

MOLECULAR BASIS OF BIODIVERSITY, CONSERVATION, AND SUSTAINED INNOVATIVE UTILIZATION

(IUPAC Technical Report)

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Abstract: In this Technical Report, recommendations are presented for international cooperation between academia and industry on molecular biodiversity. The recommendations are based on discussions in workshops/meetings held in Amsterdam (The Netherlands), Belo Horizonte (Brazil), Bangkok (Thailand), Kunming (China), and Antalya (Turkey) involving national and international representatives of relevant organizations.

INTRODUCTION AND RATIONALE

Biodiversity is a complex issue requiring global coordinated attention from various branches of natural and social sciences, but especially from physical and life sciences. One salient aspect of biodiversity is chemical in origin. The unique and diverse molecular libraries provided by the planetary flora, fauna, and microorganisms have been a source of immense practical value to mankind. As a corollary, biore-sources serve as a treasure house of as yet to be identified molecular structures, whose potential significance cannot be conceived at the present time. This treasure must be held in trust for future generations.

Different parts of the globe have varying endemic biological resources, so international cooperation is required to ensure that the benefits of global biore-sources can be distributed fairly and equitably. It is also appreciated that today the same regions rich in biore-sources may not be in an ideal position to extract the maximum benefit from those assets. The necessity for mutually advantageous global cooperation in the utilization of biore-sources is obvious. An essential element of such a common effort is the equitable benefit-sharing between the partners. This topic was the subject of several declarations (Manila Declaration, February 1992; Bukit Tinggi Declaration, October 1992; Melaka Accord, June 1994; Phuket Declaration, November 1997 [1]). It was also addressed at broader international level at the United Nations Conference on Environment and Development in Rio de Janeiro, June 1992, and has been enshrined in international law through the Convention on Biological Diversity.

Innovative utilization of biore-sources links society, governments, academia, and industry. They are the main stakeholders in both preservation and utilization of biore-sources, investing in and at the same time benefiting from the products and services originating from those assets. Any activity that adds value to a biological resource can help to support its conservation by making its sustainable use more relevant to society, and increasing public awareness of this should be promoted. Due to the fact that molecular systems or information at the molecular level are used higher up in the value chain, the chemical community is called upon to contribute to the discussion of the various scientific, economic, and ethical issues that are associated with this sort of international cooperation. To this end, the International Union of Pure and Applied Chemistry (IUPAC), the only independent global association of chemists, can and must play a crucial role in developing suitable recommendations [2]. The recommendations should subsequently be submitted to the International Council for Science (ICSU) as well.

*Within the IUPAC Working Party on Biomolecular Chemistry, the following groups participated in the project: Organic and Biomolecular Chemistry (Division III), Chemistry and Human Health (Division VII), and Committee on Chemistry and Industry (COCI).

ASPECTS OF GLOBAL COOPERATION

Three overlapping areas of international cooperation can be distinguished.

1. Exchange and generation of new scientific knowledge resulting finally in rapidly published data accessible to everybody at no cost (academic exchange)
2. Selection of newly generated intellectual property, which by the decision of the parties involved has to be patented prior to an eventual later publication (early steps in innovation)
3. Cooperation of partners focusing on the development of new products or services with expected economic output (commercial cooperation)

It is important to emphasize at the outset, that in developing international guidelines for cooperation, an approach that is anchored in recognition of mutual interest and mutual trust is absolutely essential. Personal collaboration is essential for teaching and research as well as for translation into products, and should be facilitated. The truism, that today we live in a global village, is certainly valid in this context. Historically, it might be noted that the various declarations/recommendations put forward have tended to describe partners as high-technology/biodeficient or low-technology/bioaffluent. We would like to refrain from such categorizations linking technology status with affluence in biore-sources.

Working together for the benefit of society and in more practical terms, for the parties involved, must be the objective. Once the basic common values are recognized, the first step in initiating the process toward formulating any guidelines requires the assemblage of parameters that define the authority, the interest, the investments, and the obligations of the interacting partners. Subsequently, a packet of parameters should be identified that will constitute the functional framework acceptable to both sides. Whereas ICSU/IUPAC have the mandate and responsibility to furnish the stakeholders with scientific input and recommendations, aspects involving legislation will have to be addressed by appropriate governmental bodies.

PROJECT ACTIVITIES

1. At a meeting held in Amsterdam (26 March 1999), attended by representatives of the participating groups and specially invited guests from Germany and Turkey, the existing status of international cooperation in the area of biodiversity was reviewed. In light of the regulations being enacted by different countries, it was projected that IUPAC should undertake the development of recommendations for international cooperation, in which, in particular, chemists had a significant stake. The meeting was organized/funded by IUPAC Division III, University of Amsterdam, and individual participants
2. A forum for "Business in Biodiversity" was organized within the program of the 2nd IUPAC International Conference on Biodiversity (11–15 July 1999), in Belo Horizonte, Brazil. The discussions in the forum contributed valuable ideas to the evolution of the projected recommendations. The forum was organized under the auspices of and funded by Universidade Federal de Minas Gerais, Centro Nacional de Processamento de Alto Desempenho para Minas Gerais Centro Oeste, and Fundacio BIOMINAS.
3. An ICSU/IUPAC Southeast Asia Workshop on "Molecular Basis of Biodiversity: Conservation and Sustained Innovative Utilization" was organized in Bangkok, Thailand (26–28 November 1999). This workshop was attended by participants from 14 countries, including representatives of UNESCO, International Union for Conservation of Nature (IUCN), and major biodiversity-rich countries in Southeast Asia. The workshop was opened by the Minister of Science, Technology, and Environment, Thailand. The program consisted of presentations by representatives of UNESCO, IUCN, international industry, academia, and government and nongovernmental organizations, as well as by selected members of the IUPAC task group.

At the completion of the workshop, Recommendations for International Cooperation were formulated [3]. It was planned to finalize the recommendations at a workshop in China, before submission to the IUPAC and later on to ICSU.

The workshop was organized under the auspices of/funded by UNESCO-Jakarta Office, ICSU, IUPAC, Thai National Commission for UNESCO, Thai National Center for Genetic Engineering and Technology, National Science and Technology Development Agency of Thailand, Ministry of Science and Technology, and the Environmental Chemical Society of Thailand.

4. The workshop in China was held from 6–11 April 2001, in Kunming, China. It was attended by selected IUPAC members of the Biodiversity Project and representatives of the Chinese academia, Chinese Ministry of Science, Chinese Association of Science and Technology (CAST), Chinese Chemical Society, and Chinese Governmental Research Institutes. The initial recommendations prepared at the Thailand workshop were modified in the light of discussions held in a panel session. The workshop was organized/funded by CAST, IUPAC Biodiversity Project Funds, and individual participants.
5. The final recommendations adopted at the Kunming Workshop were presented in a poster at the IUPAC General Assembly Poster Session in Brisbane (July 2001) and in a panel discussion at the 3rd IUPAC International Conference on Biodiversity in Antalya, Turkey (November 2001).

RECOMMENDATIONS

Recommendations for Global Cooperation on Sustainable Prospecting for Molecular Systems and Information at the Molecular Level derived from Natural Resources are as follows.

Preamble

- Dedicated to the conservation of biomolecular resources for future generations
- Recognizing the vital role of science worldwide in education, research and innovation
- Recognizing the important ecological roles played by local and regional biodiversity
- Recognizing the contributions which the molecular diversity of natural products from the biome have made to the health and welfare of humankind
- Recognizing the need of avoidance of environmental pollution and ecological destruction arising from over-exploitation of biological resources
- Affirming their commitment to cooperate fairly and equitably with stakeholders for the benefit of humankind and the sustainable use of diversity at both the molecular and organism level
- Recognizing the sovereign rights of states over their own natural resources and the authority of national governments to determine access to biological and genetic resources, subject to national legislation
- Acknowledging the interests of other stakeholders from the country or from abroad, including indigenous and local communities and farmers, in natural resources and existing knowledge
- Determined to honor the spirit of international, regional, national, and subnational laws and policies concerning biological and molecular diversity as well as intellectual property rights
- Committed to ensure fair and equitable sharing of benefits arising from the sustainable utilization of natural resources
- Dedicated to the fostering of research, and the accumulation and dissemination of all knowledge, especially at the molecular level
- Dedicated to the enhancement of the scientific and technological expertise and resources of developing countries

IUPAC subscribes to the following views:

Authorization of cooperation

Following an agreement to cooperate, all material exchange, early steps in innovation and commercial cooperation must be conducted under the auspices of relevant authorities.

All countries should facilitate the rapid and efficient formulation of contracts between interacting partners based upon their legal requirements.

Interests of cooperating partners

Academic interaction is directed at generating fundamental scientific knowledge in the first instance. It has to be recognized that such basic knowledge can become the subject of translation into products and services with the potential to bring about economic benefits.

There is a genuine interest of all partners in the translation of scientific knowledge into commercially viable products and services and in the fair sharing of ensuing benefits.

All of the cooperating partners are interested in fast and simple mechanisms regulating the common activities, and in avoiding a slow and complex process.

The bioaffluent countries are interested in enhancing their technical training, in improving their facilities as well as in safeguarding sustainable management of their natural resources and harnessing biodiversity for economic development.

Partners from high-technology regions are motivated by the search for novel molecular structures and the underlying biomolecular chemistry made available by the partnership.

All partners should appreciate each other's genuine interests and work in a spirit of mutual understanding, common accountability, and trust.

Authorities in bioaffluent countries are expected to invest in infrastructure and mechanisms for innovation facilitating the emergence of small- and medium-sized R&D enterprises (SMEs), as they constitute the main business partners for globally active companies.

Bioaffluent countries are expected to offer the biota within their jurisdiction for scientific investigation. They are also expected to contribute traditional information on empirical correlations between biocomponents and their potentially exploitable functions.

At all times of the collaboration, bioaffluent countries remain the owners of material from biota and of contributed information, but are obliged to enter into benefit-sharing agreements with their partners prior to commercialization.

High-technology partners are expected to provide modern technical expertise for the isolation, identification, evaluation, and eventual generation of molecular libraries of biocomponents judged to be of value. In many cases, they contribute their share of financial commitment as well, from both private and public sources.

High-technology partners are expected to provide for transfer of appropriate technology to parties in bioaffluent countries.

Bioaffluent countries are expected to contribute technical manpower and field labor to the project.

All cooperating parties are expected to contribute appropriately to the financial investments supporting the project.

Obligations

The terms of any contract constitute the basis of the formal obligations for all parties.

The partners should insure free flow of scientific information where possible. They should collaborate in any publication of scientific results, after due protection of economic interests of any partner and guided by the clauses of eventual patent laws.

Benefit sharing

Collaborating partners are expected to share fairly and equitably the benefits arising from the utilization of bioresources.

REFERENCES

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