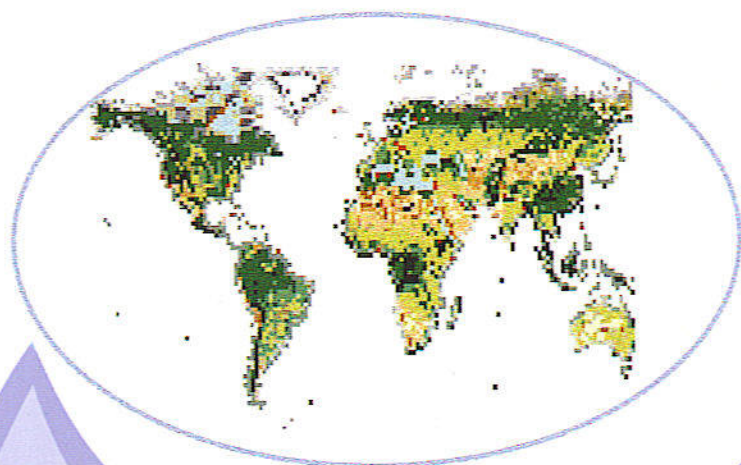


# **BIOLOGY INTERNATIONAL**

**The News Magazine of the International  
Union of Biological Sciences (IUBS)**



**TOWARDS AN INTEGRATIVE BIOLOGY (TAIB)  
Program Activities 1999**

**GLOBAL TAXONOMY INITIATIVE (GTI)  
DIVERSITAS & IBOY (2000-2001)  
An Overview**

**N° 38**

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# **Biology International N° 38 (January, 2000)**

## **Editorial**

• IUBS: 80th Jubilee By Talal Younès	1
<b>IUBS TAIB Program Activities (1999)</b>	
• TAIB Symposium on Alternative Reproductive Strategies By Marvalee H. Wake	3
• TAIB Symposium on Episodic Events in Watershed Systems By José Tundisi and Motonori Hoshi	7
• TAIB Exploratory Meeting on Molecular Biology of Stress Responses By Subhash C. Eakhotia	9
• Towards An Integrative Biology Symposium for AAAS Congress By Marvalee H. Wake	11
<b>The Global Taxonomy Initiative - Quo vadis ?</b>	
By Ian D. Cresswell and Peter Bridgewater	12
<b>DIVERSITAS</b>	
• An Overview 1999	17
• International Biodiversity Observation Year (IBOY 2000-2001)	19
<b>IUBS Members Congresses</b>	
• The New (XVIIIth) International Congress of Zoology By Francis Dov Por, Rosa Polymeni and Stuart G. Poss	22
• XVIth International Botanical Congress, 1999, St. Louis, USA By Pieter Baas	24
<b>Biology International</b>	
• Guidelines for Authors	25
<b>Publications Review</b>	27
<b>Calendar of Meetings</b>	30

## Editorial

### IUBS: 80th Jubilee

#### **Integrative biologists and the challenge of complexity**

Looking back and forward, The New York Times recently surmised, if the 20th Century could be considered the age of physics, the 21st Century will probably be the age of biology. Whether this prediction proves true or not, it still points to the high expectations inspired by biological sciences to bring about a deeper understanding of how the brain and mind work, to design genetic treatments for diseases, to develop biotechnologies to satisfy the needs for better and safer food for growing human populations, and ecotechnologies to preserve a healthy environment.

The present issue of *Biology International* not only coincides with the passage between the two centuries, but also marks the completion of eighty years in the life of the International Union of Biological Sciences (IUBS). This is occasion to look backward and recall the milestones that have marked the life of the IUBS since its foundation in 1919 at the Royal Academy of Sciences in Brussels, Belgium. For almost a century, the IUBS has been at the service of biology, biologists and societies. It has provided an open forum for discussion among scientists and promoted international collaboration in biological research and education and cooperation with national, regional and international partners concerned with life sciences (Younès, 1991). The IUBS structure and activities have accompanied and facilitated the evolution of new biological disciplines and, more importantly, helped to place biological sciences at the service of the development and welfare of humankind.

During the period extending into the 1950's, emphasis was on consolidating biological disciplines: botany, zoology, genetics, developmental biology, evolutionary biology, ecology and theoretical biology. From the sixties onward, IUBS scientific activities were pursued with three basic principles in mind: international, global and interdisciplinary collaboration, with a strong focus on linking biological research and education to societal needs.

The IUBS scientific programs included a wide array of topics ranging from biological productivity, tropical biology, theoretical biology, biological complexity, biological diversity, bioindicators, reproductive biology and aquaculture, bionomenclature, systematics biology, biological education, and bioethics, etc. And all of these programs exemplified the above three basic principles, i.e., international, global and interdisciplinary collaboration. Among these programs, three deserve special note due to their magnitude, impact, and the conceptual continuum.

Firstly, the International Biological Program (IBP), which was initiated by IUBS and implemented under the aegis of ICSU (1964-1974), marked the emergence of global, international collaborative research in biology. Directed to study the biological productivity of the Earth's terrestrial, marine and freshwater Systems, human adaptability, and resource use and management, the IPB stimulated world-wide environmental awareness and laid the foundation of such major endeavours as the Man and Biosphere Program of UNESCO, the establishment of SCOPE (ICSU Scientific Committee on the Problems of the Environment), the United Nations Environment Program (UNEP) and the United Nations Stockholm Conference on Human Environment in 1972, which was

followed, twenty years later, by the Earth Summit on Environment and Development in 1992 in Rio-de-Janeiro, Brazil.

Continuing the IBP's tradition, in the period 1982-1992, the IUBS 'Decade of the Tropics Collaborative Research Program' represented a major effort to promote biological research relevant to tropical regions. Five sub-programs were developed dealing with: (a) Responses of Savannas to Stress and Disturbances, (b) Tropical Soil Biology and Fertility, (c) Significance of Tropical Species Diversity, (d) Tropical Mountain Comparative Studies, and (e) Tropical Human Populations.

Following a long gestation (1985-1991) within the Decade's theme related to tropical species diversity, the third program, DIVERSITAS, was launched at the IUBS General Assembly in 1991. This 'International Program on the Science of Biodiversity', which is now co-sponsored by IUBS, SCOPE, UNESCO, ICSU, IUMS and IGBP, the DIVERSITAS Program (see page 17) has made an invaluable contribution to bringing about a better scientific perception and understanding of the complex issue of biodiversity. And it still fulfils an important function in providing the scientific basis and guidelines needed for the biodiversity conservation and management, in partnership with the Secretariat of the Convention on Biological Diversity.

More recently, the IUBS Program Towards An Integrative Biology (TAIB)' was adopted at the last General Assembly (1997) in Taipei. Within the context of this program, *Integrative Biology is ...both an approach to and about the practice of science. It seeks diversity and incorporation and deals with integration across all levels of biological organisation,...and diversity across taxa.* Following the paper "Towards An Integrative Biology Program," which presented the conceptual framework of TAIB in the last Issue of Biology International, the present Issue contains brief reports of four TAIB exploratory meetings held in 1999 (see pages 3-11): Towards An Integrative Biology' Symposium for the American Association for the Advancement of Science (AAAS), in January, in Anaheim, USA; 'Episodic Events in Watershed Systems' in June, in San Pedro, Brazil; 'Stress Biology' in October, in Wuhan, China; and 'Alternative Reproductive Strategies' in November, in Hayama, Japan. A meeting on 'Integrative Biology Education' will be organized within the framework of the IUBS/UNESCO International Conference "BioEd 2000: the Challenges of the 21st Century " which will be held on May 15-18, 2000 in Paris.

With the start of the 21st Century, biological domains are witnessing an explosion of information, and scientific data are accumulating at an alarming pace. Scientists are increasingly aware of the underlying complexity of biological phenomena and Systems. A new approach and a new attitude to the field and education will be needed. Now, after eighty years in the life of IUBS, the main challenge facing the Union will be how better to promote integrative biology research and education, the better to address the many complex biology related issues and problems we encounter in our lives, individuals and societies and in our environment.

Talal Younès  
Executive Director, IUBS

IUBS, 1999. "BioEd 2000: The Challenges of Biological Education for the next Century," *Biology International* 27: 10-13.

The New York Times, 12 December, 1999.

"Towards An Integrative Biology (TAIB) Program." *Biology International* 27: 3-9.

Younès, T., 1991. Seventy Years of IUBS: Assets, Constraints and Potential for International *Coopération*. *Biology International*, 22: 2-11.

## **Towards An Integrative Biology (TAIB) Program**

# **Symposium on Alternative Reproductive Strategies**

by Marvalee H. Wake

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"Integrative biology is both an approach to and an attitude about the practice of science. It seeks both diversity and incorporation. It deals with integration across all levels of biological organization,...and diversity across taxa. It provides both a philosophy and a mechanism for facilitating science at the interfaces of...disciplines, in both research and training. Work at interfaces involves discussion of significant problems among scientists with diverse expertise and perspectives." (*Biology International*. 1999, 37:2). A symposium on Alternative Reproductive Strategies was organized and hosted by Motonori Hoshi of the Technical University of Japan, and his colleagues. It took place at the Shonan International Village of the Graduate University for Advanced Studies, Hayama, Japan, overlooking Sagami Bay with Mt. Fuji looming in the background, on November 25-28, 1999.

The content of the symposium encompassed a great range of elements of reproductive strategies, organized into several topical areas. The symposium dealt with a great diversity of study organisms (microbes, plants, and animals of all sorts) and approaches to questions. Participants were researchers from throughout the world who had diverse expertise, many of whom work at several of the 'levels' of the hierarchy of biological organization, who use diverse techniques, are transdisciplinary, and are interested in complex questions. The scope of the symposium was so vast that several participants initially believed that communication would be limited, but as the symposium developed, they found themselves engaged in wide-ranging discussion that provided new insights into the mechanisms, as well as the phenomena, of alternative reproductive strategies, with syntheses of theory and empiricism from several of the sub-disciplines of biology. There was general agreement that the level of the science discussed was of the highest, and one's own research was enriched thereby. New scientific collaborations were initiated, and many collegial new friendships were established; this is a tribute to the organization and generosity of our hosts.

The symposium scientific program and its speakers illustrate the range of biological emphases that contribute to analysis of the reasons for alternative reproductive strategies, how they come to be, and how they seem to operate:

### **Opening Lecture**

Akinobu Nakazono, Kyushu University, "Sex change and alternative reproductive strategy in a temperate labrid fish, *Halichoeres bleekeri*"

Heinz-Dieter Franke, Biologische Anstalt Helgoland, "Alternative male mating tactics and their implications, exemplified by *Jaera hopeana* (Crustacea, Isopoda)"

Makito Kobayashi, University of Tokyo, "Sexual plasticity of reproductive behavior in goldfish and gynogenetic crucian carp"

Masatoshi Suzuki, University of Tokyo, "Granulin is a sex-steroid inducible gene in the hypothalamus and involved in sexual differentiation of the rat brain"

### **Oviparous or Viviparous**

Eugenia M. Del Pino V., Pontificia Universidad Catolica del Ecuador, "Alternative reproductive and developmental mechanisms in marsupial frogs"

Richard Shine, University of Sydney, "The ecology and evolution of viviparity in reptiles"

Satoshi Tanaka, University of Tokyo, "Trophoblast cells, a key player in viviparity in mammals"

### **Special Lecture**

Irving L. Weissman, Stanford University, "Evolution of stem cells: Biology, transplantation, and allorecognition"

Marvalee H. Wake, University of California, Berkeley, "Concluding remarks".

Several underlying themes emerged from the presentations and discussion that appear to characterize an integrative approach to the study of alternative reproductive strategies. In some ways, these themes characterize approaches to research in several areas of biology, so it is interesting and appropriate that they are featured in the work presented in this symposium, given all of its diversity. The themes include:

1. The search for mechanisms to explain observed phenomena (including the genetic basis and molecular, cellular, physiological, behavioral, ecological, and evolutionary mechanisms as appropriate to the question).
2. Multi-level (trans-hierarchical) analyses.
3. Diverse study organisms (choice of appropriate taxa, rather than reliance on "traditional" model organisms).
4. Both broadly comparative studies and the idiographic, in which a single case or taxon is explored.
5. Thinking in terms of the evolution of the system or mechanism in question, often including a foundation based on a phylogenetic hypothesis so that pattern and direction of evolution can be adduced.
6. Concern about complexity and/or redundancy; dichotomies are rarely simple (or even real).
7. Extensive conservatism and evolutionary retention of genes, molecules, patterns, and processes.
8. The importance of time scales--physiological to evolutionary.
9. A range of techniques and approaches that is transdisciplinary and often unanticipated.

David L. Kirk, Washington University, "Alternative reproductive strategies of *Volvox* and its relatives"

### **Asexual or Sexual**

Fuyuki Ishikawa, Tokyo Institute of Technology, "Why do we have linear chromosomes?"

Ichizo Kobayashi, University of Tokyo, "Sex as a strategy against genomic parasites--inference from bacterial worlds"

Hiroyoshi Takano, Kumamoto University, "A plot of parasite: A mitochondrial plastid that promotes mitochondrial fusion and recombination"

Hideko Urushihara, Tsukuba University, "Alternative reproductive strategies in *Dictyostelium*"

Kazuyuki Mikami, Miyagi University of Education, "Nuclear dimorphism and conjugation in *Paramecium*"

Nico K. Michiels, University of Münster, "Hermaphroditism: the long-term costs of being a short-term opportunist"

Benjamin Normark, Harvard University, "Phylogeny and evolution of alternative genetic systems in insects"

Robert Luck, University of California, Riverside, "Wolbachia-induced parthenogenesis"

Gagan Lushai, University of Southampton, "The genetic diversity within a clonal lineage"

Kazuo Kawamura, Kochi University, "Asexual reproduction in chordates"

Asako Sugimoto, University of Tokyo, "Regulation of gametogenesis and meiosis in the nematode *C. elegans*"

Satoru Kobayashi, Tsukuba University, "Mechanism of germ-line development in *Drosophila* embryos"

Adriaan W. C. Dorresteyn, Johannes Gutenberg Universität, "Spectacular reproductive strategies in polychaetes"

Kazuya Kobayashi, PRESTO, JST, and Tokyo Institute of Technology, "Switching from asexuals to sexuals in planarians"

### **Biparental or Uniparental**

Mitsuyasu Hasebe, National Institute for Basic Biology, "Origin and evolution of floral homeotic genes in green plants"

Marcy Uyenoyama, Duke University, "Evolutionary dynamics of self-incompatibility systems in flowering plants"

Rosaria De Santis, Stazione Zoologica Anton Dohrn, "Gamete self-discrimination in the hermaphrodite ascidian *Ciona intestinalis*"

Masaru Taniguchi, Chiba University, "A novel immunological mechanism of abortion"

Hiroshi Onozato, Shinsyu University, "Parthenogenesis through fertilization in fish"

### **Male or Female**

Jody Banks, Purdue University, "Genetic and epigenetic factors that control sex determination in ferns"

Claude Pieau, Université Paris 7, "Factors involved in genotypic and temperature-dependent sex determination in vertebrates"

10. The discovery that epigenetic, ecological and behavioral components of the phenomena being explored complement the molecular and genetic analyses of the phenomena.

The study of alternative reproductive strategies from an integrative perspective also illuminates a number of fundamental questions in biology. Such questions or problems include:

1. The evolution of multicellularity.
2. Haploidy *vs.* diploidy *vs.* polyploidy.
3. The evolution of sex.
4. The invasion of land by plants and animals.
5. The nature of natural selection (factors, processes, responses).
6. The search for markers, regulators, and receptors in order to determine mechanistic pathways.
7. The role of "rare" occurrences in the evolution of novelty and the maintenance of lineages.
8. The degree of generality of principles derived from the study of particular organisms, phenomena, or processes.
9. Hypothesis formation, and appropriate tests for falsification of hypotheses.
10. The explanatory power of experimental biology at molecular/cellular levels in ecological/behavioral/evolutionary contexts.

A great diversity of questions, problems, patterns, processes and organisms has been studied in order to attempt to analyze alternative reproductive strategies; an extensive and persuasive sampling of that diversity was presented in our symposium. Still, this commentator retains the impression that we have only begun our analysis of reproductive strategies; as we find an answer to a question, we open several new questions. As we resolve an issue at one level, we place it in a new context--the genetic becomes the developmental, the developmental the physiological and behavioral, and so it goes. Our diversity of presentations revealed that there are still many open questions. To cite only a few among the many considered in the papers presented, the organization of chromosomes, the nature of transposons as genomic parasites, hermaphroditism and its costs and benefits, parthenogenesis and its induction and effects, selfing *vs.* self-discrimination/incompatibility systems, mechanisms of sex determination, sexual plasticity, causal factors in the evolution of derived reproductive modes, and similar major questions require further investigation. These are just examples of problems for which we know a lot about in a few organisms, phenomena that we suspect are more widespread than currently estimated, and which would be revealed with more extensive study of other organisms and the genetic, biochemical, physiological, behavioral, ecological, and evolutionary constructs that both permit and constrain them. We remain unsure how generalizable the patterns that we observe might be. These are some of the issues that stimulate our interest and dedication, and keep us working at our research and communicating our results. This symposium will help to lead the way to bring focus to such questions and problems, and serves as a model for the communication of excellent and wide-ranging science. The future of integrative biology as a research paradigm for the study of such wide-ranging questions as those of the biology of



alternative reproductive strategies is promising. As illustrated by the presentations in this symposium, techniques abound, and communication, collaboration, and intellectual cross-fertilization among colleagues of diverse research backgrounds and interests thrives, making possible new insights into major questions in biology. We owe much to the organizer of the symposium, Professor Motonori Hoshi, for bringing together our disparate band of colleagues; we seem to agree that we have reached a new degree of open-mindedness, outreach, and interest in the many parameters of our own and each others investigations of alternative reproductive strategies. Both the science presented and the overall organization deserve extensive exposition, in the opinion of this participant.

Following the symposium, many participants had the honor to attend the award ceremony for the International Prize in Biology in Tokyo, which was accorded to S. Ebashi, for his research on the role of calcium in various cellular and physiological processes. The ceremony was attended by the Emperor and Empress of Japan, and many distinguished Japanese biologists, whom we had the opportunity to meet. All in all, the symposium and its attendant events provided outstanding science and great cordiality, with a lasting impression of the necessity of transdisciplinary communication to allow new ideas to emerge regarding major scientific questions.

## Towards An Integrative Biology (TAIB) Program

# TAIB Symposium on Episodic Events in Watershed Systems

held on 10-12 June, 1999 at Fazenda Colina Verde, S. Pedro, Brazil

by José Tundisi

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The symposium "Towards Integrative Studies of Episodic Events in Watershed Systems" was organized on the occasion of the IUBS Executive Committee meeting held in June 1999, with three main components: episodic events, the watershed approach to understanding river-reservoir interactions with the surrounding terrestrial system, and watershed management with all of its implications — ecological/economic/social.

Professor J.G. Tundisi described the **watershed approach** in ecological studies, especially in the understanding of river/reservoir ecosystems and their interactions with the terrestrial system. The watershed is a physical unit with a clear boundary, driven by *forcing* functions such as the hydrological cycle, solar radiation and wind. Soil uses and occupation and the degree of land use/conservation have a considerable impact on the aquatic systems, especially in the biogeochemical cycles, the *succession* of communities (planktonic, benthonic, fishes) and their diversity. Contamination of the aquatic ecosystems has its main input from the watershed uses, such as agricultural activities and the use of fertilizers, pesticides, herbicides.

Several approaches have been developed in South America to protect and recover the watersheds, in order to recover river/reservoir systems. Among these, ecotechnological methods, lake/river/reservoir shore protection and restoration, and special tools for waste disposal have been tried and are under experimentation. The watershed approach has also been used for environmental and biology education in such a way that a practical overview of interactions, compartments, sub-systems is given; field work, observation, measurements, collection of biological material are part of the training activities in the watershed. The watershed approach has also been instrumental for public participation and for solving the issues of conflicting upstream/downstream uses.

**Episodic events** were described by Professor Odette Rocha and her group working on several aquatic ecosystems in South America. These episodic events are linked to water level fluctuations and/or climatological events, and their effects on the productivity/diversity of the communities. Episodic events in reservoirs were mainly of an artificial origin, being a result of several human interferences in the whole system:

water withdrawal for several purposes, and as a consequence, changes in the water level, effects on the composition of the planktonic community upstream and downstream changes in the chemical composition of the water and in the biochemical cycles. The effects of el Niño on some aquatic ecosystems were described briefly.

Professor Martha Vannucci reported on the effects of **episodic events at mangrove ecosystems** and how the organization of the communities and human activities are related to these events. The interaction of human communities with the mangrove ecosystems was discussed, and one of the conclusions is that the links between the ecological, social and economical components have to be better understood.

Professor Luiz Martinelli reported the studies carried out on the *Piracicaba* river basin located 200 km from the S. Paulo metropolitan area. This basin has been heavily impacted by land use/soil *degradation*, industrial activity and the discharge of domestic, non-treated sewage.

As a result, there was a general loss of biodiversity in the terrestrial as well as the aquatic systems. The aquatic ecosystems (rivers, reservoirs, and small ponds) are equally impacted by nitrogen and phosphorus and toxic substances such as pesticides and herbicides or heavy metals. The **management approaches** are directed towards the understanding of the cause-effect relationships; the geoprocessing of all subunits and sub-systems; the detection of the sources of impact and the organization of all information related to the basin. A *consortium* of cities is in full development in such a way that the administration of the watershed is now shared by all those involved (cities, industry, general public, politicians and stakeholders). There has been some improvement on the watershed recovery. Environmental education at schools and for the general public is becoming an important tool for protection, recovery and management of the watershed.

### **Summary of Discussions on Episodic Events in Watershed Systems**

For the purpose of discussions in this workshop, episodic events are defined as the events affecting natural systems that happen unpredictably in terms of frequency and/or intensity. It is stressed by the participants of the workshop that the integration of scientific, educational and socio-economical aspects of episodic events appears to be the first and most urgent issue to be considered. Although various episodic events are also driven in other systems, those in watershed systems are mainly discussed along the following three of their features: human impacts, effects on physiology, and effects on reproduction.

#### **Human Impacts**

Human activities may cause episodic events in various ways with impact on bio-systems such as ecosystems; and conversely, natural episodic events may cause impacts on socio-economical human activities. Since we are simultaneously dealing with two distinct but strongly inter-connected systems, biological and social systems, understanding biological aspects of ecosystem functioning must go simultaneously and

in parallel with understanding social dimensions. It is recognized to be most important to line-up empirical and theoretical analysis to a well-defined management plan.

### **Effects of Physiology**

Depending on time scales, spatial scales and structures, and hierarchical levels in bio-systems, effects of episodic events on living organisms in watershed systems should be discussed separately, even though mutually closely related. Effects on physiology are mostly expressed in individuals in a rather short span of time such as behavioral alterations in response to quantitative and/or qualitative nutrient changes caused by episodic events. However, these direct effects may be followed by indirect and/or delayed consequences and may eventually affect genetic and species diversities, ecosystem structures, and even evolutionary processes.

### **Effects on Reproduction**

Reproductive events in many species of animals and plants are altered directly and/or indirectly by episodic events in a watershed system such as floods, drought and fire. Effects of episodic events upon reproduction are considered along the water flow in a watershed system, from head water sources through streams to rivers and lakes to outflow through estuaries to oceans. Then direct and indirect effects are assessed for examples of natural vs. human-induced, regular vs. irregular, and frequent vs. infrequent episodic events.

Assessments of several examples of episodic events that affect watershed systems suggest some general guidelines for the development of research and management programs. Conflicting interests must be recognized as the demands of the biological diversity present in any system. We recognize four general principles:

Effects on entire systems must be examined and assessed, not merely local or species-specific effects. Systems and proposed programs should be compared with analogous examples, programs and/or sites in order to assess feasibility and techniques. Regular monitoring programs should be established so that baseline data are available for dealing with episodic events. Scientists and policy makers should acquire the expertise and cooperation essential to the preparation of programs for research and management as situations arise and demand prompts actions.

As a conclusion, the discussants considered that it is impossible to consider only biogeophysical processes in the management of the ecosystems. It is necessary to include a human-social and economic dimension in order to understand clearly mechanisms of management and restoration. Community participation is a *functional* tool for any actions related to management and recovery of ecosystems. Community organization may change from country to country or region to region; but its participation at all levels is important. The role of education at all levels was stressed and the need for capacity building considering this new approach was emphasized.

## **TAIB Special Exploratory Meeting on Molecular Biology of Stress Responses**

by S.C. Lakhotia

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A special exploratory meeting was organized within the framework of the 2nd International Workshop on Stress Biology held on October 15-18, 1999, at Wuhan, China to review the present scenario in different areas of Stress Biology from the perspective of the IUBS "Towards An Integrative Biology (TAIB) Program, and to make recommendations for future directions which the IUBS may consider within the framework of the TAIB program.

This special session was held on October 16, 1999 with the participation of the following leading Stress Biologists: Prof. Takhashi Yura, Japan; Prof. Peter Csermely, Hungary; Prof. Wolfgang Schumann, Germany; Prof. A. Patrick Arrigo, France; Prof. Robert Tanguay; Dr. Tangchun Wu, China; Dr. J. Gowrishankar, India; Prof. Larry E. Hightower, USA; Prof. Richard I. Morimoto, USA; Prof. Martin Feder, USA; Dr. Zihai Li, USA (in place of Prof. Pramod K. Srivastava) and Prof. S. C. Lakhotia, India, (Convenor).

Prof. Lakhotia introduced the basic objectives of the TAIB Program of IUBS. Members expressed satisfaction and happiness that the IUBS has sponsored this special meeting. It was unanimously emphasized that studies relating to cellular responses to a variety of biotic and abiotic responses provided excellent opportunities to study and understand biological systems in an integrated manner. Most of the participating scientists had prepared status reports on different areas of Stress Biology in which they also highlighted the areas that deserve special attention in the coming millennium. After discussing these reports and other points, the group suggested that the following aspects of Stress Biology are of special relevance to the TAIB program of the IUBS and need to be promoted and supported.

1. Evolution and roles of stress response genes in adaptation, and in generating and maintaining biodiversity
2. Functions of Stress Proteins as molecular chaperones, in compartmentalization of molecules in cells and in maintenance of the cyto-architecture
3. Regulation of Stress Responses with special reference to:
  - a) Evolution, structure and other roles of the Heat Shock Transcription Factor/s in different organisms
  - b) Inter-individual variability in the stress responses and its relation to genotypic variations and "fitness"
  - c) Intra-individual variability in the stress response (tissue-specificity) and its functional significance

followed, twenty years later, by the Earth Summit on Environment and Development in 1992 in Rio-de-Janeiro, Brazil.

Continuing the IBP's tradition, in the period 1982-1992, the IUBS 'Decade of the Tropics Collaborative Research Program' represented a major effort to promote biological research relevant to tropical regions. Five sub-programs were developed dealing with: (a) Responses of Savannas to Stress and Disturbances, (b) Tropical Soil Biology and Fertility, (c) Significance of Tropical Species Diversity, (d) Tropical Mountain Comparative Studies, and (e) Tropical Human Populations.

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4. Stress Proteins as Bio-indicators of pollution and to identify agents that may be stressful to cells
5. Stress proteins in Health and Disease
  - a) Response of the host cells to parasite/pathogen
  - b) Response of the parasite/pathogen to host's biological environment
  - c) Involvement of stress proteins in pathological conditions involving triplet-repeat expansions in specific genes in man
  - d) Role of stress proteins in humoral and cellular immune responses
  - e) Stress proteins in cancer and apoptosis
  - f) Hyperthermia and radio-sensitivity/radio-protection
6. Biotechnological applications: Transfer of stress genes to improve survival of crop plants under different stress conditions prevailing in the nature.

The group also recommended the following steps to the IUBS so that the above activities are appropriately promoted:

A. The Cell Stress Society International (CSSI) is already functioning to promote Cell Stress related scientific activities. This Society also brings out a well-recognized scientific journal, *Cell Stress and Chaperones* (editor L. J. Hightower). In view of this, the IUBS may interact with this society in stress biology related programs.

B. The "International Workshops on Molecular Biology of Stress responses" have become a regular feature and it has been agreed that such meetings will be held in developing countries only so that more and more scientists from these countries can participate in international events: the first one was held at Varanasi, India in 1997, the second one at Wuhan, China in 1999 and the third one is planned for 2001 in Argentina. The IUBS may recognize these meetings and provide adequate support for participation of stress biologists, particularly from developing countries.

## Towards an Integrative Biology À Symposium for the American Association for the Advancement of Science

by Marvalee H. Wake

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The "Towards an Integrative Biology" program of the IUBS was introduced in the United States via a symposium held at the annual meeting of the American Association for the Advancement of Science (AAAS) in Anaheim, ÇA, on January 21, 1999. The symposium immediately followed the organizational meeting for the program that took place in Berkeley, ÇA; that meeting and its accomplishments were discussed in the last issue of *Biology International*, No. 37.

The premise for the IUBS program, and therefore the symposium, was described as follows: biology too often is perceived to be a fragmented science, interested largely in reductionistic approaches that spawn narrow sub-disciplines. The value of such approaches is undeniable, but the perception of lack of communication among biologists in research efforts and in education and public policy is a serious problem. Recognition of these difficulties has increased during the last decade, and several efforts to increase the interdisciplinary of biology, both within the larger discipline and across to the physical sciences and engineering, and to the social sciences, are developing among groups of individuals, institutions, and national and international agencies. "Integrative biology" is a rubric for cross-disciplinary, multi-level approaches to research and education. Such efforts are producing new approaches to research that yield powerful new insights because of their multiplicity, and that have broad contributions to both basic and applied science. Some broad questions in biology have an urgency that demands that an integrative approach to their solution be brought to bear quickly and deliberately (e. g., human-generated rates of extinction). Therefore the IUBS has initiated a program that promotes both the philosophy and the practice of "integrative biology."

The speakers for the symposium were selected because they represented several areas of biology and were known to exemplify integrative perspectives in their own research. Each speaker illustrated such approaches in biology, considered ways of facilitating interdisciplinary and communication, and discussed programmatic means "Towards An Integrative Biology."

1. Jean-Claude Mounolou, Centre de Génétique Moléculaire, CNRS, France, discussed "A molecular geneticist's perspective on population biology and evolution";
2. Motonori Hoshi, Department of Life Science, Tokyo Institute of Technology, Japan, presented "A developmental biologist's view of reproduction and individuality";
3. Roy L. Caldwell, Department of Integrative Biology, University of California, Berkeley, told us about "Putting the mechanism back into behavioral biology";
4. Peter M. Kareiva, Department of Zoology, University of Washington, Seattle, considered "What might save endangered species from human avarice, ignorance and fecundity?"; and
5. Marvalee H. Wake, Department of Integrative Biology, University of California, Berkeley, discussed "Evolutionary morphology: a dynamic approach to integrative biology" and organized the symposium.

The speakers' presentations were followed by a brief question/answer/discussion session with the symposium audience; interest in the nature, scope, and feasibility of "integrative biology" appeared well stimulated.



## **The Global Taxonomy Initiative - Quo vadis?**

Ian D Cresswell, Secretariat, Convention on Biological Diversity, UNEP and Peter Bridgewater, Division of Ecological Sciences, UNESCO.

### Introduction

The taxonomic community globally sees an urgent need for capacity building and infrastructure renewal if taxonomy is to keep up with the demand for up-to-date information on species. The Convention on Biological Diversity (CBD) has recognised this taxonomic impediment and has formulated the concept of a Global Taxonomy Initiative (GTI) to progress a concerted effort between international funding agencies, national and sub-national governments, and non-government bodies. The COP and SBSTTA have been quite clear that the role of the GTI is to help implement the Convention:

Capacity-building for taxonomy should be linked to the effective implementation of the Convention on Biological Diversity, particularly the national identification of areas of high diversity; improving the understanding of ecosystem functioning; giving priority to threatened taxa, taxa that are or may be of value to humanity, and those with potential use as biological indicators for conservation and sustainable use of biological diversity.

( Decision II/2 of the CBD SBSTTA, 1996)

The message is simple: there is a huge opportunity for advancement and renewal in taxonomy globally, but this must be linked to critical issues of concern of the wider biodiversity community.

The deliberations of COP IV in Bratislava, 1998, highlighted the need for fundamental taxonomic knowledge of biological diversity to underpin the key objectives of the CBD. The Convention deals with diversity at all levels of the biological hierarchy; from genes, species, populations, communities, ecosystems to earthscapes. Yet, as we know, the science of documenting all aspects of biological diversity is young and still developing. The science of taxonomy dealing mostly at the species level is well developed and has a key role to play in providing a rigorous base for the adoption of the ecosystem approach to conservation and sustainable use.

### GTI and the Convention

Leaders from major systematic institutions, ecologists and conservation managers who attended the range of meetings described above, unanimously agreed on the urgent need to accelerate the global taxonomic effort, through development and, critically, implementation, of the GTI.

Our current taxonomic knowledge base is a long way from perfect, as we still don't know all the elements. Moreover, without an understanding of what the elements are, and how they interact to maintain ecosystem function, we are limited in adopting a proactive ecosystem approach to management, as the CBD is chartered to do.

It is important to understand that the governments of the world who recognize the CBD have acknowledged the existence of a taxonomic impediment to sound management and conservation of biodiversity. Taxonomy has in the past, and must continue to provide the base information required for;

Development of food security,

Promotion of health,

Identification and control of disease vectors,

Identification and control of vectors of ecosystem dysfunction,

A scientific basis for conservation management and planning.

The GTI acknowledges that taxonomic efforts are labour intensive processes, due to the large number of organisms involved, and are usually undertaken by specialists. This problem is further amplified in developing countries, which are often species rich, but resource, and sometimes science, poor. While Governments have a strong role to play in advancing the GTI, non- government organizations, and co-financing from private philanthropy, have a key role to play.

CBD-SBSTTA IV reiterated its view that the Executive Secretary of the CBD should provide leadership for the GTI. This leadership must develop new links to other UN agencies (especially UNEP, FAO, UNESCO), and of course existing national and regional activities. It is also imperative for GTI activities to be linked with activities of scientific NGOs - inter alia, Association of Systematics Collections (ASC), DIVERSITAS, BioNET International and IUBS.

#### Taxonomy, traditional knowledge and the GTI

The role of traditional knowledge in the Convention continues to grow. Too often the importance of traditional knowledge systems is excluded from discussions of advancing our overall knowledge base. While in western science taxonomy is nearly exclusively focused on scientific descriptions of taxa characteristics, this should not mean that the GTI is solely dedicated to this ethic. The taxonomic and biodiversity science community must embrace all knowledge that helps us better understand how to manage the world's natural resources. It will only be through equal partnership with all parties who manage and understand all elements of biodiversity (and how they are related) that we will achieve the objectives of the Convention. This paper does not further address how we should develop these linkages, but acknowledges that any system that focuses solely on one world view will be poorer than one that attempts to integrate and understand knowledge from all sources.

#### How to achieve the GTI?

To achieve rapid and effective implementation of the GTI a new partnership must be forged between the world's largest and oldest natural history institutions, institutions from the developing world, professional bodies with a global reach and importantly individuals, to provide the impetus for removing the taxonomic impediment. Such removal of the impediment can only occur through several major areas of activity, each increasing in complexity; viz

Gathering of data ñ collection; enhancing the collections of specimens and the maintenance of reference collections.

Development of information ñ compilation; Compilation and organization of basic data from the collections into databases, regional checklists, key maps etc.

Development of knowledge ñ synthesis; Synthesis of this data and information into monographs, Floras, fauna checklists, keys, input to management.

Each level of increasing complexity delivers information crucial to effective implementation of the CBD. Appropriate focusing of research can assist major action in global biodiversity science. The GTI with its aim of implementing ñ and educating about ñ higher levels of taxonomic activity, and translation of the results of that activity to practical, implementable information must place that information within reach of managers and decision makers.

The taxonomic impediment will be resolved by:

An approach which fosters action to rapidly increase stand-alone taxonomy projects;

Inclusion of taxonomy as a component of broader biodiversity and development projects.

For category (i) a framework of action is needed to stimulate country-driven action, which includes criteria to guide 'needs-assessment' (in relation to their existing capacity/status of taxonomy). These criteria would be based on existing models of practice (CONABIO, SABONET, INBIO, etc.). For category (ii) major projects should be encouraged to include taxonomists in the design of the project, and where appropriate implementation, and importantly analysis of results and recommendations. That way the value-add from the taxonomic community can be maximised.

Taxonomy and systematics are all about communication and information. To conserve, manage or use organisms, or to communicate about them, we need an unambiguous nomenclature. Good taxonomy delivers stable classification and unequivocal names, both of which facilitate communication. In turn, this makes it possible to conserve, manage or use biodiversity more effectively. While, in a sense, it is possible to partially fulfil the Articles of our Convention without any taxonomic base (using the precautionary principle), it will not be possible to achieve these objectives fully, over the long term.

While it is recognised that a sound basis in taxonomy is essential for conservation and sustainable use of the world's natural resources, the taxonomic community must also work in an integrated manner within the broader biodiversity science community if it is to be relevant to the CBD. We need therefore a balance between the imperatives of management and use, and the need for solid, unequivocal information on global biodiversity at the species level (in the first instance). The truth of this is demonstrated by the fact that on both land and in the sea we are still finding species of vertebrates, including mammals - quite large ones - new to science. For other groups, like Pseudoscorpions, Tardigrades, Collembola, Ascomycetes (among others making up the mass of biodiversity garbage workers) we still have little idea of the dimensions of the task of providing the most basic information required for conservation and sustainable use decision-making.

A fundamental question for the CBD is: How many species are there? We seem as far away as ever from answering that question. We must address as quickly as possible what lives where in order to better understand the dimensions of biodiversity, then other management related questions become easier, such as what are the rates of extinction? Assessments of the taxonomic uniqueness and relative contributions of endangered organisms are required immediately to set priorities for conservation, management and use of biological diversity i.e. to fulfil the objectives of the Convention!

#### Next Steps

The following activities are seen as fundamental to capacity building in taxonomy:

developing national, regional and subregional training programmes;

strengthening reference collections in countries of origin including, where appropriate, the exchange of paratypes on mutually agreed upon terms;

(c) making information housed in collections worldwide and the taxonomy based on them available to the countries of origin;

(d) producing and distributing regional taxonomic guides;

(e) strengthening infrastructure for biological collections in countries of origin, and the transfer of modern technologies for taxonomic research and capacity-building; and

(f) disseminating taxonomic information worldwide, inter alia by the clearing-house mechanism.

Efforts to remove the taxonomic impediment and improve the ability of the CBD to function must acknowledge the fundamental characteristics of taxonomic activity in general.

Such activity:

Compromises intensive processes, due to the large number of organisms involved, and as such require specialist training of the necessary personnel, and the creation of infrastructures within developing countries where reference collections often do not exist. This problem is amplified by the fact that the taxonomic impediment is most severe in the countries which are megadiverse (containing the richest genetic and species diversity, and with the most complex land- and seascape texture).

must be performed on a regional or global basis and not just nationally, as species do not follow national borders.

is usually not best performed on an a habitat-by-habitat basis, as many taxa are found in, and are important components of, more than one ecosystem.

Requires cooperative working arrangements, in both developed and developing countries, as the existing infrastructure and expertise are concentrated in developed countries, and this expertise needs to be refined and improved in the developing countries. Taxonomic institutions of developed countries have very significant amounts of information from all over the world; these museums and herbaria are essential resources for researchers from all countries.

Framework taxonomic activity, which is necessary to help implement the CBD includes the:

Development of projects compatible with the ecosystem approach, as recommended by SBSTTA and adopted by COP. For example, such projects might focus on a particular ecological function (e.g. pollination) and examine all taxa involved in maintaining that function.

Creation of taxonomic infrastructure (collections, equipment, human resources) in countries where it does not yet exist, or is poorly developed or inadequate, and improvement of existing infrastructure especially in developed countries.

Development of projects focused on particular priority taxa, especially those with a high number of species or with known or potential impact on human activity, or which are threatened by human activity.

Establishment of inventories of taxa at the site and at the regional level, to provide the basis for biodiversity assessments and subsequent monitoring efforts, and

development of projects which develop tools that disseminate taxonomic information as widely as possible (e.g., keys for identifying organisms, regional Floras and fauna checklists, databases, CD-ROMs).

## The Future

For the taxonomic community the future has greater potential than at any time since the publication of *Systema Naturae*. Yet to realize this future taxonomists have to be more outward looking and be inclusive of other aspects of biodiversity science, and recognize the real political imperatives being developed by the CBD.

There is a danger that the existing plethora of programs (mostly poorly funded) and separate initiatives presents an image of a poorly organized and non-integrated science. New Initiatives, such as the Global Biodiversity Information Facility (GBIF) of the OECD, offer new vision for providing an appropriate information base for taxonomy, and are welcome developments. Therefore the taxonomic community must pull together and decide on some major integrated informatics/taxonomy projects, to ensure best use of resources.

The GTI should initiate a major project to scope the actual dimensions of the taxonomic impediment, through a series of subprojects that will both remedy identified broad taxonomic

knowledge gaps of globally significant taxa, while simultaneously addressing the fundamental issues that contribute to the taxonomic impediment.

Such a project would build and strengthen national and local taxonomic capacity through:

Human resource development and training of taxonomists

Institutional strengthening and capacity building

Development of tools and mechanisms for wide distribution of the information

Development of regional networks and linkages and south-north exchanges

Development of taxonomic guides.

Specific outputs would include:

Literature collection

Species inventory (including synonyms)

Collection of distributional data

Development of keys, regional information

Capacity building through the formation of regional networks, and cooperation in research methods and in field collecting and collection management

Development of monographs and other traditional forms of publication, and

Development of CD and Web based identification systems

Such a project could be supported by the Global Environment Facility, or by a consortium of other partners. One mechanism that could be used to galvanise existing efforts and expertise is the DIVERSITAS expert panel on setting global priorities for overcoming the taxonomic impediment.

This panel could:

(a) identify successful case studies on systematic inventories at different levels (national, regional and global) and analyze the reasons for their success as possible models for new projects (examples: Southern African Botanical Survey, Flora of Australia, Flora of China).

(b) analyze national country studies and national reports of the parties to the CBD, as to their content on systematic biology, aiming to use any biosystematic information in such reports to identify needs, priorities, gaps and opportunities for further work.

(c) identify and prioritise (existing and new) projects on taxonomic groups, taking into account factors such as geographical distributions, ecological function and economic relevance. This is a prerequisite to fulfilling the obligations under Articles 6-8 of the CBD.

The panel should consult widely, particularly with relevant societies and members of the International Union of Biological Sciences. Experts will be asked to contribute, covering the major taxa, the continental regions (terrestrial and freshwater systems), and the other components of biodiversity (marine, soil, microbial).

Discussion of the GTI will take place at the SBSTTA meeting in February 2000, and possibly at the fifth meeting of the COP in May 2000. Now is the opportune time for the taxonomic/systematic community to organize their role in this exercise, and help take taxonomy, as the core of biodiversity, into the new millennium!

# **An Overview**

## **DIVERSITAS: An Integrated Programme of Biodiversity Science**

DIVERSITAS, created in 1991, is co-sponsored by six international scientific organisations: the International Union of Biological Sciences (IUBS), the Scientific Committee on Problems of the Environment (SCOPE), the United Nations Educational, Scientific and Cultural Organisation (UNESCO), the International Union of Microbiological Societies (IUMS), the International Council for Science (ICSU), and the International Geosphere-Biosphere Programme (IGBP).

The major objective of this scientific programme is to unify the various approaches to the study of biodiversity under one umbrella. Research should, by definition, be international, but since this is not always the case, DIVERSITAS aims to ensure that the science of biodiversity is indeed, international, and that it transcends all boundaries. Given the breadth and scope of DIVERSITAS, it is possible to compare the various ongoing activities, attempt to eliminate duplication and redundancy, and present coherent syntheses that can be used by both scientists and policy-makers. DIVERSITAS can facilitate and mediate the exchange of information, as well as promote the ideas that develop from these syntheses.

DIVERSITAS currently has twelve Programme Elements, each focused on a fundamental scientific question about life's diversity.

### Five core Programme Elements

- The Effect of Biodiversity on Ecosystem Functioning
  - Origins, Maintenance, and Change of Biodiversity
  - Systematics: Inventorying and Classification of Biodiversity
  - Monitoring of Biodiversity
  - Conservation, Restoration and Sustainable Use of Biodiversity
- represent the central parts of the DIVERSITAS research effort.

### The seven Special Target Areas of Research (STAR)s

- Soil and Sediment Biodiversity
- Marine Biodiversity
- Microbial Biodiversity
- Inland Water Biodiversity
- Human Dimensions of Biodiversity
- Invasive Species and Their Effect on Biodiversity
- Global Mountain Biodiversity Assessment

are cross-cutting themes among the core Programme Elements, and focus on problems of special concern within biodiversity science that are often neglected or receive only limited attention.

Several elements are supported by the co-sponsors of DIVERSITAS. Element 1 by IGBP, Element 3 and STAR 9 by IUBS and STARs 6 and 11 (Global Invasive Species Programme) by SCOPE.

Although most of the Programme Elements of DIVERSITAS have traditionally operated independently, there are numerous reasons for them to be associated into a single research programme. The DIVERSITAS unified approach highlights and promotes the concept that there is a science of biodiversity that has many functionally linked elements, including the socio-economic-anthropological aspects. These inter-connections are reinforced in periodic 'Programme-comprehensive' scientific conferences and in product-focused workshops. Such interaction of the Elements stimulates new and important research directions.

For example, during 1999 the STAR 6 - soil and sediment biodiversity - held a meetings in Corvallis, USA on biodiversity above and below the surface of the earth (see [www.nrel.colostate.edu/soil/home.html](http://www.nrel.colostate.edu/soil/home.html)). Convenors of STAR 7 - marine biodiversity - made progress in looking at biodiversity and the functioning of coral reefs, with a research programme commencing in the Caribbean and Indian Ocean, and in mobilising the marine Systematics community and establishing regional networks of marine laboratories. The Global Invasive Species Programme (GISP, <http://jasper.stanford.edu/GISP>) - STAR 11 brings together an international team of biologists, natural resource managers, economists, lawyers and policy makers who are developing a global strategy to address the invasive species problem. This group provided a major input to the CBD SBSTTA4 meeting. Programme Element 3 - Systematics - convened three meetings on the Global Taxonomy Initiative to provide documents for CBD SBSTTA4.

### **Structure**

A Scientific Steering Committee (SSC) manages DIVERSITAS, and is composed of experts in particular research areas of biodiversity, in consideration of the Programme's overall scientific balance and goals. This Committee is led by Professor José Sarukhan, Chairman. An independent DIVERSITAS Secretariat has been established to provide overall co-ordination for and access to the Programme and its expertise in biodiversity science, as well as to assure relationships among current and emerging policy issues. The DIVERSITAS Home Page on the Web contains up to date information of its activities ([www.icsu.org/DIVERSITAS](http://www.icsu.org/DIVERSITAS)).

### **Linkages with the Convention on Biological Diversity (CBD)**

Recognising the vital need to bridge the knowledge gap on biodiversity, the Convention on Biological Diversity (CBD) clearly underlines that scientific work and training represent essential tasks for its implementation, and highlights the role of the Subsidiary Body on Scientific, Technical and Technological Advice (SBSTTA), in this context. DIVERSITAS, through its access to ongoing integrated research activities, has signed a Memorandum of Co-operation with the Convention on Biological Diversity Secretariat.

DIVERSITAS convened a workshop of experts in Mexico City in March 1998 to provide recommendations on the scientific research that should be undertaken for the effective implementation of Articles 7, 8, 9, 10 and 14 of the CBD. As a result of these recommendations, DIVERSITAS was officially cited by the Conference of Parties (CoP4, Bratislava May, 1998) to be used as a mechanism to provide advice to the CBD Advisory Body (SBSTTA). DIVERSITAS now regularly presents information documents to assist the SBSTTA meetings and at SBSTTA 4 (held in Montreal, June 1999), it made major contributions on the Global Taxonomy Initiative (GTI) and the problem of invasive species.

At the SBSTTA5 meeting, being held in Montreal in Jan/Feb 2000, DIVERSITAS will again be providing contributions on the GTI and inland water biodiversity.

### **The Formation of DIVERSITAS National Committees**

At present the following countries have established national committees: Belgium, Brazil, France, Germany, Hungary, Indonesia, Malaysia, Peru, Russia, Mexico and the USA. In addition DIVERSITAS has established links with official national biodiversity liaison groups in Egypt, Finland, Japan, Malawi, the Netherlands, Norway, Saudi Arabia, Switzerland and the UK.

National Committees are indispensable to the DIVERSITAS programme in order to adapt to national concerns and priorities: biodiversity implies a diversity of organisms and ecological systems, a diversity of human-related impacts, as well as a diversity of approaches.

National Committees can

- create targeted national programmes to feed into DIVERSITAS programme elements. This will also help in the consolidation of different scientific disciplines within the country and coordinate with other national initiatives (systematics, genetic resources, conservation and restoration).
- involve the scientific community in the international scientific arena. Science is thought to transcend all boundaries but this is not always the case. Very often nations operate on a bi-lateral system, but rarely on a multi-national system.
- stimulation of international initiatives such as workshops both within and outside the country
- facilitate the obtaining of funds. There are many national ministries or donor organisations which receive requests for funds for various projects within each country. Forming National Committees can organise and consolidate the activities, creating a unified front with the best possible science guaranteed
- aid in the Convention on Biological Diversity process and ensure that the information channel is open from the "bottom up" as well as "top down".

**DIVERSITAS-IBOY**  
**International Biodiversity Observation Year 2001**

DIVERSITAS is about life's diversity. A major challenge of the programme is to forge the necessary unity within the scientific community beyond its own diversity. Another is to educate the policy-makers, managers and general public about biodiversity. An important initiative that it is hoped can contribute to these goals is the launch of the IBOY 2001, with the aim of providing a snapshot of the status of biodiversity at the turn of the millennium and a prognosis for the future. Some 30 projects proposals have already been selected for the initiative, including: indexing the world's known species, biological diversity at sea - a set of sustainable indicators, global register of migratory species, a global study of soil biodiversity and decomposition.

For all further information about the programme please contact the Secretariat, or see the IBOY web site at [www.nrel.colostate.edu/IBOY](http://www.nrel.colostate.edu/IBOY).

<b>IUBS</b>	<b>SCOPE</b>	<b>UNESCO</b>	<b>ICSU</b>	<b>IGBP</b>	<b>IUMS</b>
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# **International Biodiversity Observation Year IBOY (2001-2002)**

## **Voyages of discovery through research, education and exploration: An Initiative of DIVERSITAS**

### **The Challenge: Communicating the value of biodiversity**

The Earth's biodiversity is a capital resource that provides vital ecosystem services, goods such as food, fuel, fiber and medicines, and the aesthetic, recreational and cultural riches associated with nature. It remains a largely unexplored scientific frontier, with an estimated 90% of species yet to be discovered and described. Alarmingly, this biological diversity is being lost across the planet, at all levels of organization from genes, through species, to landscapes. Biologists generally believe that these losses represent a threat to Earth system functioning and the well being of human societies. Yet, this concern does not seem to be penetrating the public's consciousness, much less the policy and planning processes of many nations. In short, biologists have not yet made a compelling case for general concern and action about the loss of biodiversity and its consequences for society.

### **A window to observe biological diversity**

The DIVERSITAS-IBOY 2001-2002, will be a time of celebrating and promoting observations of biodiversity. An international team of scientists, educators, and media professionals are compiling a portfolio of projects with two major objectives: to advance our knowledge of biodiversity and convey the excitement of its exuberant richness. These voyages of discovery will use science, exploration, art, and education to focus global attention on the Earth's biodiversity and its contribution to Earth system functioning and society.

DIVERSITAS-IBOY projects will:

- push the frontiers of science
- forge links to develop a new integral science
- make new information on biodiversity available
- provide the basis for policy decisions
- engage and educate the public

DIVERSITAS-IBOY projects address questions such as:

- What biodiversity do we have and where is it?
- How is biodiversity changing?
- What goods and services are provided by biodiversity?

DIVERSITAS-IBOY is still accepting proposals for global scientific and educational projects.

DIVERSITAS-IBOY Projects:

### **What do we have and where is it?**

A prokaryote survey of major habitats on Earth

Allium: A nexus of global biodiversity observation databases

Arboreal microarthropod diversity and distribution within the canopies of tropical forests

Assembling the tree of life

Biodiversity of stickleback parasites

Exploration and conservation of anchialine faunas

Latitudinal gradients of biodiversity in the deep sea of the Atlantic Ocean

MAB flora and fauna of Biosphere Reserves

Ocean Biogeographic Information System (OBIS)

Species 2000: Indexing the world's known species

**How is it changing?**

AmphibiaWeb: A global communication network on vanishing amphibians

Biological diversity at sea: a set of sustainable indicators

CREO: A preliminary list of recently extinct species

DNA banks of endangered species

DYNAMO ñ Dynamics of Biodiversity: Ostracods as models in freshwater ecosystems

Global Register of Migratory Species (GROMS)

Impacts of biological invasions on ecosystem function and economic values

Network study on biodiversity in ecosystems on the Green and Blue Belts of the Western Pacific and Asia

Recovery of Coral Reef Biodiversity Following Bleaching: International Coral Reef Observation Year

'Life in the Balance': An IMAX film on biodiversity and conservation

**What goods and services are provided by biodiversity?**

A first catalogue of the wild relatives of the world's crops

A global study of soil biodiversity and decomposition

Metabolic diversity of terrestrial ecosystems (FLUXNET)

Soil macrofauna: An endangered resource in a changing world

Millennium Assessment: Ecosystems' ability to meet human needs

For more information, see the DIVERSITAS-IBOY webpage and Secretariat (addresses below).

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ICSU

# **Putting the Puzzle Back Together**

## **The New (XVIIIth) International Congress of Zoology**

(Athens 28 August- 2 September, 2000)

by Francis D.Por\*, Rosa M.Polymeri \*\* and Stuart.G.Poss\*\*\*

Zoology is a biological discipline that imploded under the weight of its own complexity. At the time of the International Congress of Zoology in Washington, DC, some 40 years ago, zoologists of this increasingly diversified discipline felt that scientific progress could be best served by advancing on separate tracks. The International Congresses were abandoned. Each major taxon and each special field enjoyed the close-knit familiarity of small-attendance meetings, but consequently many of them became too large themselves. Unable to maintain the links of exchange of information across areas of specialisation, zoology entered in a process of progressive fragmentation.

Although the last decades have led to impressive advances in the different zoological specialties, this fragmentation has led to an increased emphasis on reductionism and to the loss of a general understanding of Kingdom Animalia in all its complexity and wealth of diversity. Consequently, the teaching of zoology at the college and graduate levels suffered greatly. It is easier to teach particular and modern aspects of animal biology, emphasizing aspects of molecular genetics that are common to the entire biological world, than to present an integrative picture of the whole animal organism. All too often, zoology as such disappeared from curricula altogether; Zoology departments closed and zoological collections were abandoned or left without curators. It is perhaps no surprise that evolutionary theory, which draws heavily on arguments of comparative zoology, has lost out in the minds of the young generations, and even in the minds of some of the teachers and professionals who fail to understand its role in explaining molecular diversity. All this had an impact at the top academic and administrative levels, with repercussions on the whole system.

At the same time, the last decades saw a robust growth in ecological awareness and conservation ethics. However, without having a broad and solid base of zoological knowledge, many ecological studies remain literature-bound. Likewise, many conservation efforts remain amateurish, for lack of taxonomic expertise. To effectively address and cope with the magnitude of the loss of millions of animal species, broadly trained zoologists are needed. Complete identification of the relevant species, using all the classical and modern tools, is the essential first step.

The negative trends can be reversed, the science of zoology can overcome its extreme fragmentation and can develop the infrastructure necessary for a renewed integration and synthesis. The advent of new tools of electronic computation and networked communication make it possible to reconnect the enormous wealth of specialized information as well as the many dimensions of zoological research, without loss of information. This was unthinkable 40 years ago. One does not have to be a believer in dialectic processes in order to appreciate the new qualitative levels of explanation that now can be reached through interdisciplinary contact.

This is the basic philosophy behind our project of reconvening a New International Congress of Zoology. The New Congress will have a policy and program to reflect this. Most our activities are web-based and virtual, both in the preparatory phase and perhaps more importantly, after the congress in Athens. Not only the information about the Congress is to be found on our site web-site [http://www.ims.usm.edu/~musweb/icz\\_xviii/icz\\_home.html](http://www.ims.usm.edu/~musweb/icz_xviii/icz_home.html), but also interaction through various Web-fora will allow for information and for pre-congress opinion and input dissemination.

The proceedings in Athens will center on invited symposia. To ensure maximum inter-disciplinary interaction between the participants, only two parallel sessions will take place. Eight General Symposia will give a two-dimensional view of Zoology in its specialized fields: both in-depth specialization as a vertical dimension and a comparative trans-zoological review as a horizontal dimension. Ample time will be given for recorded and published discussions, which will discuss ways to reinvigorate synthesis across sub-disciplines. A number of Special Symposia will give the possibility to present a limited number of subjects of narrower but more recent interest.

Contributed participation will be limited to poster presentation, in order to avoid the possible inflation in the number of oral sessions. Some of these posters will be associated with the subjects of the symposia; others need not, and may reflect any dimension of zoology. In any event the discussion sessions on each subject will be open to participation by everyone, virtually on the web page and orally during the Congress in session.

Four General Discussions will deal with Zoological Education; The Development of Zoological Collections and Data Bases; The Impasse in Zoological Taxonomy Training; The New Zoological Code of Nomenclature. This last discussion will mark the renewed public participation of the zoological community in the workings of the ICZN.

As a special highlight we wish to mention the planned visit to the newly excavated site of the Lycaeum of Aristotle, the father of Zoology. We hope that the well-known Greek hospitality and joie de vivre will also brighten the other social activities.

Finally, a General Assembly will evaluate the work done in Athens and recommend further activity, web-centered and at the venue of the next ICZ.

We hope that Zoology will start to emerge after the Congress as a discipline re-integrated again, enriched by the many new results and methodologies of experimental biology and of the dissemination of net-based information and fertile with the new data and insights of palaeontology, molecular biology, and many other new subject areas. Zoology will be thus again ready to reassume its philosophical and educational role and to fulfill its professional responsibilities in the field of biodiversity conservation in our ecosystems, as well as leadership among all biologists. We are expecting that this new image of Zoology will help us to convince the decision-making conclaves of the financing agencies worldwide of the urgent need for their support. We hope that the support entrusted by IUBS to our initiative will be well deserved.

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## XVIth International Botanical Congress

August 1-7, 1999, St. Louis, USA

Close to 5,000 scientists from around 100 countries assembled in St. Louis, Missouri last August to attend the 26th International Botanical Congress. The Congress coincided with a heat wave. Strangely enough, the coolest botanical venue in town was the tropical interior of the Climatron in the Missouri Botanical Garden, whose Director Peter Raven and his staff must be congratulated for a logistically well-organised and, above all, scientifically exciting programme.

Any impression of a Congress with on average 20 parallel sessions can only be personal, but even in objective terms, this 16th IBC was the historical landmark for new insights into the evolution and phylogeny of fungi, algae, mosses and vascular plants. Thanks to the advances in molecular systematics, no classification of plants and fungi will be quite the same 'A. 16th IBC' as it was 'B. 16th IBC'. For the angiosperm branches of the tree of life, based on sequences of 365 genes from chloroplast, nuclear and mitochondrial DNA, a consensus is emerging with the vesselless genus *Amborella* firmly at the root (confirming good old wood anatomical prejudices that angiosperms are primitively vesselless).

I was also impressed with programmes dealing with the societal relevance of botanical research: feeding the world and nature conservation were high-profile themes that rightfully also attracted much publicity of the local and international media. Peter Raven himself gave a visionary address on newly updated, conservative and yet very alarming estimates of 100,000 higher plant species that are at serious risk of becoming extinct before 2050. He also presented a seven-point plan to prevent this doomsday scenario from becoming reality, including the establishment of a new UN body for global plant conservation and increased funding for botanical research.

IUBS was represented at the Congress by Vice President C. - H. Chou, who welcomed all delegates on behalf of the Union at the opening session and presented IUBS's new programme 'Towards an Integrative Biology' during the Conference dinner - quite a side dish to chew on.

Pieter Baas, Nationaal Herbarium Nederland  
Leiden

# **Biology International GUIDELINES FOR AUTHORS**

## **Editorial Focus and Readership**

Biology International is the news magazine of the International Union of Biological Sciences (IUBS). Three issues per year are published in English. Biology International covers all aspects related to the work and concerns of IUBS including: (1) lists of meetings of interest to biologists; (2) abstracts of books of interest to a wide range of biologists; (3) reports on IUBS research projects and activities; and (4) opinion pieces, reviews, or fora on issues of broad significance to biologists.

Articles submitted should be written so as to address the broadest possible cross-section of Biology International's readership, which includes the following groups:

- Academics and government officials concerned with research, training and education in the biological sciences, and their relevance to society.
- International governmental and non-governmental organizations active in the domain of international cooperation in biological sciences.
- Individual scientists and decision-makers who are interested in promoting biological studies to assist sustainable development.

## **Submission of Material**

Biology International publishes mainly articles written specifically for the newsmagazine. All papers should be submitted with the understanding that they will be edited to bring them in line with the overall framework of the newsmagazine. Material should be submitted in English.

Unsolicited manuscripts, opinion pieces, book abstracts or reviews may be accepted, but authors are encouraged to submit proposals first, rather than finished articles. Text should be submitted in electronic format, either on diskette or as an e-mail-attached document. In all cases, the word processing program used should be indicated. When editing articles accepted for publication, Biology International will attempt to maintain the style and point of view of the author(s), who will be consulted with respect to major changes. Authors will be sent page proofs for correction of typographical, etc., errors. Proofs must be returned within 72 hours of their receipt.

## **Copy Specifications**

1. Information about meetings of interest to biologists should be submitted to the managing editor. The name, date, site and host of the meeting should be included.
2. Abstracts of books of wide interest to biologists are solicited by the editorial board; however, recommendations from the Biology International readership are welcome. Abstracts should be headed with the name of the author(s), the title, publisher, and price of the book. Abstracts must be analytical, rather than lists of

chapters and summaries of content. Abstracts should be one printed page (400 words) maximum.

3. IUBS Ordinary and Scientific Members are encouraged to submit regular reports on IUBS-related research projects and activities. Such reports should be three published pages (1200 words) maximum. Reports should be headed with the name of the project or activity, the name of the author(s), their addresses, and the e-mail address of the corresponding author. The reports should include information about the purpose and goals of the project or activity, recent activities or events, and plans for the future. If references are cited in the text, the full citation should be included in a bibliography (see below re style).
4. Opinion pieces, reviews, and fora on issues of broad biological significance are usually solicited by the editorial board from the entire IUBS family; see comments above regarding unsolicited manuscripts. Such articles should be ten published pages maximum (between 2000 and 5000 words) in length. However, shorter or longer articles may be considered or specifically requested in certain cases.

Illustrative material (tables, graphs, maps, drawings and photographs) should be separate from the body of the text, with the point of reference indicated in the text. Photographs are printed in black and white; however, originals may be submitted either as black and white or color prints.

Articles should be written in plain, concise language and in a style that is accessible and interesting to the general readership of *Biology International*. Jargon should be avoided, technical terms, acronyms and abbreviations that may be unfamiliar to readers should be defined the first time they appear. Scientific names and words in other languages other than English should be in italics. Footnotes should be avoided as far as possible. See a recent issue of *Biology International* for style of title, author name and address, etc.

### **Measurement and currency**

All measurements should be in the metric system. When monetary data are mentioned, a conversion to US\$ dollars should be included, based on the current rate at the time the article is submitted.

### **Bibliographies**

Articles should be accompanied by appropriate bibliographies. The names of the author(s) and date of publication should be indicated at the appropriate points in the text (e.g. Solbrig and Young, 1993), with the full reference given in a separate list at the end of the article.

Example of reference to a monograph:

Solbrig, O.T., & Young M.D., 1993. *The World's Savannas*, Man and the Biosphere Series; vol. 12, UNESCO, Paris (350 pages).

Example of reference to an article in periodical:

Hardy, C., Callou, C., Vigne, J.-D., Casane, D., Dennebouy, N., Mounolou, J.-C. and Monnerot, M. 1995. Rabbit mitochondria DNA diversity from prehistoric to modern times. *Journal of Molecular Evolution*, 40: 227-237.

In the text, this second reference would be cited as: Hardy *et al.*, 1995. The term *et al.* is only used in the text when there are three or more authors to be listed.

Example of reference to an Internet document:

Paton, R. 1998. Glue, Verb and Text Metaphors in Biology (available at [www.csc.liv.ac.uk/biocomp/a\\_resea/glue2.html](http://www.csc.liv.ac.uk/biocomp/a_resea/glue2.html)).



## PUBLICATIONS REVIEW

### **ANCIENT LAKES Their Cultural and Biological Diversity**

Edited by H. Kawanabe, G. W. Coulter and Anna C. Roosevelt. Published by KENOBI Productions, Ghent Belgium, 1999 (340 pages).

The main theme of this book is the long-term interaction between people and nature in and around ancient lakes. It also focuses on conservation needs, sustainable exploitation of lake resources and preservation of cultural diversity and reconciliation of different values and viewpoints at each lake to ensure its survival and that of its human and biological inhabitants.

The term "ancient lakes" refers to lakes with exceptionally long geological histories and ecological continuity. Most such lakes are characterised by highly endemic faunas. They are few, the best known being Lakes Biwa, Baikal, Titicaca, Tanganyika, Malawi and Victoria.

Most of the articles in this book are based on presentations made at the International Conference on Ancient Lakes: Their Biological and Cultural Diversities" (ICAL'97), which was held on 22-28 June 1997 at the Lake Biwa Museum in Japan.

### **GUIDELINES OF LAKE MANAGEMENT Reservoir Water Quality Management**

Edited by M. Straskraba and J. Galizia Tundisi. Published by International Lake Environment Committee (ILEC) Website: [www.ilec.or.jp](http://www.ilec.or.jp), 1999 (229 pages).

This book represents an extremely useful guide for anyone interested in reservoir water quality. It provides an overview of the reservoirs main characteristics and properties, the main problems of their

management, and an interdisciplinary integrative approach to their solutions. The tight couplings of physics, chemistry and biology are important to understanding water quality and as an essential tool in many management techniques.

Also, reservoir ecosystem is considered within the overall watershed system and in connection with the outflow and the socio-economic and management sub-systems.

### **LIMNOLOGICAL STUDIES ON THE RIO DOCE VALLEY LAKES, BRAZIL**

Edited by José Galizia Tundisi & Yatsuka Saijo. Published by Brazilian Academy of Sciences. University of S. Paulo School of Engineering at S. Carlos. Center for Water Resources and Applied Ecology. 1997 (513 pages).

This book represents a unique contribution towards the scientific understanding of a tropical lake system located at the Middle Rio Doce Valley in Brazil. This Lake system consists of approximately 150 lakes not connected to Rio Doce, amidst a extensive Tropical Atlantic Forest and Eucalyptus plantations. The book presents reports on geomorpho-logical characteristics of the lakes and their origin, climate, physics, chemistry and biology. It also includes chapters dedicated to paleo-climatology, the impact of human activities, and enclosure experiments, as well as a synthesis of achievements.

Based upon the results and experience of more than 20 years of international collaborative research among scientists from Brazil, Japan, UK and Belgium, the book provides a good example of an integrative approach for developing interdisciplinary research programs.

## **THE GLOBALIZATION OF ECOLOGICAL THOUGHT**

By Harold A. Mooney. Published by Ecology Institute (ECI), D-21385 Oldendorf/ Luhe, Germany, 1998 (153 pages).

This volume, which is part of the book, series "Excellence in Ecology", authored by the recipients of the international Ecology Institute Prize, was published 8 years after the Prize Award to Harold Mooney in 1990. In "The Globalization of Ecological Thought", the author provides a first hand description and analysis of the efforts of scientists and politicians to come to grips with phenomena directly affecting the future of humanity: The increasing modification of natural ecosystems by modern societies, the changes in the capacities of ecosystems to support life as we know it, and the contributions of individuals and organizations to document, assess and control these developments.

This book is not only about the emergence and development of the new science of global ecology, it is an essay about the ecology of science. The globalization of ecological thought as related to a changing environment (atmosphere, biota, ocean, population, and rates of resource consumption), has its roots in the development of global technology, global observation networks, and international collaborative endeavors illustrated by a constellation of scientific actors: individuals, programs and organisations that paved the way from the International Biological Program to the International Geosphere and Biosphere (IGBP), and DIVERSITAS Programs.

## **THE GENOSPHERE The Genetic System of the Biosphere**

By U. K. Sauchanka. Published by The Parthenon Publishing Group, New York & London, 1997 (134 pages).

Based on the classical works of the school of Soviet biologists in the first half of the 20th century and the great concern for the

conservation of the biosphere genetic resources, This essay by U. Sauchanka deals with the genetic system of the biosphere, the genosphere, in a global and integrated manner. It includes a series of ambitious scientific hypotheses which address the issues of co-evolution and integration, change and stability of the genosphere. It also deals with genetic and ecological methods for conservation of the genetic resources, as well as for the monitoring of the genosphere.

## **STRUGGLE OF LIFE or The Natural History of Stress and Adaptation**

By M. Rossignol, L. Rossignol, R.A.A. Oldeman, and Sorya Benzine-Tizroutine. Published by Treemail, Heelsom, The Netherlands (*Website: www.treemail.nl*), 1998 (273 pages).

This volume reports on more than twenty years of research collaboration on the Guyanas where ocean meets tropical rain forests. The Authors, who are outstanding scientists, claim that their publication is intended to present, outside the traditional channels of scientific literature, their scientific hypotheses and research results to a wider public than the restricted community of tropical biologists.

The book offers a series of innovative and provocative hypotheses and results dealing with the cells, plant architecture and ecosystems under stress, and the issues of complexity and diversity, order and disorder, and adaptive responses of species and ecosystems.

## **LA DIVERSIDAD BIOLÓGICA DE IBEROAMÉRICA Vol. II**

Edited by Gonzalo Halffter. Published in Acta Zoologica Mexicana, New Series, Special Volume, Instituto de Ecología, A.C., A.P. 63, Xalapa 91000, Veracruz, México, (libros@ecologia.edu.mx), 1998 (337 pages, in Spanish).

Along the line of the volume I of "La Diversidad Biológica de

Iberoamerica," published in 1992 by the "Programa Iberoamericano de Ciencia y Tecnología para el Desarrollo" (CYTED), volume II includes a compilation of several papers ranging from conceptual issues to essays about the biota of a country or a region. The general part deals with the issues related to the management of landscape biodiversity, systematics and conservation, epistemological and ontological aspects related to the use of classifications in ecological biodiversity studies.

Also, included in this volume there is a compilation of research reports and studies on biodiversity in Cuba, Mexico and the Dominican Republic.

## **THE BIOLOGY OF BIODIVERSITY**

Edited by Masahiro Kato. Published by Springer-Verlag. 1999 (324 pages).

This is the Proceedings volume of the symposium held on 9-10 December, 1998, in Hayama, Japan, and organized on the occasion of the 1998 International Prize of Biology dedicated to biological diversity and awarded to Prof. Otto T. Solbrig.

This book presents a broad review of current biological research on biodiversity, with a seminal paper on "theory and practice in the science of biodiversity" by Prof. Solbrig. It also includes chapters synthesizing modern approaches, the current status of research and future perspectives of biodiversity science for the better understanding of the origin, changes and maintenance of biodiversity. Emphasis was put on the increasing use of molecular biology approaches to the problems of speciation, phylogeny, developmental morphology and genetic diversity.

## **VAVILOV AND HIS INSTITUTE: A History of the World Collection of Plant Genetic Resources in Russia**

By Igor G. Loskutov. Published by the International Plant Genetic Resources Institute (IPGRI), Rome, Italy, 1999 (188 pages).

Prepared within the framework of the IPGRI Fellowships Programme to commemorate the unique contributions to plant science by Academician Nikolai Vavilov and Sir Otto Frankel, this book is complementary to the volume published in 1997 "Scientists, Plants and Politics- A History of the Plant Genetics Resources Movement", by R. Pistorius.

Together, these two volumes describe and analyze the historical background to today's efforts to conserve and use plant genetic resources. They are a tribute to the early pioneers in this field and a record of the actions and debates that have done so much to shape the way the scientists address conservation today.

## **II WORLD CONGRESS ON MEDICINAL AND AROMATIC PLANTS FOR HUMAN WELFARE (II ICMAP)- Proceedings**

Published as Special Issues (N°s 500-503) of Acta Horticulturae, ISHS, 1998 & 1999.

The Proceedings of the Second ICMAP which was held on 10-15 November, 1997, in Mendoza, Argentina, were published in Acta Horticulturae. They including four volumes (N°s 500-503), consisting of more than 600 papers addressing all aspects of basic and applied research and developments related to medicinal and aromatic plants. The first volume focuses on biological resources, sustainable use, conservation and ethnobotany; the 2nd deals with pharmacognosy, pharmacology, phyto-medicines and toxicology; the 3rd on agricultural production, post-harvest techniques, and biotechnology; and the 4th on industrial processing, standards and regulations, quality control, supply and marketing, economics.

**Reviews in Ecology:  
DESERT CONSERVATION AND  
DEVELOPMENT**

Edited by Hala N. Barakat & Ahmed K. Hegazy. Published by IDRC Canada, UNESCO and South Valley University, Egypt, 1997 (331 pages).

A festschrift for Prof. Mohamed Kassas on the occasion of his 75th Birthday, by his colleagues and students. It includes 16 papers related to Prof. Kassas main interest and studies related to plant ecology, desertification, biodiversity, development and conservation of arid lands with an emphasis on Egypt and the Middle Eastern Region.