FishBase

KUNGL. VETENSKAPSAKADEMIEN
THE ROYAL SWEDISH ACADEMY OF SCIENCES

Naturhistoriska riksmuseet

Petrus Artedi – Father of Modern Ichthyology

Artedi Lecture on Systematic Ichthyology

5 December 2008, 8:30 – 12:30,
Beijer Hall, the Royal Swedish Academy of Sciences, Stockholm

Programme

Biographies

Abstracts

Fang Kullander, Joseph Nelson, Bo Fernholm, Gloria Arratia, Jan Bergström, Zhang Miman. Photo Te-Yu Liao.

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Moderator	Professor Bo Fernholm, Swedish Museum of Natural History
8:30 – 9:00	Registration, coffee and sandwich
9:00 – 9:10	Professor Jan Bergström, fellow of the Royal Swedish Academy of Sciences *Opening address*
9:10 – 10:00	Professor Joseph S. Nelson, Department of Biological Sciences, University of Alberta *Why so many changes in fish systematics and taxonomy after Artedi?*
10:00 – 10:50	Professor Gloria Arratia, Museum of Natural History, University of Kansas *Fishes in a temporal dimension*
10:50 – 11:10	Coffee break
11:10 – 12:00	Professor Meemann Chang, Institute of Vertebrate Paleontology and Paleoanthropology,Chinese Academy of Sciences *Fossil cypriniforms from China and their paleogeographical and paleoecological implications*
12:00 – 12:10	Professor Jan Bergström, on behalf of professor Gunnar Öquist, Secretary General of the Royal Swedish Academy of Sciences *Presentation of Artedi Lecturer diploma*
12:10 – 12:30	*Round up discussion and close of the symposium*

12:30 – 13:30	Lunch

Artedi lectureships 2008

Professor Gloria Arratia was born in Chile and received her academic education in the University of Chile in Santiago. She defended her PhD dissertation in Historical Geology and Paleontology, at the University of Uppsala, Sweden, in 1996, but that after a long career as a leading scientist in the fields of Recent and Fossil fish systematics, with positions in the University of Chile, the Museum of Natural History in Berlin, and, presently, The University of Kansas. Her main interest is in the morphology, ontogeny and phylogenetic relationships of teleosts, and that is where her main contributions come in, including several classical papers on teleost phylogeny and morphology. Professor Arratia is the author of over 100 scientific papers and book chapters, and editor or co-editor of several books. She supervised 10 PhD students and a similar number of postdoctoral fellows, and has given numerous presentations at scientific meetings. She already received several honors and awards, such as the Humboldt Prize and the Robert H. Gibbs, Jr Memorial Award for 'An outstanding body of published work in systematic ichthyology', and is a member of the Academy of Sciences of Chile.

Professor Arratia is recognized for her scientific contributions combining both Neontology and Paleontology in novel syntheses and hypotheses advancing our understanding of particularly teleost interrelationships, and for her stimulating mentorship expressed in teaching and training of students, conference presentations, and book production.

Professor Joseph S. Nelson, emeritus of the University of Alberta, Canada, is one of the world's best known and influential ichthyologists. He received his PhD at the University of British Columbia in 1965 on hybridization and isolation mechanisms in catostomid fishes. Professor Nelson publishes the book *Fishes of the World*, which is a scientific, comprehensive review of all families of fishes, fossil and Recent, contained in an eclectic classification that has become a world standard for fish classification and an invaluable source for information about the diversity of fishes. The first edition appeared in 1976, and the most recent, fourth edition in 2006. Professor Nelson is the author of more than 100 scientific papers and books, covering a very wide range of interest in fishes, from the accepted common names of North American fishes (in a committee that he Chairs) to morphological variation in sticklebacks. He has already received several awards, including the Robert H. Gibbs, Jr. Memorial Award for 'An outstanding body of published work in systematic ichthyology'.

Professor Nelson is recognized for his very special, high impact contribution to ichthyology in the book *Fishes of the World*, now in its fourth edition, and its comprehensive classification, representing the *Ichthyologia* of our time.

Professor Zhang Miman (appears in all her scientific publications as Meemann Chang) is one of the world's most renowned paleoichthyologists. Born in China, she was educated also in Sweden and the Soviet Union. She received her PhD from Stockholm University in 1982 on the anatomy of the braincase of *Youngolepis*, a fossil crossopterygian from China. *Youngolepis* challenged the views held then about sarcopterygian interrelationships, and revitalized the systematic study of Devonian fish-like vertebrates. Returned to China, Professor Zhang developed the Institute of Vertebrate Paleontology and Paleoanthropology in Beijing to a world leading center of paleontology backed by the rich Chinese fossil fauna. Professor Zhang is a member of the Chinese Academy and the author of some 60 scientific papers and books. Professor Zhang provided opportunities for many students to develop internationally important careers, and herself has continued her career at the frontline of fossil fish systematics.

Professor Zhang is recognized for her considerable breadth of expertise in fish systematics, her overall impact on lower vertebrate systematics, her untiring quest for new frontiers in paleontology, and her mentorship for Chinese ichthyologists and biology students worldwide.

Why so many changes in fish systematics and taxonomy after Artedi?

Joseph S. Nelson

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We celebrate the short life of Petrus Artedi, the Father of Ichthyology, whose contributions, thanks to Carl Linnaeus, put Ichthyology on a scientific basis. After Artedi's work, there have been many changes to our classification. A yearly average of 100 valid new species of fishes have been described since the monumental list of Artedi. Estimating what the total species count might eventually be above the currently recognized 29,000 valid species has problems. Many workers are employing a species concept that is resulting in an inflation of species numbers. Diagnosability as the criterion is also being used to assist conservation efforts in countries/states that lack a solid means of protecting biodiversity other than by using the Linnaean species concept (versus lower categories). This is a problem that confounds making meaningful comparisons.

Fishes are part of our ancestry and have been around for over 500 million years, but they are not a natural group in classification. They are a diversified group whose 29,000 species, outnumbering tetrapod species, are placed in about 515 families. Amongst other differences, there is a disproportionate number of fishes lacking the pelvic fins in families with few species. Many of Artedi's species as described by Linnaeus remain valid. However, there have been enormous changes in our classifications and in the meaning and significance of the difference and similarity between species. The cladistic revolution, whose beginnings in fish systematics had its origins in Sweden, brought about much change in classification and renewal in research. Rather than achieving agreement in what the relationships of fishes are given our enormous resources in paleontology, molecular biology, and morphological studies, we have a great deal of disagreement in some groups. Conflicts between differing approaches present challenges in understanding phylogenetic relationships. However, we do have many areas of agreement. Scientific names will always change to meet the results of expanding knowledge, but, for the publics benefit, there are many successful efforts on a regional basis to standardize common names in English. However, the misuse of common names by some vendors, thereby deceiving the public, is a serious problem.

For the future, it behooves us in understanding global biodiversity of fishes to increase field collecting, lab studies on the species, and the ability museums to properly maintain specimens and make them available to other workers. This will be achieved with the continuing help of such groups as FishBase Sweden, The Royal Swedish Academy of Sciences, and The Swedish Museum of Natural History.

Fishes in a temporal dimension

Gloria Arratia

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Fishes are represented today by three major lineages—the cartilaginous fishes or chondrichthyans (e.g., sharks) and the bony fishes including sarcopterygians (e.g., lungfishes) and actinopterygians or fin-rayed fishes (e.g., trouts). Among the three, the largest diversity is shown by one group, the actinopterygians. Among the actinopterygians, the teleosts alone are the most specious group of vertebrates. Artedi dealt almost exclusively with teleost fishes. Only a few lower actinopterygians, such as the sturgeon, were known to him.

The fossil record reveals quite a different history compared to the present diversity; one that began more than 400 million years ago with (1) fish lineages that are long extinct (e.g., placoderms and acanthodians), (2) groups that were once greatly successful (e.g., coelacanthiforms and lungfishes), but are represented by only a few species today, and (3) groups that are successful today, but have experienced significant changes during their evolutionary history (e.g., chondrichthyans with about 18 extinct orders in contrast to 13 extant orders). Commonly, the changes in diversity have not been the result of one major extinction event, but successive and alternated extinction and radiation events. For instance, during the Mesozoic the coelacanthiforms showed two major diversification events, one at the beginning of the Triassic and another close to the end of the Jurassic. These diversification events alternate with progressive extinction events during the Permian, Middle Jurassic and close to the end Cretaceous. In contrast, the teleosts show a different and unique pattern of diversification. The teleosts, which were present with only a few species at the end of the Triassic, experienced a progressive increase in the total number of genera. It is important to note that these were not the same genera—there were at least three times between the Late Triassic and end Jurassic when complete replacements of genera occurred. In addition, the record shows that most species do not survive for long periods of time, but are rather short-lived lasting just a few million years. Groups under similar environmental changes and pressure show different capacities of adaptation and consequently of survival. In addition, the evolutionary rate of morphological changes (innovations) differs in time for different fish groups.

The evolutionary history of some selected fish groups will be shown and the differences between successful lineages versus disappearing groups will be discussed.

Fossil cypriniforms from China and their paleobiogeographical and paleoecological implications

Zhang Miman 弥曼

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The Cypriniformes is a widespread and very diverse freshwater group today, and is of considerable significance in fisheries in Asia. Although the group has a very interesting evolutionary and distributional history, views about its taxonomic subdivision are still diverse.

Fossil cypriniforms are very abundant in China. They represent three of the five or six Recent families: the Catostomidae, Cobitidae and Cyprinidae. Yet their studies have been neglected mainly because of their fossils occurred mostly in the often easily weathered Cenozoic deposits, unfavorable for good preservation of fossils. In addition, these fossils are not sensational enough to media or general public so as to attract researchers' attention. With the recent growing concerns, by citizens and scientists alike, of the global climatic changes and especially the major impacts on the welfare of human society by modern geological events, more interest is shifted to the earth history of more recent past, including the fossils of younger age. Moreover, the disposition of the land and sea has reached its recent configuration in the Cenozoic, and it is easier to trace back what happened in the recent past than in the more distant past.

In addition to systematics, the recent studies on the fossil cypriniforms from China provide interesting results in at least two aspects: paleobiogeographical and paleoecological. Comparison of the Eocene catostomids from mainland East Asia with those from western North America points to an obvious transpacific distributional pattern: whereas the fossil record reveals that they reached their maximum during the Eocene, their modern day disjunct distribution shows that there is only one species surviving in restricted areas of Asia and more than 70 species widespread in North America. Fossil cobitids are comparatively rare. Cyprinids are the most diverse and widespread group among the three families. The Miocene and Pliocene taxa shared by east mainland Asia and the Japanese Islands indicate that the fishes from these areas must have belonged to the same ichthyofauna during the Neogene. At the same time, some of them are quite similar to those from Europe, indicating there was a closer connection between the two areas than previously thought.

Fossil cypriniforms also provide evidence for understanding the environmental changes during the period of their existence. An example of an extraordinarily thick-boned cyprinid discovered from the Qaidam Basin (northern Tibetan Plateau) is shown to be a link to the aridification of the area since the beginning of the Late Cenozoic as a result of the India–Asia plate collision and associated uplift of the Tibetan Plateau.