists, among other services. An active community of specialists is involved in the expansion and integration of LIAS within the GBIF network. White [9] analyzes common challenges that occur when biodiversity databases are merged to yield a more comprehensive information resource. Most examples are taken from the 20+ year history of ILDIS, the International Legume Database and Information Service. Of particular interest are situations where regional databases represent different assessments with regards to the validity and taxonomic inclusiveness of species names (*pro parte* synonymy, etc.). The Litchi Project aims to merge checklists while applying a set of rules to identify and resolve taxonomic conflict. "Intelligent" species links (generated via prior searches or registration) can connect multiple resources with similar content. The author advocates maintaining a system of cross-mappings that

**I recommend *Biodiversity Databases* to anyone who is looking for a good entry point into the field of biodiversity informatics**

particular circumscription (Berendsohn 1995) – is one of the most significant conceptual contributions to systematics made so far by developers of taxonomic databases. The authors explain how this approach permits assessments of taxonomic stability as multiple succeeding classifications are imported into a single repository and its elements cross-linked via concept relationships. They argue that taxonomic concepts represent a valid solution to the problem of integrating evolving taxonomic perspectives without imposing a consensus view. Projects focusing on algae, mosses and vascular plants underscore the feasibility of the concept approach. Scoble & Berendsohn [4] recount the historical trajectory and challenges of networking specimen-level information generated by natural history collections in Europe. Issues of technical implementation, scalability, information quality, intellectual ownership, and general operability across 30 or more countries are addressed with laudable realism. Support from the European Commission has played an important role in developing the database network.

MacLeod et al. [5] present an

automated identification projects (see also Gaston & O'Neill 2004), arguing that such services are needed to reinvigorate morphological systematics. But surely there remain some less than ideal parallels to traditional DNA barcoding, in the sense that we are limited methodologically to one or a few sets of features to identify species when others may reflect more immediately upon particular historical speciation events. There are trade-offs between the practicality for automation and maximizing the diversity and diagnostic power of features selected to achieve reliable species recognition.

Curry & Connor [6] examine new technologies capable of extracting taxonomic descriptions from historical publications and parsing them into a structured digital format based on markup language tags. Their proof-of-concept study involves a monograph of brachiopods from which they scanned pages with high accuracy using optical character recognition software. The development of a suitable XML parser program adds semantic structure and allows selective querying of names, synonyms, authors, descriptions,

resemble concept relationships (see [3]).

In the final and longest chapter of the volume, Andersen et al. [10] develop an innovative approach using WORLDMAP (Williams 2001) to prioritize areas for conservation on Borneo based on distributional information (> 5000 records) of endemic rattan palm species. Their analysis reflects great attention to detail and scholarship. Application of the criterion of complementarity indicates that 26 grid cells out of a total of 1087 are required to represent all taxa at least once. Congruence with less extensive datasets of birds and butterflies appears to solidify the original recommendations for areas of high conservation priority.

Even though *Biodiversity Databases* no longer reflects on the very latest developments (such as globally unique identifiers; see Pyle et al. 2008), it succeeds in touching on many prevalent themes in the field. The exclusive spotlight on Europe is readily justified given that more than 50% of all recognized species and type specimens and over 4000 collections are potentially involved. As stated on numerous occasions, GBIF and incentives stemming from the Framework Programme of the European Commission have helped forge Europe's leadership role in biodiversity informatics. The fruits of such high-level support are fully on display in the volume, as large-scale networks of high-quality biodiversity data are starting to become reality. One must also applaud the balanced line-up of papers emphasizing new concepts (taxonomic concepts, workflows), issues of implementation (databases, networking), and empirical applications (morphometrics, conservation). As different factions (e.g. phylogeneticists versus conservationists) within biodiversity informatics pursue their primary agendas, it is easy to move away from the vision of a globally

coordinated platform for information about species.

On the other hand, in my estimation *Biodiversity Databases* would have benefited from a more confrontational and critical perspective towards some of the greatest challenges we are experiencing at this juncture. Too often the reader gets little more than a rundown of original goals, then progress towards them as implemented in a series of projects, then more goals. The message one might take from this promotional style of presentation is that simply plugging ahead will take care of things. But there are *major* obstacles to be overcome on the path towards reliable and precise integration of biodiversity information. The sociopolitical challenges involved in merging data and factional interests (including financial ones) are not adequately stated and scrutinized. An unresolved tension runs through the volume between producing traditional checklists with species names versus integrating different regional or temporal taxonomic perspectives which would require a community-wide commitment to the taxonomic concept approach. Is it time for a paradigm change? Other relevant issues are left unmentioned, for example the discouraging fact that none of the most popular – and populated – biodiversity databases are designed to readily incorporate new phylogenetic insights. Do we need a new ontology translating trees into database fields? In short, the vision of a global and semantically concordant network needs strong ideas and passionate advocates in order to succeed. In that sense I was disappointed by the sober tone adopted by many authors. I also missed a critical synthesis and outlook at the end of the volume.

On the technical side, the chapters are generally well presented, illustrated, and indexed. An unfortunate exception is Figure 7.1 which should show a Grid

architecture instead of repeating Figure 6.7. I recommend *Biodiversity Databases* to anyone who is looking for a good entry point into the field of biodiversity informatics, with the qualification that the reality of data integration might be more "lively" than some chapters let on.

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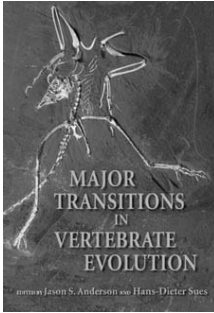
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## Major Transitions in Vertebrate Evolution



Anderson J, Sues H-D (eds.). 2007. Indiana university Press, Bloomington and Indianapolis. ISBN 978-0-253-34926-2

(hardback), US\$49.45.

Vertebrates are the most complex and highly studied organisms, and they have one of the most complete fossil records. Consequently, they have long been an exemplar group for documenting major evolutionary transitions. Robert Lynn "Bob" Carroll has been a leading figure in this research for half a century, and the present festschrift, with contributions from his students and colleagues, is a fitting tribute. There are two chapters on basal vertebrates (Janvier, Wilson et al.), two on amphibians (Anderson, Reisz), two on ontogeny and evolution (Hall and Witten, Larsson), two on mammals (Chiappe and Dyke, Luo), and one each on reptiles and birds (Caldwell, Chiappe and Dyke). Most chapters largely summarise and review recent information, rather than presenting new empirical data, but this makes the volume a much more useful general reference. All are well-written overviews of fairly large areas of research, covering the origin of several different groups. Given the long history of vertebrate palaeontology, it is surprising that a wealth of information for several classic evolutionary transitions has only surfaced in the last few decades. Notable are the feathered

dinosaurs, the fish-tetrapod intermediates, the amphibious basal cetaceans, and the limbed early snakes: all of these (except the fish-tetrapod transition) are all well-covered in the relevant chapters.

How do the current contributions differ from analogous contributions fifty years ago, when Bob Carroll's research began? Almost all recent workers use trees constructed via rigorous phylogenetic analysis, an innovation that spread widely only after the English translation of Hennig's ideas (Hennig 1966). Notably, many the chapters explicitly integrate developmental information into interpreting the fossil record, an innovation that Carroll employed in some of his early works (e.g. Carroll 1970). Conversely, the recent emphasis on testability and rigour in evolutionary biology might have caused a decline of interest in rates and trends of morphological evolution as inferred from the fossil record (e.g. Simpson 1944, 1953): most chapters don't address this topic in detail, or use rather antiquated methods (e.g. using higher taxa as proxies for morphological diversity). But such questions remain of paramount importance, as recognised by other disciplines (e.g. the focus on rates and trends in invertebrate palaeontology, and the amount of research on rate heterogeneity in molecular evolution). They are harder to investigate rigorously in vertebrate fossils given the smaller sample sizes, and the uniqueness of morphological characters, but this challenge deserves to be tackled (e.g. Kemp 2007).

While development has rightly been accorded a central position in this volume, I was surprised that the wealth of phylogenetic information provided by molecular biology remains under-utilised by vertebrate palaeontologists (at least those contributing to this book). Yet this information can be crucial, because without it, palaeontologists will often end up attempting to shoehorn

fossils into an incorrect phylogenetic framework for living taxa. Recent molecular data strongly suggest that urochordates (not cephalochordates) are the closest relatives of vertebrates and share several developmental novelties (e.g. Delsuc et al. 2006); however, one of the agnathan chapters attempts to place several fossil taxa between cephalochordates and vertebrates. Similarly, multiple genes strongly indicate hippopotamids alone (rather than ungulates as whole) are sister to cetaceans: the chapter on whale origins touches on this but does not tackle the issue head-on, interpreting character changes and homologies at the origin of whales using hippopotamids (and their fossil relatives) as the living outgroup.

Incidentally, the formatting of this book appears not terribly efficient, with most pages being 40% blank due to inexplicably wide margins; this extra space could have contained an extra couple of chapters that might have filled some of the gaps above. Admittedly, it is always too easy to suggest what else could have been included in an edited volume: regardless of the above comments, the book is a fine snapshot of current research on vertebrate macroevolution. Most chapters are valuable and highly current reviews that will have a long citation life: unusually for such a work, information from papers within two years of publication (2005 and 2006) is incorporated into the chapters.

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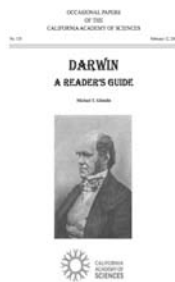
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## Darwin, A Reader's Guide. Occasional Papers of the California Academy of Sciences, 155.



Ghiselin M. 2009. Occasional Papers of the California Academy of Sciences, 155. ISSN 0068-5461. US\$16 (Paperback; pdf

free).

The book under review, *Darwin, A Reader's Guide* by Michael Ghiselin, was published early 2009 as number 155 of the *Occasional Papers of the California Academy of Sciences*. It is the first of the series to be published as a hardcopy and downloadable pdf, both versions obtainable from the *California Academy of Sciences* scientific publications web site, the hard copy for \$16 (£10), the download free. Choosing early 2009 to publish a reader's guide to Darwin might seem intuitively sensible or frighteningly unwise, given that it was a double Darwin anniversary year: 150 years after the publication of the *On the Origin of Species by Means of Natural Selection* (1859)

as well as the bicentenary of Darwin's birth (1809). The *Guide*, therefore, stands as a record of items published before these anniversaries. Ghiselin writes: "I have prepared this *Guide*, one that reflects my personal experience and draws upon the materials I have accumulated with the passage of decades" (p. 7): it is, thus, a personal document (p. 8).

Ghiselin is an evolutionary biologist, a bioeconomist, a malacologist, "a biologist... who works on the philosophy of classification" (*Journal of Bioeconomics* 7, 2005, Special Issue: The Economics and Bioeconomics of Classification) and a Darwin Scholar. He "read all of Darwin's major works" (p. 5) as preparation for writing his book on Darwin, *The Triumph of the Darwinian Method*, published in 1969, reprinted in 1984 (with a new preface) and again in 2003 (a reprinting of the first paperback edition, published in 1972). *The Triumph of the Darwinian Method* is part of the beginning of the Darwin Industry (p. 44), a 'movement' described by Timothy Lenoir as "a select group of scholars who have in recent years concentrated their efforts on utilising the vast resources of Darwin's unpublished notebooks and correspondence in order to illuminate individual episodes in his intellectual development" (Lenoir 1987, p. 115) – Lenoir also wrote that the Darwin Industry "has a slightly derogatory connotation, as if the scale of the research has gotten out of control with people cranking out studies on perhaps less and less important aspects of Darwin's work" (Lenoir 1987, p. 115). As Ghiselin writes, with characteristic modesty, "The impetus [to study Darwin] came from four zoologists: Gavin de Beer, Sydney Smith, Ernst Mayr and Michael Ghiselin" (p. 44), of which more below.

Introductory matter to one side,

*Darwin, A Reader's Guide* is divided into five parts: Darwin's Life and Works, Secondary literature and Other Sources, Darwin Chronology, Biographical Dictionary and three Bibliographies.

Darwin's Life and Works (pp. 9—43) takes the reader through Darwin's life, providing an account that differs little from that found in the many other biographies. If anything, Ghiselin deals more with the substance of Darwin's ideas rather than the events in his life or the context of those events. Needless to say, the scientific interpretations are Ghiselin's, views that can be found elsewhere in many of his other works (e.g. Ghiselin, M.T. 1997. *Metaphysics and the Origin of Species*, State University of New York Press, Albany). According to the Table of Contents, the Life and Works section is organized around Darwin's books, their titles acting as sub-headings: starting with the *Journal of Researches* (1839), Darwin's account of the Beagle voyage, to *The Formation of Vegetable Mould, through the Action of Worms, with Observations on their Habits* (1881), Darwin's final book. The text is actually ordered somewhat differently. For example, where the Table of Contents indicates a subsection entitled *Journal of Researches* (1839) starting on page 11, while there is indeed an account of the Beagle voyage on that page, no such heading exists. The mismatch between the Table of Contents and text remains throughout this section, except for a few items.

The Secondary literature and Other Sources (pp. 43—46) includes a brief account of the rise of the Modern Synthesis (1930s) and the accompanying birth of the Darwin Industry (1950-60s) noted above, alongside a summary of books and people Ghiselin believes have had significance in the development of evolutionary biology during the last century. Ernst Mayr and David Hull

are significant, according to Ghiselin. Ernst Mayr and zoologist Arthur Cain, with David Hull and Ghiselin himself following closely behind, created what has recently been called the Essentialist Story, a myth that, as Polly Winsor so eloquently puts it, “portrays pre-Darwinian taxonomists as caught in the grip of an ancient philosophy called essentialism, from which they were not released until Charles Darwin’s 1859 *Origin of Species*. Mayr’s motive was to promote the Modern Synthesis in opposition to the typology of idealist morphologists; demonizing Plato served this end” (Winsor, M.P. 2006. The creation of the essentialism story: an exercise in metahistory. *Hist Philos Life Sci.* 28:149—74). Interestingly, while Winsor has four items listed in the Secondary References (pp. 183—184), none of her papers exposing this myth are included. As for Darwin, Stephen Gould wrote of the 1959 Chicago symposium, the first centennial commemoration of the *Origin* held at the University of Chicago, Illinois, that “The panel discussions ended in a virtual orgy of agreement, with Darwin as hero and adaptation as king” (Gould, S.J. 2002. *The Structure of Evolutionary Theory*, p. 574). The central theme of the Chicago symposium was to embrace the integration of population genetics with selection theory. It is thus not surprising, then, that there are so many books and papers on Darwin and that 2009 was, once again, the year of Darwin as Hero – but it is surprising that Betty Smocovitis’s paper detailing events of the first centennial is missing from the bibliographies in this Reader (Smocovitis, B.V. 1999. The 1959 Darwin Centennial Celebration in America. *Osiris* 14: 274—323). But what of Mayr’s history of essentialism? “In its broad sweep across the history of systematics... it is not merely inaccurate in particulars, it is wrong and harmful in its basic message”

(Winsor 2006, p. 3 in Winsor, M. P. Linnaeus’s biology was not essentialist. *Annals of the Missouri Botanical Gardens* 93: 2—7); in short, the Essentialist Story was a thinly disguised – and largely fabricated – attack on taxonomy.

My main problem with this *Guide*, then, is who would use it and how. The *Guide* has no guide as to what one might find within the pages of any of the listed books and papers...

Without it, would our interest in Darwin be quite so obsessive?

The Darwin Chronology (pp. 47—68) is interesting inasmuch as determining how and why Ghiselin chose certain entries. All the obvious ones are included, of course: the Beagle journey, the publication of the *Origin*, the British Association debate at Oxford, and so on. Yet skimming through the chronology can lead to some puzzling encounters. An entry for 1841, for example, reads: “OCTOBER 25, finished Youatt on sheep” (p. 53). But Youatt never makes another appearance in the Guide, so one might be left wondering who Youatt was and what his significance might be, never mind the sheep. As it happens, Darwin is referring to William Youatt (1776—1847), author of *Sheep: their breeds, management, and diseases* (1837). This was part of Darwin’s reading on domesticated animals. Youatt wrote on the horse, cattle and pig as well. Still, six days later, we learn, Darwin “had breakfast at Owen’s”. Perhaps they discussed food (“...those species, such as the nutritious cod, the savory herring, the rich-flavoured salmon, and the succulent turbot, have greatly predominated at the period immediately preceding and accompanying the advent of man, and that they have superseded species which, to judge by the bony Garpikes (*Lepidosteus*), were much less fitted to afford mankind a sapid and wholesome food”, Owen, 1860,

*Palaeontology*, Edinburgh, p. 151).

The Biographical Dictionary (pp. 69—117) is an eclectic mix of people, again one must assume the choice reflects Ghiselin’s personal preferences.

The three Bibliographies are

probably considered the meat of this particular offering. The first of the three is Publications of Charles Darwin (pp. 118—123), the second Publications based on Darwin’s Collections (pp. 123—126) and the third Secondary literature, which includes a Supplement to Secondary literature (126—185). The first part, Publications of Charles Darwin, is made redundant by web based projects such as the Complete Work of Charles Darwin Online (<http://darwin-online.org.uk>). This website has, or will have, not just the reference but its text and a downloadable pdf of each of Darwin’s papers. The website also includes a section on Publications based on Darwin’s Collections (entitled Darwin’s Specimens, <http://darwin-online.org.uk/specimens.html>), thus rendering the second bibliography in this Guide redundant as well. In any case, Ghiselin’s rather idiosyncratic listing can frustrate. For example, one might look up Christian Gottfried Ehrenberg in the Biographical Dictionary, thought by many to be the father of micropalaeontology, and discover that he examined samples of dust from the Beagle voyage (p. 84). Yet Ehrenberg’s publications on this material are missing from the Publications based on Darwin’s Collections bibliography. Although Ghiselin writes that “It [the bibliography] aims at a good representative sample”, the sample should at least be joined up with the biographical data to be of some use.

The final bibliography, Secondary literature, is extensive – yet it too is idiosyncratic. One might plough through the pages looking for obvious omissions or puzzling inclusions. If nothing else, it certainly allows the reader some fun. Why include Ralph Colp’s paper on “Charles Darwin’s dream of his double execution” (p. 137) but not Colp’s paper on Darwin’s coffin (Colp, R. Jr. 1980. Charles Darwin’s coffin, and its maker. *J Hist Med Allied Sci.* 35:59–63)? After all, Ruth Padel found the details of Darwin’s coffin of interest (“I Made His Coffin Just The Way He Wanted It, All Rough”, from Ruth Padel, 2009. *Darwin: A Life in Poems*, Chatto & Windus).

Given the date of publication of the *Guide*, the Supplement to Secondary literature seems a little pointless. As 2009 comes to a close, there are more new books about Darwin than one could ever want or need (and quite a number lined up for 2010). None of these can be found listed in *Darwin, A Reader’s Guide*, except one, Desmond and Moore’s new biography (*Darwin’s Sacred Cause*), added to the Supplement (p. 185), which, in any case, has only three items.

My main problem with this *Guide*, then, is who would use it and how. The *Guide* has no guide as to what one might find within the pages of any of the listed books and papers, beyond interpreting the title and a few notes in the introductory sections. Without some prior knowledge it is virtually impossible to select items from the secondary bibliography that may or may not address any particular interest one might be investigating, as the entire secondary bibliography is founded almost exclusively on Darwin’s name rather than any particular subject matter. Commentary is necessary for such a compilation to make sense. For example, Soren Løvtrup’s entertaining *Darwinism: The Refutation of a Myth* (1987), a book wholly critical of Darwin,

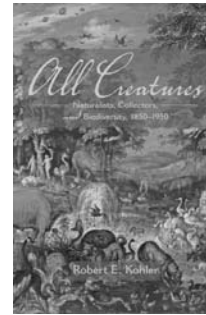
Darwinism and Neo-Darwinism, is included as secondary literature, as is Gavin de Beer’s hagiography *Charles Darwin: Evolution by Natural Selection* (1963). Løvtrup’s book is controversial but interesting (and virtually impossible to buy); de Beer’s is out of date and redundant (but easy and cheap to buy). Løvtrup’s book is worth reading; de Beer’s isn’t. But that’s my view, one I doubt shared by Ghiselin. Still, Ghiselin offers a warning “Perhaps the best advice that can be offered to the users of this guide and its bibliography is *caveat emptor*” (p. 45), which returns me to my original problem: who would use this *Guide*, how and, in the face of internet resources, why? It would have been a far more useful guide if the bibliography of secondary literature had been presented chronologically rather than alphabetically and had been subdivided into subject matter, however roughly the subject division was made. This would have allowed a view into how ideas relative to Darwin were changing, what levels of interest were being generated, and how those views mutated relative to prevailing scientific interests.

As a supplement to the Complete Work of Charles Darwin Online, coupled with the Darwin Correspondence Project (<http://www.darwinproject.ac.uk/home>) and Google, at \$16 (£10), *Darwin, A Reader’s Guide* is inexpensive enough; the pdf is free. If I might offer a humble suggestion: read Polly Winsor on the essentialism story, and then find someone other than Darwin or something other than population biology to focus attention upon. Try the history of systematics in Europe. It might be revealing. The entomologist Lars Brundin (1907–1993) and his effect on palaeontology might be a good place to start.

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## All creatures. Naturalists, collectors, and biodiversity, 1850-1950



Kohler RE. 2006. Princeton University Press, Princeton. ISBN13: 9780691125398 (hardback), £28, 95.

Despite the broad remit claimed by the title of this book, it in fact deals with a specific style of natural history collecting practiced by a set of taxonomic specialists during a specific phase in the history of science in a specific part of the world. Yet, the book should be of general interest to systematists. Specifically, Kohler describes the culture and practice of survey collecting of birds and mammals in North America from the 1850s to the 1950s. Survey collecting refers to the rigorous, systematic, intense and extensive field collecting of local flora and fauna to accurately map biodiversity on the scales of state and nation. It provided an important foundation for scientific research into the nature of biological variation, species, and speciation. Despite the spatio-temporal restriction of Kohler’s subject, he manages to place it into a context of more general interest and importance by elaborating the environmental, cultural, and scientific backgrounds of survey collecting. Any systematist curious about the processes that have been responsible for filling the filing cabinets of American natural history museums should read this book.

Kohler’s book is divided into seven main chapters. The first, titled

*Nature*, discusses the environmental context of survey collecting, in particular the nature of the ‘inner frontiers.’ The period of the 1870s to the 1920s saw the landscape of North America dotted with a mosaic of patches of densely inhabited and uninhabited landscape. Here a remarkable diversity of wildlife, both flora and fauna, could for a time co-exist relatively undisturbed alongside human settlements, before the relentless destruction of nature was started by virulent population growth and suburban sprawl, and the terminal penetration into nature’s last refuges that was especially facilitated by the affordability of cars in the early 20th century. Apart from the deliberate setting aside of national forests, the characteristic topography of the inner frontiers was left in the wake of waves of settlement and subsequent abandonment in areas exploited for agriculture, mining, and timber. For example, the westward wave of homesteading in the late 19th century left ghost towns in its wake as people migrated away from poorer agricultural regions of the Northeast. This resulted in passive reforestation, such that a state like Vermont could revert back to forest within a matter of decades after having been completely denuded of original forest. Kohler discusses in detail how access to the inner frontiers was provided in particular by a large network of railroads, which made them attractive spots for fishing and hunting. Naturalists were aware that the inner frontiers were a fleeting phenomenon, in need of scientific documentation.

The second chapter titled *Culture*, describes the cultural context in which survey collecting originated. Kohler presents an interesting picture of the profoundly changing attitudes of people to nature in the late 19th and early 20th centuries.

Kohler’s specific focus is on the middle class, and their attitude towards leisure. The 1870s saw the origin of “vacation” as a quintessential middle class invention, or rather an ideological refashioning of “leisure” as enjoyed by the aristocracy and the labouring classes. Leisure had the undesirable connotation of “mere idleness and entertainment,” so middle class vacationing came to consist of a broad range of outdoors activities, from hiking and bird watching, to camping and fishing. Being outdoors in nature during regular vacations became the recreational complement to day-to-day hard

mental or physical work. Kohler suggests that vacationing and natural history were connected because the latter (studying nature, collecting specimens, etc.) dignified leisure. Kohler argues that there is a link between recreational outdoors activities and science, or at least an intellectual interest in nature. Recreational walking and mountain climbing, for example, afforded direct experience of nature, which Kohler argues is at least “congruent with a scientific interest.” He also points out the similarities between hunting and natural history collecting, and the establishment of marine biological stations as a means for scientists to blend vacationing with science in an outdoor setting. The second half of the 19th century also saw the blossoming of indirect ways to get into contact with nature: nature essays, wilderness novels (for example by Jack London) and wildlife dioramas in museums. The appetite for these indirect means to experience nature coincided exactly with that of cottaging, walking, and camping by the middle classes. In short, Kohler argues that the direct

and indirect means for the middle classes to experience nature intellectually and emotionally set the context for the rise of survey collecting. However, the environmental and cultural contexts of survey collecting of course needed to be supplemented by a third factor: economic incentive. The wish of museums to have realistic dioramas in particular became a major economic driving force to go out into the field to collect specimens.

The third chapter is titled *Patrons*, and it sketches the institutional, organizational, and economic contexts of survey collecting. The

**Kohler makes the interesting point that the key rationale for civic museums to organize and support collecting parties was a change in exhibition style: the origin of naturalistic habitat dioramas**

time-honoured way of collecting during unpaid working vacations by college teachers and

museum curators was obviously not the most efficient way to survey biodiversity. Legitimacy had to be sought for large-scale scientific collecting. Unlike geological, topographical, agricultural, and land-use surveys, natural history surveys never became a regular feature of state government. Kohler surmises that a main reason for this relative neglect was the fact that biological surveys didn’t produce knowledge that could be used by any significant social group to exploit a state’s natural resources. Another factor was timing. Natural history surveys appeared on the scene at the end of the period in which extractive resource industries flourished. Surprisingly, Kohler didn’t find evidence that states had an interest in helping to develop nascent recreational and tourist economies. Yet, the general rationale advanced in support of survey collecting was economic, namely to assist in agriculture, such as understanding crop pests, and mapping biogeographical zones conducive to crop growing. But of course the surveyors also had ‘purer’ interests, so that “[p]ure-

science survey was the tail that wagged the economic-biology dog” (p. 98). Kohler discusses in some detail the U.S. Biological Survey (within the Department of Agriculture), which was the first public institution dedicated to large-scale natural history survey. Under the leadership of C. Hart Merriam from 1887 to 1910, it was very important to taxonomy and biogeography. Merriam was uniquely successful in attracting federal funding. The level of support was only equalled by the largest of the civic museums. State funding was much more haphazard.

Kohler makes the interesting point that the key rationale for civic museums to organize and support collecting parties was a change in exhibition style: the origin of naturalistic habitat dioramas, and the separation of study and exhibition collections in the last decades of the 19th century. Curators required better quality specimens for both exhibits and taxonomic study. For example, changing taxonomic standards necessitated the rebuilding of collections, so that series of specimens were required to assess variation and properly delimit species. The need for high-quality specimens for dioramas also made curators and taxidermists field collectors. Realistic dioramas not only needed the collection of animals, but also of important contextual elements, including rocks, grasses, soil, etc. Since dioramas depicted local scenes, the locality of collecting was crucial. The resulting collecting efforts could be tremendous. For example, Frank Chapman travelled some 65,000 miles to collect for the American Museum’s hall of North American birds! Luckily museum trustees and patrons were very willing to donate money to collecting expeditions, especially if they could come along to shoot game for dioramas. Scientific collecting was in these cases a by-

catch. In fact, offers to finance collecting trips, especially for big game in exotic locations, were so frequent that it was difficult for museums to always oblige. It was indeed very big business, and some deplored that more time and effort was spent on collecting than on the science. Research museums, not needing expensive dioramas, could do with smaller donations from middle class nature enthusiasts primarily interested in science. Local businessmen and sportsmen also donated in the hope of fostering the local economy. A close relationship between curators and patrons was essential.

Chapter 4, titled *Expedition*, and chapter 5, titled *Work* discuss the dual character of survey collecting, as a mix of both work and recreation. Chapter 4 focuses on the inter-human relationships during field collecting trips. Chapter 5 looks into the importance of the various skills required of survey collectors, and chronicles the shift from survey collecting as a stage to launch a career in academia to that of a craft occupation. Both chapters contain some wonderful black and white photographs of field collecting parties, of donkeys packed with iguanas, ropes strung up as washing lines full of deer skins, and proud collectors alongside their newfangled beasts of burden: the first generation of affordable automobiles. Chapter 4 is the most entertaining of the book, as it describes all the joys and difficulties of organizing and managing collecting parties in the field. Field parties often brought a heterogeneous mix of people together, combining different skills and predilections. An entourage could include sportsmen, nature tourists, naturalists, taxidermists, artists, but also cooks, packers, and locals with intimate knowledge of the area. Interpersonal tension arose sometimes, for example when taxidermists and curators managed to collect just one or a few rare

specimens to be used for either science or exhibit.

Chapter 5 contains some of the most dramatic stories of the book. It describes how the skills and experience of survey collectors, though invariably valued, became increasingly seen as insufficient as a reliable entry ticket into a learned profession. For would-be scientists and curators alike, formal university training rapidly became an indispensable part of their education around the turn of the 19th century. Kohler relates the dramatic story of Thomas Large who around the turn of the century worked on a survey of fishes of Illinois. Unfortunately, his focus on field and collecting work resulted in him being bypassed as a potential author of *The fishes of Illinois*. Despite having been instrumental in organizing expeditions, and personally identifying and recording 90 percent of the survey’s 200,000 specimens, Large’s contributions were barely mentioned in the book. The emerging rift between what Kohler labels as craft and literary activities sadly blocked Large’s career ambitions. As a result, in the early 1900s a social stratification had become apparent, with on the one side craftsmen, including taxidermists and field men, and on the other side the professional curators and university-trained biologists.

Chapter 6 is titled *Knowledge*, and may be the one most directly interesting to practicing systematists. The chapter investigates the relationship between strategies of specimen collecting and scientific concepts derived from the study of the specimens. Kohler argues that the collections resulting from surveys were instrumental in the conceptual change from typological to population thinking, leading to a reappraisal of what species are. This went hand in hand with a change from type to survey collecting in late 19th century and



then to population collecting in mid-20th century. He argues that changing collecting practices went hand in hand with changing views of taxonomic categories. In particular, the subspecies as a distinct category could only be firmly established on the basis of collections that were both deep enough and geographically comprehensive enough. In 1884 the American Ornithologists' Union officially adopted trinomial names for subspecies. This decision was ratified at the Fifth International Congress of Zoologists in 1901. In Europe the scheme of trinomials was adopted later because it's museum's collections were not deep enough. Yet, subspecies as a distinct category were increasingly questioned from the 1930s, until in 1953 Brown & Wilson published their famous critique of the concept. Kohler thinks that the reason enthusiasm for subspecies declined in the 20th century was not a result of theoretical or regulatory (nomenclatural) flaws. Instead he thinks it was the result of changing collecting practices, in particular the decline in survey collecting, which yielded rich series on the basis of which subspecies could be demarcated. There was a shift to more local and intense collecting to study biological aspects of populations, including speciation. The central aim was no longer taxonomy. The preponderance of geographically distinct local populations would explode subspecies. It became too cumbersome to formally recognize and name them. In Kohler's words: "The crisis in subspecies taxonomy was symptomatic of the broader shift in systematic biology from inventory and housekeeping to evolutionary biology" (p. 268).

The final chapter titled *Envoi* explores the complex reasons for the decline of survey collecting, ranging from the demise of the inner frontiers as they succumbed to development and to the automobile,

to a change from collecting to observing organisms, to simple diminishing returns as biodiversity became better known. But as we systematists know, the process of documenting and understanding biodiversity in its totality is scarcely post-conception. American survey collecting will probably never return, but as Kohler writes: "Biologists will continue to collect, sort, name, map, and classify – but in new ways and to new ends" (p. 285).

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**Summarize yourself in the form of a title of a scientific paper**

Helping phylogenetic analysis evolve: phylogenetic supertrees and beyond.

**Summarize the when and where of your academic career**

I finished my undergraduate at the University of Calgary in Canada in 1990. Despite being interested in systematics and evolution, I somehow managed to finish the four years without really doing any projects in these areas at all! After about a year and a half of wondering what to do (traveling, doing odd jobs around the university), I started my Masters in 1992, again at the University of Calgary, having become fascinated by the question if the mammalian

pinnipeds were monophyletic or diphyletic. Following the end of the Masters in early 1995, there came an extended period of "pond-hopping". First, I did my PhD at the University of Oxford from 1995–1998, where Andy Purvis and John Gittleman introduced me to supertrees. Then I did my first postdoc at the University of California at Davis (from 1999–2000; largely supertrees) and another postdoc at the University of Leiden in the Netherlands (from 2000–2002; mammalian EvoDevo). I then stayed in Europe, with an extended postdoc at the Technical University of Munich, Germany (2002–2006; bioinformatics) and a Heisenberg Fellowship at the University of Jena in the former East Germany (2006–2008). Since March 2008, I'm the Professor for Molecular Systematics and the University of Oldenburg in Germany.

**When did you decide to follow the career path you are on now?**

Ever since high school, I was always fascinated with systematics and, to a lesser extent, taxonomy. The idea that there was an ordering to life was always very compelling to me. This naturally led into evolutionary studies in general because it is evolution that provides this structure and the interesting hypotheses to test. After a few years of studying bats in a very non-phylogenetic way as an undergraduate, I finally built my first phylogenetic tree (for the true seals, Phocidae) and have never looked back. Phylogenetic trees, including building them and researching how to build them, remain my great interest.

**What are the main goals of your research, and what is your future ambition?**

The goals vary, depending on what phase I'm currently in. Sometimes the research is more methodological and theoretical, sometimes more

empirical. I'm in more of an empirical phase at the moment, building trees and testing evolutionary hypotheses. Once I stumble on some difficulties in doing that, I'll probably shift to being more methodological again to try and find some solutions to the problems.

At the moment though, I'm breaking into something completely new, which is to study the evolution of chemical communication in mammalian carnivores (Carnivora) and to see whether or not the scent compounds that they use have phylogenetic signal or how they have evolved in general. So, I plan on characterizing the compounds and the olfactory receptors that they are using, investigating their evolutionary histories, and also seeing if there's some connection between them. Being more chemical biology, it is a new direction for me, but one with a lot of potential because an evolutionary framework has yet to really become established in this area. So, there's a lot to learn and to do, and this is something that will easily become my focus for the next decade or so.

But, of course, I won't leave supertrees behind at all. They'll always be there somewhere as well.

**What organisms have you worked on, and which are your favourite organisms and why?**

Mostly mammals, although I've dabbled with snails, amphipods, beetles, turtles, birds, and even viruses! My favourite groups, however, are the mammalian carnivores and then the true seals within that. These are the first groups that I started investigating and were the ones that drew me into becoming an evolutionary biologist.

**How many hours per week do you work?**

It varies, obviously, but is invariably over 60. Most of that has been compacted into a four-day stretch because I have been commuting



Olaf Bininda-Emonds

weekly between work and home ever since I started at Jena, and like to keep work for the office.

**What percentage of time do you spend on each of your different responsibilities?**

At the moment, teaching and admin are devouring most of my time, having to develop several new courses and modules, and also now being in charge of a lab group together with all the growing pains of being in a new location. So the research side of things is suffering at the moment, but I hope to get a nice 50-50 balance between research and teaching / admin before too long.

**What is the current composition of your lab?**

My lab has five Masters students, six PhD students, one technician, and one scientific assistant.

**What gives you the most satisfaction and frustration in your job?**

The most frustration is easy: the admin! As important as it is, there's just too much of it and it steals time away from the research, which is the reason most of us decided to become academics in the first place. Getting tenure has been quite eye opening in this regard. As a student or postdoc, you never realize just how much admin and paperwork the

profs are taking off your hands to let you do your studies or research.

On the flip side, I find teaching to be very satisfying. I always enjoy talking about systematics and evolution and bringing these concepts to a wider audience. I also invariably find that I'm learning new things as I prepare my lectures as well. But, what really gives me satisfaction are a few uninterrupted hours to do a bit of programming. Sounds geeky, I know, but programming is utterly addictive: once you seriously get started, you just can't stop. It's both a form of creativity and a challenge at the same time. You can't stop until you hunt down all the bugs that stop the program from doing what you want.

**Could you say something about the importance of international collaborations for your research?**

I think that collaborations are important, regardless if they are international or not. It's only through collaborations that you get exposed to new ideas and perspectives, or have someone to brainstorm with. For instance, one of my most productive and creative periods was at Leiden working together with Mike Richardson (a developmental biologist) and another postdoc Jon Jeffery (a paleontologist). We were developing methods of analyzing developmental timing data in an evolutionary framework and brought three completely different perspectives, backgrounds, and biases to the problem. Without this diversity of interests, I'm certain that we would never have come upon the solutions that we did.

The internet has made it incredibly easy to have far-flung collaborations. For instance, I've yet to meet quite a few of my co-authors in the flesh! But, there's no substitute for being in the same room with the person and having immediate feedback to the ideas that you bounce off of them.

**What kind of fieldwork do you do and where has it taken you so far?**

Fieldwork??? As someone who’s been tagged increasingly as a “bioinformatician”, the closest I’ve come to fieldwork is hooking up my laptop to a WLAN outside of the university! But, way back when I was collecting my own data, I did a few museum tours (along the east coast of the United States and also to the Natural History Museum in London) measuring seals skulls and bones. Not sure if that counts as field work though ...

**Did any memorable incidents happen during your collection of data?**

I do remember my time at the Natural History Museum in London with a smile. At the time, the pinnipeds were housed in the basement of the main building and there was no way to enter or leave the room (apart from the fire escape) without having one of the staff come get me. So, it was eight hours a day measuring skulls without any natural light and hardly any company whatsoever. Thank God there was an adjoining toilet.

But, the staff at the NHM was always very helpful and cheerfully rescued the poor Canadian in the “seal dungeon” (my words) whenever I rang. I could also roam freely throughout the main museum any time I liked, and made the most of the opportunity (great museum!). So, maybe it wasn’t quite eight hours straight in the “dungeon” ...

**Is there any paper or book that has been very influential for your thinking?**

It sounds like an odd choice, but it would probably be “Phylogenetic Patterns and the Evolutionary Process” by Niles Eldredge and Joel Cracraft. It was the first book on phylogenetics that I read cover to cover and then a few months before the start of my Masters (i.e., the start of my systematic career). So it both stimulated my interest in

systematics even further and also provided the necessary framework and background knowledge for my research.

**How was the most important mentor in your career?**

I’ve been blessed to have had a number of good mentors throughout my career, some official, some not: Tony Russell (University of Calgary), Andy Purvis (now Imperial College London), John Gittleman (now University of Georgia at Athens), and Mike Richardson (Leiden University). What set them apart was both the time that they invested in me (given what I now recognize as their undoubtedly heavy workloads!) and also the freedom and support they provided to investigate interesting questions that didn’t necessarily fit into their own research programs. I especially admire Tony Russell. While I was with him, he managed to have a full teaching load, a full lab of students with whom he held individual weekly meetings, started as Head of Department, and still managed to do research and write papers! God only knows where he found the time!

**What is the best advice you have ever received?**

Perhaps the best pieces of advice came from Tony Russell. He was the one who advised me to only do a Masters with him and not a PhD (although he personally would have profited more if I did the latter) because the opportunity for doing a PhD would still come along and with someone perhaps more fitting. Also, with the opportunities being what they were (and still are) for systematic biologists, he pointed out

that it was wise to stay in the system for as long as possible. But not too long, and that was his second valuable piece of advice, namely that academics should take stock of their situation by age 35 at the latest and decide whether there’s really a future there. Those were two refreshing doses of reality that one usually doesn’t hear.

**Could you nominate any of your discoveries or papers as the most important one(s), or the one(s) that you personally like best?**

Obviously the mammal supertree paper published in Nature in 2007 has to rank up there. It represented the culmination of about six years of effort by a large number of people. And it turned out to be a beautiful paper too (not just because of the tree!). The lack of any explosive radiation by the extant mammalian lineages after the death of the dinosaurs was utterly unexpected and took us all by surprise (and shock; we checked the data and analyses umpteen times to make sure that the result wasn’t an artifact!). In the end, it was a good example of how the use of an evolutionary perspective can yield surprising results.

I’m also quite fond of the paper that I published with Mike Richardson and Jon Jeffery in Proceedings examining the reality of the phylotypic stage in vertebrate development. The concept of the phylotypic stage (conserved taxon-specific periods during early ontogeny) is fairly controversial in developmental biology. We had compiled a ton of developmental timing information for mammals and vertebrates in general for other research and simply decided to apply it to test out whether we could find any support for the phylotypic stage. So we developed our own tests and statistics and found no evidence of it whatsoever. In fact, phenotypic divergence was actually greatest during the time when the phylotypic stage should have been

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present. It turned out to be another fun paper and not one that we had planned on doing or investigating at the outset.

**Is there a particular contribution you generally bring to collaborative papers?**

My main contribution is in stressing the importance of bringing an evolutionary perspective to the papers and in carrying this through by analyzing the hypotheses in an explicit phylogenetic framework. It seems to be working because I keep getting a lot of requests in exactly this kind of direction! I also think that I often help to improve the papers in terms of their flow, style, and logical structure. One of my old bosses said that “writing papers is a torture that no one enjoys except Olaf”. I can’t speak for “no one” but I do enjoy writing and find that it comes easily to me. So, I don’t see it as a punishment to sit down and rework and polish a paper until it gleams.

**What skills do you think a successful researcher in your discipline must possess?**

Nowadays it very important to think outside the box and to not become focused too narrowly. Regardless of the exact research field, people who are more multi-disciplinary or at least embrace ideas and techniques from outside their areas will have better chances (and do more interesting research). As important as systematic and taxonomic research is, there will probably be increasingly fewer positions for people just doing systematics and taxonomy compared to those who can apply their research to other fields of biology. That’s the key: making your research interesting not only to your direct colleagues, but also to other biologists and the general public.

**Do you have any tips for students aspiring to a career like yours?**

Just one: think carefully about it and

make sure that this is something that you really want to do. If it isn’t or the prospects aren’t looking good, then don’t be afraid to pull the plug and try something else.

The job is certainly rewarding and I couldn’t imagine doing anything else. But the road is long and hard and by no means certain. I finally got a permanent position when I was nearly 40 after many years of being paid too little and moving too often. That constellation is difficult for relationships and especially so for having a family.

**What do you think are currently the greatest impediments to achieving a successful career in your field?**

There are the obvious laments about there not being enough positions and funding, but I think that they hold true for most academic fields, not just systematics and taxonomy.

Instead, I think that an underrated impediment is the dedication demanded of those looking to establish themselves: numerous postdocs, often entailing long hours and multiple moves. These demands are not so problematic so long as one is still young and single. If nothing else, you get to see cool new places every couple of years. But they conflict strongly with having a family, often to the point of it becoming an either/or situation. And my gut feeling is that this choice might play a surprisingly important role in helping explain why there are so few female academics.

Unfortunately, the solutions won’t be easy so long as the positions and funding are limited, and the competition for both high. But more could still be done to support families, including more day-care facilities attached to the university and more provisions from the granting agencies and universities to support families (e.g., helping pay for day-care, generating temporary positions for academic spouses, among others). Such measures

won’t solve things by any means, but would make it easier to be an academic with a family.

## Calendar

15 April 2010

**The obvious solution to biodiversity loss: a bigger planet**

*Linnean Society, London*

Speaker: Dr Martin Sharman

See [www.linnean.org](http://www.linnean.org) for details

20-22 April 2010

**Early Events in Monocot Evolution**

*The Linnean Society of London and*

*the Royal Botanic Gardens, Kew*

See [www.linnean.org/](http://www.linnean.org/) for details

7 July 2010

**Sir Julian Huxley Lecture**

*Linnean Society, London*

Speaker: Prof. Andy Purvis

Title: Species for Macroevolution

More details: [www.systass.org](http://www.systass.org)

11-17 July 2010

**18th International Congress of Arachnology**

*Siedlce, Poland*

For details and registration see

<http://www.arachnologia.edu.pl/>

December 2010

**12th Young Systematists’ Forum**

*The Natural History Museum, London*

For more details: [www.systass.org](http://www.systass.org)

8 December 2010

**Annual General Meeting and The President’s Lecture**

*Linnean Society, London*

Speaker: Prof. Ole Seehausen

For more details: [www.systass.org](http://www.systass.org)

4-8 July 2011

**Eighth Biennial Meeting of the Systematics Association**

*Queens University Belfast*

For more details: [www.systass.org](http://www.systass.org)