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Program and Abstracts

Global Genetic Resources—Access, Ownership, and Intellectual Property Rights

Agricultural Research Service
U.S. Department of Agriculture
Association of Systematics Collections

Beltsville, Maryland
May 19–22, 1996

Beltsville Symposium XXI

Welcome from the Association of Systematics Collections

The Association of Systematics Collections is pleased to co-sponsor this important symposium with the Beltsville Area, Agricultural Research Service, USDA. ASC has long been concerned about the equitable sharing of genetic resources (including biological specimens). We have participated in a number of meetings and discussions in which the primary participants were representatives of developing countries, non-governmental organizations (NGO's) with interests in conservation issues, and corporations that use biodiversity. Scientists and scientific collections have generally been less central to these discussions, although our ability to do our work is strongly affected by them.

We see this meeting as an effort to improve the balance in discussions of genetic resources. One goal is to inform systematists and other researchers of worldwide political and social trends affecting access to biological specimens. Another goal is to provide a forum for scientists and those responsible for collections to participate in policy discussions, so that their needs and interests are represented.

The last morning of this meeting will be devoted to development of ideas for a white paper that ASC will write concerning scientific access to biological specimens in the context of the goals of the Convention on Biodiversity. The paper will provide a basis for our continuing discussions with governments, NGO's, industry representatives, and local peoples. It is very important for scientists to understand the issues and to participate in these debates, so that we can continue to provide the world with sound information on the world's biological resources. It is our hope that under the biodiversity convention and the state and regional laws it spawns, taxonomic and systematics research will flourish worldwide, and systematics collections will play an integral part in preserving biodiversity.

K. Elaine Hoagland
Executive Director
Association of Systematics Collections

FOREWORD

The abstracts and biographical sketches in this program/abstract book were prepared for Beltsville Symposium XXI, "Global Genetic Resources: Access, Ownership, and Intellectual Property Rights". In the abstracts, presenting authors are indicated in the abstracts by all uppercase letters, and all authors are identified in the index by cross-references to abstract numbers.

The Beltsville Symposium XXI Organizing Committee included—Co-Chairs: Amy Y. Rossman, Systematic Botany and Mycology Laboratory, USDA-ARS; Thomas S. Elias, U.S. National Arboretum, USDA-ARS; K. Elaine Hoagland, Association of Systematics Collections; Secretary: Virginia Hupfer, USDA-ARS; Steering Committee: Hank Becker, ARS Information Staff, USDA-ARS; Morton Beroza, Friends of Agriculture–Beltsville; David J. Chitwood, Nematology Laboratory, USDA-ARS; Ray H. Cypess, American Type Culture Collection; Eric P. Hoberg, Biosystematics and National Parasite Collection Unit, USDA-ARS; J. Ralph Lichtenfels, Biosystematics and National Parasite Collection Unit, USDA-ARS; Douglass R. Miller, Systematic Entomology Laboratory, USDA-ARS; Henry L. Shands, National Program Staff, USDA-ARS; Manya B. Stoetzel, Systematic Entomology Laboratory, USDA-ARS; and Allan K. Stoner, National Germplasm Resources Laboratory, USDA-ARS.

Amy Y. Rossman
Co-Chair, Beltsville Symposium XXI Organizing Committee

Thomas S. Elias
Co-chair, Beltsville Symposium XXI Organizing Committee

K. Elaine Hoagland
Co-Chair, Beltsville Symposium XXI Organizing Committee

ACKNOWLEDGMENTS

The **Friends of Agricultural Research–Beltsville (FAR-B), Inc.**, are cosponsors of the Beltsville Symposium series. FAR-B is a nonprofit group dedicated to supporting the research and educational programs at the Beltsville Agricultural Research Center. Membership is made up of former and current employees and a growing number of industry supporters. The Beltsville Symposium XXI Committee thanks the members of FAR-B for their many contributions to this symposium.

In addition to FAR-B, Inc., the Beltsville Symposium XXI Organizing Committee also expresses its appreciation to the Agricultural Research Service and several other USDA agencies outside of the Beltsville Area. The Foreign Agricultural Service, International Cooperation and Development, Research and Scientific Exchange Division, sponsored three of the international speakers. The Agricultural Research Service Information Staff is acknowledged for developing the special publication on the major systematics collections and repositories within ARS.

We are extremely grateful to the following organizations that provided financial contributions in support of the Symposium:

Sponsors (donation of $500 or more as of May 2, 1996)

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PREVIOUS BELTSVILLE SYMPOSIA

1976 Virology in Agriculture
1977 Biosystematics in Agriculture
1978 Animal Reproduction
1979 Human Nutrition Research
1980 Biological Control in Crop Production
1981 Strategies of Plant Reproduction
1982 Genetic Engineering: Applications to Agriculture
1983 Agricultural Chemicals of the Future
1984 Frontiers of Membrane Research
1985 Biotechnology for Solving Agricultural Problems
1986 Research Instrumentation for the 21st Century
1987 Biomechanisms Regulating Growth and Development: Keys to Progress
1988 Biotic Diversity and Germplasm Preservation—Global Imperatives
1989 The Rhizosphere and Plant Growth
1990 Remote Sensing for Agriculture
1991 Photomorphogenesis in Plants: Emerging Strategies for Crop Improvement
1992 Agricultural Water Quality Priorities
1993 Pest Management: Biologically Based Technologies
1994 Advances in Human Energy Metabolism
1995 Biotechnology's Role in the Genetic Improvement of Farm Animals

FAR-B DISTINGUISHED SCIENTIST AWARD

James A. Duke

In 1963 Dr. James A. Duke was hired by the U.S. Department of Agriculture, Agricultural Research Service as an ecologist located in Beltsville, Maryland. In 1965 he resigned from the USDA to join the Battelle Columbus Laboratories to conduct ecological and ethnobotanical studies in Panama and Colombia. From 1965 to 1971, Dr. Duke lived with various ethnic groups, closely observing their deep dependence on forest products. The first of the fifteen books that he has authored resulted from this work and catalogs hundreds of Isthmian plants and their uses. In 1971 Dr. Duke rejoined the USDA and undertook numerous assignments relating to crop diversification, medicinal plants, and energy plant studies in the United States and in developing countries.

Fluent in Spanish, Dr. Duke has studied and lectured widely in Central and South America. In addition, he has traveled in the Middle East, Asia and Africa conducting botanical research and carrying out special assignments for ARS and other government agencies. During his career, Dr. Duke prepared an encyclopedia of economic plants, published fifteen books, authored scores of scientific and popular articles on a wide range of subjects, collaborated with the National Cancer Institute on their AIDS and cancer screening programs and their Designer Food Program (to prevent cancer). Dr. Duke also developed databases on the ecology, nutritional content, folk medicinal uses and chemical constituents of more than 1000 plant species. These databases are online and available to anyone worldwide to access and use. Since his retirement in September 1995, Dr. Duke has continued to add additional data to the databases and make them more easily accessible. The databases are now being referred to by hundreds of interested scientists and lay people monthly.

Dr. Duke has been a member of numerous scientific societies and served as an advisor or unpaid consultant to many organizations and projects, including the Amazon Center for Environmental Education and Research, the Center for Plant Conservation, the Kuwait Environment Council, the World Health Organization, the Center for Natural and Traditional Medicines, and the Herb Research Foundation. Throughout his career Dr. Duke has been a very productive research scientist and a prolific and effective writer and lecturer on many topics related to economic botany.

ASC AWARD FOR SERVICE

The Association of Systematics Collections

In recognition of his outstanding contribution to the systematics community, presents the

1996 Award for Service

to

Lorin I. Nevling, Jr., Scientist, Administrator, Counselor, and Public Servant

for his

. . . lasting contribution to the systematics of higher plants, especially the family Thymelaeaceae, and years of service in many capacities to the national botanical community;

. . . enlightened, humane, resolute leadership in science administration posts of increasing scope and responsibility, from the Herbaria of Harvard University to the Field Museum of Natural History and the Illinois Natural History Survey;

. . . selfless dedication to the work of ASC, serving on the board for over a decade—one of the few who retained a sense of focus on the big picture for the commonwealth of North American collections;

. . . impressive knowledge and wise counsel in matters of national policy relating to systematic biology collections and biological survey.

GENERAL INFORMATION

Registration

Sun.	May 19	4–8 pm	Holiday Inn, 10000 Baltimore Blvd. (U.S. Route 1 and Interstate 95)
Mon.	May 20	7:30 am–3 pm	Room 020, Bldg. 003, BARC-West
Tue.	May 21	7:30 am–3 pm	Room 020, Bldg. 003, BARC-West
Wed.	May 22	7:30–9 am	Room 020, Bldg. 003, BARC-West

Podium Presentations

All podium presentations will be given at the Beltsville Agricultural Research Center (BARC) in the auditorium of Building 003, BARC-West.

Poster Presentations

All posters will be displayed in the Grand Ballroom of the Holiday Inn. Posters should be set up from 1:00 pm to 8:00 pm on Sunday, May 19. Authors must be present between 5:00 pm and 6:00 pm during the Poster Session and Social on Monday, May 20. Posters should be removed before 12:00 noon on Wednesday, May 22.

Breakfasts

Symposium registrants staying at the Holiday Inn are entitled to a complimentary buffet breakfast at the restaurant.

Luncheons and Evening Socials

The luncheon on Monday and the evening socials, except for the Tuesday evening Banquet at the National Wildlife Visitor Center, will be held in the Grand Ballroom of the Holiday Inn. On Tuesday, boxed lunches will be available in the lobby of Building 003.

Slide Preview

Podium presenters can preview their slides in Room 020, Bldg. 003, BARC-West.

Transportation from Holiday Inn to Auditorium

Participants are expected to walk the short distance between the Holiday Inn and the auditorium in Building 003. A map is enclosed in the registration packet. For those who require assistance with transportation to the Building 003, van transportation will be provided.

ARCEA Exhibit

The Agricultural Research Center Employees' Association (ARCEA) will have souvenirs available for purchase in Room 020, Bldg. 003, BARC-West, Beltsville, MD, on Monday, May 20, from 9:45 am to 4:15 pm, on Tuesday, May 21, from 9:30 am to 3:30 pm, and on Wednesday, May 22, from 9:30 am to 1 pm.

SCHEDULE OF EVENTS

Beltsville Symposium XXI
May 19–22, 1996

SATURDAY, MAY 18, 1996

ASC Long Range Planning (Open to All), 1:00–5:00 pm, Terrapin Room, Holiday Inn

SUNDAY, MAY 19, 1996

ASC Board Meeting, 8:00 am–2:00 pm, Prince Georges Room, Holiday Inn
ASC Business Meeting (Open to All), 3:00–5:00, Terrapin Room, Holiday Inn

Symposium Registration, Poster Setup, and Reception

Registration, poster setup, and opening reception and social will be held at the Holiday Inn, 10000 Baltimore Blvd. (U.S. Routes 1 & 95), Beltsville, Maryland:

Registration	4–8 pm	Hallway in front of grand ballroom
Poster setup	1–8 pm	Grand ballroom
Social with Cash Bar	5–8 pm	Grand ballroom

MONDAY, MAY 20, 1996 (Auditorium, Building 003, BARC-West)

Session I Use of Genetic Resources: The Problem

Moderator: Dr. Henry L. Shands, Associate Deputy Administrator for Genetic Resources, National Program Staff, USDA, ARS, Beltsville, Maryland

8:00 am **Welcome**
Dr. Jan van Schilfgaarde, Acting Director, Beltsville Area, USDA, ARS, Beltsville, Maryland

8:10 am **Presentation of FAR-B Distinguished Scientist Award to Dr. James A. Duke**
Dr. Angus A. Hanson, Friends of Agricultural Research-Beltsville, Inc., Beltsville, Maryland

8:20 am **Opening Remarks**
Dr. Floyd Horn, Administrator, USDA, ARS, Washington, D.C.

8:35 am **KEYNOTE ADDRESS**
Biodiversity and the Equitable Use of the World's Genetic Resources
Dr. Peter R. Day, Director, Center for Agricultural Molecular Biology, Cook College, Rutgers University, New Brunswick, New Jersey

9:10 am **The North–South Politics of Genetic Resources: Issues and Implications**
Dr. Daniel M. Witmeyer, Senior Analyst, MSTI, Fairfax, Virginia

9:45 am **Break**

10:10 am **International Treaties and Other Legal and Economic Issues Relating to the Use of Genetic Resources**
Dr. William Lesser, Professor of Agricultural Economics, Cornell University, Ithaca, New York

10:45 am **The Biodiversity Convention and the Flow of Scientific Information**
Dr. John H. Barton, Professor, School of Law, Stanford University, Stanford, California

11:20 am–11:40 am **Discussion**

Luncheon (Noon to 1:15, Holiday Inn)

Session II Value of Specimen-Based Research to the Global Community

Moderator: Dr. Brian M. Boom, Vice President for Botanical Science, New York Botanical Garden, Bronx, New York

1:30 pm **Opening Talk—Mining Monophyla: Discovering, Managing and Accessing Genetic Resources**
Dr. Quentin D. Wheeler, Professor, Department of Entomology and Liberty Hyde Bailey Hortorium, Cornell University, Ithaca, New York

Case Studies

2:00 pm **Natural Products from Microorganisms**
Dr. Jennie C. Hunter-Cevera, Director, Center for Environmental Biotechnology, Lawrence Berkeley National Laboratory, Berkeley, California

2:20 pm **Systematics and the Use of Fungi in Biological Control**
Dr. Amy Y. Rossman, Director, U.S. National Fungus Collections, ARS, Beltsville, Maryland

2:40 pm **Agricultural Germplasm and Global Contributions**
Drs. Henry L. Shands and Allan K. Stoner, Associate Deputy Administrator for Genetic Resources, ARS, Beltsville, Maryland, and Research Leader, National Germplasm Resources Laboratory, ARS, Beltsville, Maryland

3:00 pm **Break**

3:30 pm **Beetle Economics**
Dr. Natalia J. Vandenberg, Entomologist, Systematic Entomology Laboratory, ARS, Beltsville, Maryland

3:50 pm **Parasite Biodiversity and Emerging Pathogens: A Role for Systematics in Limiting Impacts on Genetic Resources**
Dr. Eric P. Hoberg, Zoologist and Associate Curator, Biosystematics and National Parasite Collection Unit, ARS, Beltsville, Maryland

4:10 pm **Using Specimen-Based Information to Devise a Protected Area System for Guyana**
Dr. Vicki A. Funk, Curator, Department of Botany, Smithsonian Institution, Washington, D.C.

4:30 pm **Economic Trends and the Importance of Genetic Diversity in Ornamental Horticulture**
Dr. Roger H. Lawson, National Program Leader for Horticulture and Sugar Crops, USDA, Agricultural Research Service, Beltsville, Maryland

Poster Session, Cash Bar, and Social (Grand Ballroom, Holiday Inn, 5:00–7:00 pm)

Media Panel Discussion (Maryland Room, Holiday Inn, 7:30 pm). Open to all.

Moderator: Dr. Allan K. Stoner, Research Leader, National Germplasm Resources Laboratory, ARS, Beltsville

TUESDAY, MAY 21, 1996 (Auditorium, Building 003, BARC-West)

Session II Value of Specimen-Based Research to the Global Community Case Studies (continued)

8:20 am **Plant Exploration**
Dr. Maxine M. Thompson, Professor Emeritus, Department of Horticulture, Oregon State University, Corvallis, Oregon

8:40 am **Vertebrate Tissue Collections**
Dr. Frederick M. Sheldon, Associate Curator, Collection of Genetic Resources, Museum of Natural Science, Louisiana State University, Baton Rouge, Louisiana

9:00 am **Summary and Discussion of Case Studies**

9:20 am **Break**

Session III Models For Equitable Use Of Genetic Resources

Moderator: Dr. Allen Allison, Assistant Director for Research and Scholarly Studies, Bishop Museum, Honolulu, Hawaii

9:50 am **The Use of Fungi from a Biodiversity Hotspot: Conservation and Property Rights in Oaxaca, Mexico**
Dr. Ignacio H. Chapela, Assistant Professor, College of Natural Resources, University of California, Berkeley, California, and Scientific Director, The Mycological Facility: Oaxaca, Oaxaca, Mexico

10:15 am **Bioprospecting Using African Genetic Resources**
Dr. Maurice Iwu, Executive Director, Bioresources Development and Conservation Programme and Walter Reed Army Institute of Research, Washington, D.C.

10:40 am **Global Genetic Resources: Agriculture and Agri-food Canada**
Dr. Jacques Surprenant, Program Manager, Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-food Canada, Ottawa, Ontario

11:05 am **Biodiversity, Research Agreements, Intellectual and Other Property Rights: The Costa Rican Case**
Lic. Carlos Manuel Rodríguez Echandi, Legal Consul, Instituto Nacional de Biodiversidad, Santo Domingo, Costa Rica.

11:25 am –11:45 am **Summary and Closing Comments; Discussion**

Lunch (Box Lunches Available in Lobby, Building 003, 12:15 pm)

Session IV Potential Solutions For Equitable Use Of Genetic Resources

Moderator: Dr. James S. Miller, Associate Curator and Head, Applied Research Department, Missouri Botanical Garden, St. Louis, Missouri

1:30 pm **Opening Talk: International Germplasm Collections under the Biodiversity Convention—Options for a Continued Multilateral Exchange of Genetic Resources for Food and Agriculture**
Drs. Geoffrey Hawtin (Director General, International Plant Genetic Resources Institute [IPGRI], Rome, Italy, Jan Engels (Director of Germplasm Maintenance and Use, IPGRI, Rome, Italy), and Wolfgang Siebeck, (Consultant, Consultative Group on International Agricultural Research, The World Bank, Washington, D.C.)

2:00 pm **Biodiversity Prospecting and Models for Collections Resources: NSF/USAID/NIH Model**
Dr. Barbara N. Timmermann, Professor, Department of Pharmacology and Toxicology, College of Pharmacy, University of Arizona, Tucson, Arizona

2:30 pm **Marine Biodiversity Prospecting**
Dr. Shirley A. Pomponi, Director, Division of Biomedical Marine Research, Harbor Branch Oceanographic Institution, Inc., Fort Pierce, Florida

3:00 pm **Break**

3:30 pm **Sustainable Development in the Tropical Deciduous Forest of Mexico: Myths and Realities**
Dr. Oscar R. Dorado Ramirez, Director, Centro de Educación Ambiental e Investigación Sierra de Huautla, and Professor, Universidad Autónoma del Estado de Morelos, Cuernavaca, Mexico

4:00 pm **"Triangular Privity"—A Working Paradigm for the Equitable Sharing of Benefits from Biodiversity Research and Development**
Dr. Thomas D. Mays, Director, Office of Technology Development, National Cancer Institute, National Institutes of Health, Bethesda, Maryland

4:30 pm **Summary and Discussion**

Evening Banquet at National Wildlife Visitor Center, Laurel, Maryland
ASC Presentations
(7 to 10 pm; Buses Leave Holiday Inn at 6:30 pm)

WEDNESDAY, MAY 22, 1996 (Auditorium, Building 003)

Session IV Potential Solutions For Equitable Use Of Genetic Resources (Continued)

8:15 am **Opening Comments**
Moderator: Dr. K. Elaine Hoagland, Executive Director, Association of Systematics Collections Washington, D.C.

8:30 am **The Andean Common Code for the Genetic Resources Access: A General Overview**
Dr. Raul O. Castillo, Director, Departamento Nacional De Recursos Fitogeneticos y Biotecnologia (DENAREF), National Institute of Agricultural Research (INIAP), Quito, Ecuador

9:00 am **Biodiversity Access Legislation as a Tool for Promoting Conservation and Sustainable Use of Biodiversity**
Dr. Walter V. Reid, Vice President for Program, World Resources Institute, Washington, D.C.

9:30 am **Culture Collections: Agents for Equitable Use of Genetic Resources**
Drs. Raymond H. Cypess (President/CEO) and Shung-Chang Jong (Director, Mycology and Protistology Program), American Type Culture Collection, Rockville, Maryland

10:00 am **Summary of the Meeting**
Dr. Henry L. Shands, Associate Deputy Administrator for Genetic Resources, ARS, Beltsville, Maryland

10:30 am **Discussion**

ASC Policy Work Session (Open to All), Auditorium, Building 003

1:00 pm –3:00 pm **Development of White Paper for ASC to Present to Governments, International Agencies and Other Interested Parties**
Dr. Quentin D. Wheeler, ASC President, Presiding

PODIUM ABSTRACTS

Beltsville Symposium XXI
May 19–22, 1996

1 Biodiversity and the Equitable Use of the World's Genetic Resources

PETER R. DAY, Center for Agricultural Molecular Biology, 204A Foran Hall, Cook College, Rutgers, The State University of New Jersey, New Brunswick NJ, 08902

Surprisingly few people are aware of the links between biodiversity, genetic resources, and the agricultural productivity that sustains us. In recent years these links have been closely scrutinized because of two principal factors: I) the continuing decline of the natural environment, and with it the disappearance of many organisms of known and unknown potential value; and ii) an increasing awareness of the intrinsic value of genetic diversity, both in the broad sense of conserving what we know of the natural environment, and in the more narrow sense of materials for current and future exploitation by humanity. Global genetic resources are now seen as economically, and therefore politically, important. Unfortunately few governments understand how to protect and sustain these resources, the costs of doing so, and the true reasons for why they should. Perhaps no country is in a better position to appreciate the importance of sharing biodiversity for the generation of wealth than the United States, whose agricultural productivity largely depends on non-native species introduced in the early years of the nation's development. Since a 1993 NRC report examining these issues, there has been a continuing concern to establish sound and sustainable national and international policies based on accurate data and broad consultation. Effective genetic conservation must be an ongoing activity coupled to a variety of other disciplines including breeding, site management for in situ methods, and the components of ex situ conservation. Equitable use requires a better understanding of the value of reciprocal free and open access in return for help in conservation. In the end the objectives of conserving global biodiversity and economically important germplasm are identical. The quality of our future depends on both.

2 The North–South Politics of Genetic Resources: Issues and Implications

DANIEL M. WITMEYER, MSTI, Fairfax, VA 22030

The debate over appropriate international policies for the conservation and use of genetic resources includes a number of political and economic issues regarding access to both private and public collections (current and future) and to in situ resources. Among these are issues concerning intellectual property rights or alternative forms of ownership; rights of "indigenous or local communities"; Farmers' Rights; access to and compensation for genetic resources collected prior to implementation of the Convention on Biological Diversity (CBD); and religious and cultural objections to property rights for some or all categories of genetic resources. Underlying the more explicit policy debates are conflicting political values and beliefs, as well as differences in perceptions, attitudes, and communication styles. These are usually implicit and unacknowledged. A number of models and constructs are used to help elucidate them and some of their effects on the policy debate and negotiations. These include concepts of fairness and of efficiency; of the individual vs the collective; of (neo)liberalism vs mercantilism; of attitude formation under conditions of uncertainty or ambiguity; of styles of information gathering and processing; and of cognitive and persuasive styles. The implications for collecting and collections are discussed.

3 International Treaties and Other Legal and Economic Issues Relating to the Use of Genetic Resources

WILLIAM H. LESSER, Department of Agricultural Economics, Cornell University, 405 Warren Hall, Ithaca, NY 14853

Genetic resources were once treated as a common heritage, available without restriction for research and other usage. The system was perceived as contributing to a rapid extinction rate and as unfair to developing countries—the major source of genetic resources. Since the Biodiversity Convention declared that governments have the "sovereign right to exploit" the genetic resources under their domain, efforts to regulate access have begun. Conceptually, payments will lead to greater conservation efforts; practically, the incentive will depend on use and distribution of the limited funds generated. Benefits to countries of origin are associated with the "equitable sharing" stipulations of the Convention. Within countries, where rights of indigenous peoples to their traditional lands have not been clarified, equitable sharing may be difficult to achieve. To date, a modest but nonetheless troubling effect has been a slowing of access, especially for third parties. Current approaches to access include I) Intellectual Property Rights (a system not attuned conceptually or practically to genetic resources); ii) Farmers' Rights (a system grouping together all agricultural genetic resources transferred in the past, present and future); iii) Bilateral Systems, such as material transfer agreements in place (Philippines) or in process (Andean Pact); iv) Voluntary Systems (e.g., the well-construed Kew Gardens Code of Conduct), which, regrettably, have no legal standing; and v) Multilateral Systems, as endorsed by the FAO and outlined by IPGRI. A truly effective system(s) for access to genetic resources has not yet emerged; it is time for wider inputs into the process, especially by biological scientists.

4 The Biodiversity Convention and the Flow of Scientific Information

JOHN H. BARTON, School of Law, Stanford University, Stanford, CA 94305-8610

The United Nations Biodiversity Convention is intended to strengthen the position of developing nations in controlling access to genetic resources. The new legal regimes that may emerge, however, can affect the development of agricultural science, including science oriented for developing nations. Moreover, further scientific advance may significantly affect the effectiveness of the regimes. The presentation begins with a review of the practical implementation of rights in agricultural genetic resources and explores their implications for science, especially for public sector science. It then turns to the emerging issues posed by the flow of and control of gene sequences and genomic information, and to the implications of these issues for science and for the Biodiversity Convention regime.

5 Mining Monophyla: Discovering, Managing and Accessing Genetic Resources

QUENTIN D. WHEELER, Department of Entomology and Liberty Hyde Bailey Hortorium, Cornell University, Comstock Hall, Ithaca, NY 14853

Given estimates of as many as ten million or more living species and a rapidly accelerating rate of species extinction, an urgent need exists to discover, manage, and access genetic resources. The logical, scientific approach to this problem involves organization of biodiversity information into a conceptual system that is consistent with knowledge of phylogenetic history. Such systems support both efficient access to what is known about genetic resources and, more significantly, predictions about what is not yet known. "Mining" genetic resources from millions of poorly understood species necessitates the ability to predict where to begin searching for desirable properties of organisms. Ironically, while strides have been made in the theory and methods required to construct such predictive, phylogenetic classifications, support for necessary taxonomic expertise and research infrastructure has been permitted to decline. The most rational and cost effective strategy, then, involves meeting the unique needs of taxonomy for worldwide collections of specimens, taxon-focused inventory projects, and taxon-specific expertise and research programs and assuring the fullest use possible of existing collections, specialists, and research resources.

6 Parasite Biodiversity and Emerging Pathogens: A Role for Systematics in Limiting Impacts on Genetic Resources

ERIC P. HOBERG, Biosystematics and National Parasite Collection Unit, USDA, ARS, Bldg. 1180, BARC-East, Beltsville, MD 20705

Pathogenic parasites represent potential threats to economically important genetic resources within the context of agriculture, conservation, and management of recovering, threatened or endangered species. Parasites are ubiquitous and have characteristic host and geographic distributions and predictable life cycles and transmission patterns. Documentation of parasite biodiversity through survey and inventory is requisite to defining endemic versus introduced elements of faunas. Systematics provides the foundation for understanding the history and biogeography of parasite–host assemblages and for predicting the behavior of parasites introduced into new ecological settings. Translocation of hosts and introduction and establishment of "exotic" parasites is a continuing problem. The history of the agriculturally important nematode *Nematodirus battus* demonstrates the concept of introduction and the factors involved in later emergence. In contrast, a pathogenic nematode of muskoxen in the Canadian Arctic represents an enigma with respect to its origins, contemporary host-range and biogeography. The lungworm *Umingmakstrongylus pallikuukensis* is apparently associated with morbidity and mortality in muskoxen and may have implications for management of wild ruminants in the Arctic. Additionally, this parasite may have an adverse impact on food resources, as it affects a component of the ruminant prey base historically exploited by native cultures in the Holarctic. This emerging problem is being addressed in a multidisciplinary manner involving parasite systematics and host–parasite coevolution and depends on collaboration among academic scientists, government agencies, and native Inuit hunters.

7 Systematics and the Use of Fungi in Biological Control

AMY Y. ROSSMAN, USDA, ARS, U.S. National Fungus Collections, Bldg. 011A, Room 304, Beltsville, MD 20705

Exotic weeds, insects, and pathogens cause billions of dollars of damage to agricultural crops and contribute to the destruction of native plants and animals throughout the world. Increasingly, there is a need to control these pests using biologically based management strategies that involve beneficial organisms. As a group the fungi hold tremendous potential as agents of biological control, but their development has been limited primarily by a lack of systematic knowledge about them. Several successes in the use of fungi for biological control will be discussed. Examples will be presented in which the success is directly related to two factors. One of these factors is adequate systematic knowledge of the groups of organisms to which the potentially beneficial fungus belongs. This systematic knowledge then serves as the basis for the discovery and safe development of particular fungi used in biological control. The second factor is access to germplasm from around the world. Because of global access to related groups of fungi, it has been possible to develop adequate knowledge of a related group of organisms and to obtain the specific germplasm that is effective as the biological control agent.

8 Agricultural Germplasm and Global Contributions

HENRY L. SHANDS, Genetic Resources National Program Leader, USDA, ARS, Beltsville, MD 20705, and **Allan K. Stoner** National Germplasm Resources Laboratory, USDA, ARS, Beltsville, MD 20705.

The USDA's National Plant Germplasm System has assembled from many sources a collection of over 450,000 samples which serves as an important global resource. During the 5-year period 1990–1994, the USDA received 50,671 germplasm samples from 155 countries (including 9,378 from international agricultural research centers) and, under USDA's open and free access policy, distributed over 180,000 samples to 145 countries. Open and free exchange of germplasm as a global policy has been criticized by nonindustrial countries who say that the benefits of use of germplasm have not been shared with them. The Convention on Biological Diversity establishes the sharing of benefits but also encourages providing access to germplasm. The programs of the USDA and other U.S. organizations and agencies have shared greatly with other countries by providing improved germplasm, technical assistance, and training. The U.S. contributions to different bilateral and multilateral technical assistance programs have made a significant difference for many nonindustrial nations by improving crop production, establishing infrastructure, and educating agriculturists. The USDA collection helps repatriate collections to countries establishing their own collections. USDA herbarium specimens serve to assist systematists to assess the world's biological diversity, and improved cultivars are available to introduce useful gene combinations into breeding programs. If nations restrict the flow of agricultural germplasm as a result of the Convention, the most vulnerable nations will be those without adequate infrastructure to provide for themselves. Global and national food security will be threatened and weakened, perhaps even in the countries believing that they have all the genetic resource base they need.

9 Beetle Economics

NATALIA J. VANDENBERG, Systematic Entomology Laboratory, USDA, ARS, c/o National Museum of Natural History, NHB 168, Washington, DC 20560

Lift the stone and you will find me, cleave the wood and I am there.
—Scott Russell Sanders, from *Terrarium*

Beetles (Coleoptera) first appeared in the Permian, over 250 million years ago. Their origin predates the first dinosaurs but their success has been much more enduring. Today they constitute the dominant animal life of our planet with nearly 300,000 described species (about one-fourth of all animals). A uniquely adaptive body design has allowed beetles to exploit an array of ecological niches from the driest desert to mountain streams, agricultural fields and human habitations. Beetles feed on everything: green plants, stored products, wood, animals, dung and each other. Individual species are often quite restrictive in diet and form an essential part of the food web. Inadvertent introduction of an exotic species can have profound environmental and economic impact, as can the absence of a species from a system where it plays a key role in maintaining a delicate ecological balance. Thus the study of foreign beetles is often of greater economic urgency than that of our stable native fauna. We must screen foreign shipments against potential pest species and investigate the purposeful introduction of host-specific beneficials to control established weeds and foreign pests. Because of the great number of superficially identical beetle species, each with its separate biology, careful systematic-based studies of foreign collections are essential to the ecological management of our native agriculture, natural resources and urban environment.

10 Natural Products from Microorganisms

JENNIE C. HUNTER-CEVERA, Lawrence Berkeley National Laboratory, 1 Cyclotron Road, MS 50A-5131, Berkeley, CA 94720

At a recent American Academy of Microbiology workshop on biodiversity, microbes were described as the invisible guardians of the earth. These tiny, single-cell organisms have been around for eons and have influenced our life on this planet as an unseen force, both positive and negative. They have shaped our history, sustained the earth, and produced some incredible gastronomic delights. Some scientists will go as far as to say that microbes, not macrobes, rule the earth. *Homo sapiens* first appreciation of microbiology in being able to halt death was when a yellow liquid produced from a fungus proved to exhibit unseen power (activity) against biological infections. Penicillin was called the "yellow magic medicine." When this molecule was finally elucidated as an antibiotic, a new area of applied microbiology was introduced; i.e., screening for natural microbial products with therapeutic value. Considering the microorganisms' metabolic role in providing therapeutics for health and products and processes that improve our lifestyle, as well as their diverse role in the environment, some people might even consider them a sound investment for the future stability of our gross national product. Since it has been stated many times that we have been able to isolate only <0.1% of the diverse microbial population existing in nature, one can only imagine the array of novel compounds and enzymes waiting to be "conjured up" for new applications.

11 Using Specimen-Based Information to Devise a Protected Area System for Guyana

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Guyana is a country rich in biodiversity but with only one 1-sq.-mile protected area, Kaieteur Falls National Park. The Smithsonian Institution, in conjunction with the Centre for the Study of Biodiversity at the University of Guyana, is compiling information to assist in the establishment of a protected area system in Guyana. The goal is to assemble data from plant and animal specimens from museums around the world and to combine the data with recent collection information to produce recommendations for the establishment of protected areas. In addition, these data would be used as a basis for monitoring the health of the protected areas. The World Bank–GEF is attempting to assist the government of Guyana in setting up and maintaining a protected area system by funding a pilot project. This project has allowed us to gather information, historical and current, on approximately 3% of the species from a number of plant and animal groups in Guyana. Preliminary results clearly define areas where collections are frequent and areas where additional collections are necessary for specific groups. Indeed, there are areas where we apparently have no information. However, these data are insufficient to identify areas with high levels of endemism. This study is showing that specimen-based research is very valuable for answering biodiversity questions and that only by involving local scientists and the global scientific community can we hope to address pressing conservation problems.

12 Economic Trends and the Importance of Genetic Diversity in Ornamental Horticulture

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Ornamental horticulture has shown rapid and significant growth in the United States and many other countries. In the U.S., the "green industry" involving floral, nursery and foliage crops is the fastest growing segment of American agriculture. The industry has experienced an annual growth rate in excess of 9 percent a year since 1982. Ornamental horticulture earned 11 percent of the total cash receipts of all crops and ranked sixth in grower cash receipts in 1991. Worldwide trends in floriculture are rapidly changing. The trend is shifting from cut flower to flowering pot plant production in the U.S. In spite of this trend, cut flower sales remain strong in Western Europe, where sales exceed $12 billion a year. Production centers are also shifting away from the U.S. to Colombia and Ecuador. Changes are also occurring in Europe with production expanding in Africa and India. Emerging economics are increasing consumption of these products as per capita income grows in countries like China and Indonesia. Changes in production and consumption patterns have been associated with the development of new types of germplasm. Crops that were formally restricted to production only in a temperate climate have been hybridized for sub-tropical cultivation. The importance of these changes in climatic adaptation are related to the use of genetically diverse materials and their incorporation into new plant types with greater adaptability. This presentation will provide specific examples of how genetic diversity can be utilized to produce new ornamental plant forms in cooperative programs involving U.S. scientists and foreign cooperators.

13 Plant Exploration

MAXINE M. THOMPSON, Department of Horticulture, Oregon State University, Corvallis, OR 97331

Plant exploration is essential to provide a continuing supply of new genetic diversity for plant breeders whose goal is to develop new cultivars to meet the ever-emerging new challenges faced by agriculture. It has long been recognized that the narrow genetic base available in the United States has seriously restricted progress in many fruit and nut breeding programs. Therefore, following a career in fruit breeding, I embarked on an international quest for exotic fruit and nut germplasm to expand the diversity available to currently active and future fruit breeders. Fortunately, within a few years of my new career, two major centers of diversity for fruit and nut crop germplasm, Central Asia in the former Soviet Union and China, opened their borders for foreign visitors, including plant explorers. Areas that had been closed for decades suddenly became accessible to botanists and plant breeders. During the past few years, several expeditions have gone to these regions and have collected many plant species and cultivars with valuable new genetic traits. In this presentation, I discuss the places in Central Asia and China that I have visited and some of the valuable new traits in fruit and nut crops species that I and my colleagues have collected. Examples will be mentioned where some outstanding traits present in the newly introduced germplasm are already being incorporated into breeding programs.

14 Vertebrate Tissue Collections

FREDERICK M. SHELDON, Collection of Genetic Resources, Museum of Natural Science, Louisiana State University, Baton Rouge, LA, 70803-3216

Collections of tissues from wild vertebrates (as opposed to cultured tissues) present special problems and opportunities. In general, the public is interested in the ecology and conservation of vertebrates and, thus, may understand the value of vertebrate systematics studies. However, heightened awareness and emphasis on vertebrate natural history create concerns over (1) collecting vertebrate specimens and (2) spending disproportionate amounts of scanty government funds on the study of vertebrates at the expense of other organisms. These feelings in the public and scientific communities currently make it difficult to build vertebrate tissue collections. Such problems are exacerbated by the poor investment potential of vertebrate tissue collections in the private sector; it is unlikely that pharmaceutical, agricultural, biochemical, or other investors would reap as much return from vertebrate collections as from some plant or invertebrate collections. However, the potential value of vertebrate collections for evolutionary, conservation, medical, and other research is still enormous. The LSU Genetic Resources Collection, for example, has been a major source of information for research on such disparate topics as human disturbance of Neotropical bird populations, epidemiology of Hanta virus, and wildlife management forensics, not to mention hundreds of more traditional evolutionary studies.

15 The Use of Fungi from a Biodiversity Hotspot: Conservation and Property Rights in Oaxaca, Mexico

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Oaxaca (southern Mexico) harbors one of the "nodes" of bioinformatic resources. Not only is the natural environment particularly rich in this area, but a history of civilized human habitation over thousands of years makes this region of special interest for conservation. A Management Plan is in place in the Sierra Norte which envisions cycles of 60/120 years. This plan has been developed by a union of indigenous communities with assistance from assorted NGOs and includes the discovery and economic use of microbial resources in applications ranging from bioprospecting for pharmaceuticals, harvest of wild mushrooms for specialty global markets, production of biocontrol agents, to edible protein production. As the list of applications grows, this example is testing the frontiers of legislative and regulatory schemes in Mexico, Latin America and the world. Neither an absolutely open access policy nor the current race to enforce national boundaries to bioinformatic resources is most conducive to promoting the use of novel products of biodiversity to foster stable local economies. In Oaxaca, recognition of communal-level property rights and access to information have been essential elements to enable local communities to preserve "wild" bioinformatic resources and incorporate them in their sustainable management of the land.

16 Bioprospecting Using African Genetic Resources

MAURICE M. IWU, Bioresources Development and Conservation Programme and Walter Reed Army Institute of Research, Washington, DC 20307-5100

Africa is a continent endowed with enormous biological resources. The vegetation is characterized by unsurpassed natural variance—from the tropical forests in the west and central regions with their high degrees of endemism, to the huge savannah belt including the famed Rift Valley; from the unique Cape Floral Kingdom to the desolation found in the Sahara, Namib and Kalahari deserts. Although several important medicinal plants owe their origin to Africa, there has been little benefit derived by Africans from bioprospecting projects in the continent. The genetic resources of Africa contributed immensely to European economic growth in the 18th and 19th centuries. Even today, many genetic materials transferred outside the continent for academic purposes are traded without the knowledge of the source countries. The Bioresources Development and Conservation Programme (BDCP), an international NGO operating in several African countries, has developed an innovative model for biological prospecting based on establishing strategic partnerships and capacity building. The plan ensures that economic benefits are channeled back to the area in which the source plants were found, with provision made to compensate individuals, rural communities and local institutions. The BDCP approach links the economic needs of rural communities with the demands of biodiversity conservation.

17 Global Genetic Resources: Agriculture and Agri-food Canada

JACQUES SURPRENANT, Eastern Cereal and Oilseed Research Centre, Agriculture and Agri-food Canada, K.W. Neatby Building, Room 4101B, Ottawa, Ontario K1A 0C6

Agriculture and Agri-food Canada (AAFC) is the major player on the Canadian scene with regard to plant genetic resources as well as entomological, botanical, mycological and fungal culture collections. AAFC has the mandate to maintain the national collection of plant genetic resources. The collection maintained by AAFC's Plant Gene Resources of Canada (PGRC) has grown over 100,000 seed samples since 1970. As part of our commitment to the international community, the department maintains the world's principal collections for oats and barley and the secondary collection for pearl millet and crucifers. Canada has always adhered to a strict policy of an open and cost-free access to the material stored in its gene bank(s). The Canadian Collection of Fungal Cultures (CCFC) is a smaller collection with 10,500 cultures. As is common with similar collections worldwide, cost recovery is achieved by culture sales, which partially defray the costs of preparing the cultures but do not cover maintenance costs. No other restriction has been imposed on the distribution of this collection. AAFC also maintains a major mycological herbarium at the Department of Agriculture Ottawa Mycology (DAOM) with 300,000 specimens and the Department of Agriculture Ottawa vascular plant herbarium (DAO) with 850,000 specimens. AAFC maintains the Canadian National Collection of insects, arachnids and nematodes (CNC) with 12 million specimens—one of the biggest collections in the world. These three collections (DAOM, DAO and CNC) are managed fairly similarly. A new formal policy is being put in place now. This policy follows the general guidelines provided by the Association of Systematic Collections. Differences between the ASC policy and ours will be discussed.

18 Biodiversity, Research Agreements, Intellectual and Other Property Rights: The Costa Rican Case

CARLOS MANUEL RODRÍGUEZ ECHANDI, Legal Consul, Instituto Nacional de Biodiversidad, 3100 Santo Domingo, Heredia, Costa Rica

The Instituto Nacional de Biodiversidad (INBio) is a Costa Rican non-governmental organization that is committed to ensuring the survival of the protected areas of Costa Rica by developing non-destructive uses of the natural wildlands. The biodiversity prospecting and other activities at INBio have the expressed goal of generating income from the protected areas in order to contribute to their management costs and to Costa Rica's intellectual capital and financial prosperity. INBio places conditions on all contractual agreements with commercial corporations and research institutions. These conditions include direct payments both in cash and barter, payments of project costs and royalties, royalties based on net sales from commercialization, support for in-country research and development, minimal exclusivity although INBio recognizes that some exclusivity is essential, definition of ownership, minimal damage to protected areas, and protective legal mechanisms. Under Costa Rican law any person or organization intending to collect or manage biological resources from protected areas for commercial or other uses must sign an agreement with the federal government. In commercializing biodiversity as a means of developing natural parks, INBio must seek out potential uses as well as foster the political and legislative climate that supports this venture. INBio's success demonstrates that biodiversity resources can be made available to the commercial community without destroying the living capital.

19 International Germplasm Collections under the Biodiversity Convention: Options for a Continued Multilateral Exchange of Genetic Resources for Food and Agriculture

Geoffrey C. Hawtin (Director General), **Jan Engels** (Director of Germplasm Maintenance and Use), International Plant Genetic Resources Institute (IPGRI), Via delle Sette Chiese 142, 00145 Rome, Italy, and **WOLFGANG E. SIEBECK,** Consultative Group on International Agricultural Research (CGIAR), The World Bank, 2555 Pennsylvania Avenue N.W. #1010, Washington, DC 20037

International germplasm collections of the CGIAR-sponsored International Agricultural Research Centers are among the world's most important, accounting for ⅓ of the genetic material of the major food crops. In 1994, the Centers as trustees placed these collections under the auspices of FAO. The FAO International Undertaking on Plant Genetic Resources and the Convention on Biological Diversity recognize the sovereign right of nations to control access to genetic resources. Thus, current CGIAR policy of making this material available without restriction for breeding and commercial use is being questioned. The ongoing renegotiation of the Undertaking to bring it in line with the Convention offers an opportunity to devise an access system that would ensure the equitable sharing of benefits. While all agree that wide international availability of this material to the global scientific community is vital to sustainable food security, few proposals on how this could be accomplished have been advanced. In response to a request from FAO, IPGRI has recently studied a range of options allowing the exchange of genetic material in compliance with the Convention. It concludes that, at least for the major food crops, only a multilateral system can ensure adequate availability of germplasm for crop improvement. Proposals are developed that would promote access and ensure that benefits are shared transparently and equitably among providers and users. In this system the CGIAR collections could continue their major role.

20 Biodiversity Prospecting and Models for Collections Resources: NSF/USAID/NIH Model

BARBARA N. TIMMERMANN, Department of Pharmacology and Toxicology, The University of Arizona, Tucson, AZ 85721

The International Cooperative Biodiversity Group Program is an experimental effort for research into biodiversity conservation, economic development in developing countries, and drug discovery from natural products. The five ICBG Programs are jointly funded by the National Science Foundation (NSF), the U.S. Agency for International Development (USAID), and several components of the National Institutes of Health (NIH). These programs are administered through the Fogarty International Center of the NIH. The awards are in the form of cooperative agreements rather than grants. In 1993 and 1994, following a multidisciplinary peer review of 34 competitive proposals, five awards were made for a duration of five years. The University of Arizona, in cooperation with universities and research institutes from Argentina, Chile and Mexico, has developed a program that is looking at plants from arid ecosystems as potential sources of new pharmaceuticals and agrochemicals. Other collaborators in this ICBG Program include Purdue University, the G.W.L. Hansen's Disease Center and Wyeth-Ayerst Research Laboratories, and American Cyanamid Company. While plants from arid lands are well known to produce a variety of secondary metabolites as defensive agents and poisons, they have received much less attention than plants from the rainforests as potential sources of useful pharmaceutical agents.

21 Marine Biodiversity Prospecting

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Marine organisms have yielded an exceptional number of novel chemical compounds, some of which are currently used or have the potential to be used as pharmaceuticals, agrochemicals, and food additives. Access to marine environments for biodiversity prospecting has become increasingly more difficult as resource managers try to develop and implement plans for conservation and sustainable use of their marine resources. Permits for biodiversity prospecting often include provisions for fair and equitable sharing of the financial benefits of marine biodiversity prospecting; however, such agreements seldom incorporate provisions for the sharing of non-financial benefits, such as biodiversity inventories of poorly known ecosystems that could help resource managers in resource assessment and conservation, and technology transfer and training opportunities that could support the enhancement of the scientific infrastructure in developing countries. While our primary objective is the discovery of marine-derived compounds with pharmaceutical potential, equally important are the characterization of habitats studied, the taxonomic identification of samples, and the development of biological alternatives for bulk production of bioactive compounds. Each of these areas can provide opportunities for both the bioprospector and the resource manager to equitably and sustainably use marine resources. Strategies for marine biodiversity prospecting and the implications for coastal zone management and economic development will be presented.

22 Sustainable Development in The Tropical Deciduous Forest of Mexico: Myths and Realities

OSCAR R. DORADO RAMIREZ, Centro de Educación Ambiental e Investigación Sierra de Huautla and Departmento de Biologia, Universidad Autónoma del Estado de Morelos, Ave. Universidad No. 1001, Colonia Chamilpa, CP 62210 Cuernavaca, Morelos, México.

Although most environmentally protected areas in Mexico contain high altitude perennial tropical forests, other types of vegetation are probably in greater danger of disappearing, e.g., the dry tropical deciduous forest. This forest has great biological wealth but is the least studied and least understood of Mexico's ecosystems. One remaining portion is in the region known as Sierra de Huautla in the state of Morelos and was recently proclaimed a protected area. The Sierra de Huautla Program (SHP) inverted the strategies followed by most conservationists. Instead of conducting detailed studies on the biological wealth of the region and then proposing the creation of a reserve a decade later, the SHP proposed the reserve based on some biological considerations but principally on dialogues with Morelos' political figures. As a result, the Sierra de Huautla Reserve was created in the remarkably short time of two years. This paper describes the approaches used by SHP and the diverse array of options for successfully creating a sustainable development program. Although sustainable development is generally believed to be based solely on the direct use of natural resources for agriculture, the SHP has proven that this strategy is not the only feasible one for biodiversity conservation. There are two main obstacles to the continued development of innovative conservation programs in Mexico: I) politically motivated agricultural development schemes, and ii) the misguided influence of environmental groups. In either case, environmentally harmful consequences can result. Tourism, non-polluting microindustries, and other strategies are often more efficient and last longer than agricultural development as tools for the conservation of biological resources in semiarid tropical areas in Mexico.

23 "Triangular Privity"—A Working Paradigm for the Equitable Sharing of Benefits from Biodiversity Research and Development

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Approximately 40 years ago, the National Cancer Institute (NCI) embarked upon an extensive program to screen natural products for potential chemotherapeutic activity. Over 40,000 plant samples, representing 9,000–10,000 different species, and over 6,000 marine samples, have been collected. It is NCI policy that the source country share in benefits resulting from new chemotherapeutic agents discovered from the screening of the country's natural products. The working paradigm of NCI's benefit-sharing program includes the use of three agreements that form "triangular privity" among the NCI, the source country and the licensee of NCI's patentable discoveries. Privity is the relationship between two (or among three or more) parties, usually involving legally enforceable duties or obligations. "Triangular privity" is created through separate agreements between NCI and source country, NCI and its licensee, and source country and the licensee. The first agreement is a Letter of Collection (LOC), under which the NCI agrees to require the licensee of any NCI invention that results from screening natural products to enter into a separate agreement with the source country. NCI further commits to the sharing of technology and training opportunities to the benefit of the source country under the LOC. The second agreement is the patent license between the NCI and its licensee. The third agreement is between the source country and licensee, which are then free to address all concerns and interests relating to the commercialization of the resulting invention. At present NCI has two licensed potential chemotherapeutic agents under early development that arose under the LOC policy. In one case, the licensee and source country have concluded a separate agreement to promote the sharing of commercial and other benefits. In the other the licensee is closely affiliated with the source country's government and thus a separate agreement is not required.

24 The Andean Common Code for the Genetic Resources Access: A General Overview

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A newly approved common code for the access of biodiversity or genetic resources is being discussed in the Andean Countries Pact. This code intends that countries participate equitably in the benefits coming from biodiversity utilization. It will also support conservation programs, capacity and development for utilization, and negotiating capabilities of biodiversity through training programs and the use of biotechnological techniques. The code includes only those species that originated in or migrated to the region and that are growing within the territories of the Andean countries. This agreement establishes that biodiversity and its products are of national patrimony and, therefore, are not alienable or embargable. The code, however, will not stop normal interchange under the CITIES convention nor plant quarantine, food security, biosafety, and variety protection between the member countries. Studies on biodiversity will require a formal request and a contract with the national authority (to be designated as soon as the code is signed) and a national organization. Eventually, contracts might have to be approved by the local communities where the research project will take place. A general consensus is that agro-biodiversity will not be included in the present agreement.

25 Biodiversity Access Legislation as a Tool for Promoting Conservation and Sustainable Use of Biodiversity

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Policies to regulate access to genetic resources and biochemical samples under the 1992 Convention on Biological Diversity need to take into account trends in the biotechnology industry and, in particular, the implications of these trends for effective benefit sharing arrangements. Governments and NGO's can help ensure that the policies developed by nations to regulate access will meet conservation and development objectives by promoting I) the inclusion in access regulations of a requirement to obtain prior informed consent of local communities, ii) the establishment of simple "one-stop-shopping" review and permitting offices for the issuance of access approval, and iii) the elaboration of "certification" systems to guarantee that the collection of genetic and biochemical samples within countries is undertaken in a manner consistent with the letter of the access regulations and the intent of the biodiversity convention. Two of the major hurdles that must be overcome in the design of access legislation are the risk of substantially burdening basic research and the need for far greater understanding within industry of how firms should operate—and how they might benefit competitively—under these new access regimes.

26 Culture Collections: Agents for Equitable Use of Genetic Resources

RAYMOND H. CYPESS, President/CEO and **Shung-Chang Jong**, Director, Mycology and Protistology Program, American Type Culture Collection, Rockville, MD, 20852-1776

Since modern technologies continue to increase the economic value of living biological material, the ATCC Board of Directors recently adopted new policies to harmonize ATCC's traditional acquisition policy with the current thinking on access, ownership, and intellectual property rights of such resources. The collection continues to encourage contribution of materials for use in contemporary research and economic development, but seeks to clarify ownership of the physical and intellectual property relevant to materials at the time of deposit, while at the same time limiting undue access and/or use restrictions. The ATCC is currently designing appropriate policies to address technological change and mechanisms for the equitable sharing of the resulting benefits. New programs, such as partnerships, technology transfer, and R&D, which complement those previously offered by the collection, are being added. Most deposited materials are placed in the general collection with unrestricted access and use. The option of depositing new value-added material with depositor-requested use or access restrictions will encourage those who want mechanisms in place to commercialize or limit distribution of those materials. Traditional proprietary collections offer additional forms of deposit under which access and/or use restrictions are permitted. They include patent deposit, safe deposit, intramural R&D materials, and extramural materials (partnerships). Technology transfer materials are placed in special collections. With the ATCC as a model, new policies and mechanisms will be discussed in detail.

PODIUM BIOGRAPHIES

Beltsville Symposium XXI
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1 **DR. PETER R. DAY**
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Dr. Day was born and educated in England. He received a B.Sc. in Botany in 1950 and a Ph.D. in Plant Pathology and Genetics in 1954 from the University of London. He began work in plant science in 1946 at the John Innes Institute and remained there, apart from a period as a Commonwealth Fund Fellow at the University of Wisconsin, until 1963 when he moved to Ohio State University as Associate Professor in Botany. In 1964, Dr. Day became head of the Genetics Department of the Connecticut Agricultural Experiment Station. While there he became a U.S. citizen and spent a sabbatic leave as a Guggenheim Fellow in Australia. He returned to the U.K. in 1979 to become Director of the Plant Breeding Institute in Cambridge. In August 1987, Dr. Day was appointed Director of the Center for Agricultural Molecular Biology and University Professor of Genetics at Rutgers, the State University of New Jersey, where he is now. His research has been concerned principally with the genetics of fungal plant pathogens and the challenge of breeding disease resistant crop plants. During the latter part of his career, Dr. Day has been involved with the development and application of molecular biology to crop plant improvement. Most recently this has been expanded to the use of new technology for environmental bioremediation and livestock improvement, which are among the interests of the Center he directs at Rutgers.

2 **DR. DANIEL M. WITMEYER**
Senior Analyst
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After receiving a B.A. in Biological Sciences and an M.A. in Communication from the University of Delaware, Dr. Witmeyer was awarded a Ph.D. in International Affairs from the Graduate School of Public and International Affairs at the University of Pittsburgh in 1994. He is presently Senior Analyst at MSTI in Fairfax, Virginia. Previous positions held include being Liaison Officer for the International Board for Plant Genetic Resources (IBPGR), Analyst at DESTECH, Foreign Affairs Analyst for the Congressional Research Service, and Consultant for the USDA Graduate School. Dr. Witmeyer's current research interest is in international policy for genetic resources.

3 **DR. WILLIAM H. LESSER**
Professor
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A professor of marketing at Cornell University since 1978, Dr. Lesser has directed significant efforts toward assessing the probable outcomes of the higher proportion of private vs. public sector agricultural research funding and the changing access conditions for genetic resources for countries as diverse as Indonesia and Canada. This work follows the pattern of industrial organization analysis of agricultural subsectors. During 1994–95 Dr. Lesser served as Acting Executive Director of the International Service for the Acquisition of Agri-biotechnology Applications (ISAAA) based at Cornell. ISAAA assists developing countries in accessing new agricultural technologies. Dr. Lesser's 1993–94 sabbatical leave was with the International Academy of the Environment in Geneva, Switzerland. He continues to serve as Director of the Biodiversity/Biotechnology Programme there. A significant Programme effort is developing a mechanism to establish use arrangements for genetic prospecting and to identify the commitments of industrialized countries under technology transfer objectives.

4 **DR. JOHN H. BARTON**
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John H. Barton is George E. Osborne Professor of Law at Stanford, where he specializes in high technology law, international business law, and international environmental law. He is Director of the school's International Center for Law and Technology. He has particular background on the legal aspects of agricultural biotechnology and has been active in a variety of panel and consulting efforts in the area of international agricultural genetic resources. These include membership on the 1984–85 review of the International Board for Plant Genetic Resources and consulting for the 1990–91 review of the same center, membership in the National Research Council Board on Agriculture's Committee on Managing Global Genetic Resources, assistant to the Food and Agriculture Organization on interpretations of the International Undertaking on Plant Genetic Resources and on development of a program for conservation of animal genetic resources, and consulting on a variety of genetic resources issues for the Consultative Group of International Agricultural Research. He has published on genetic resource issues in *Diversity* (with W. Siebeck) and in *Biosciences* (on the Rio Convention) and has contributed to the Kloppenberg volume, *Seeds and Sovereignty*, and to the 1985 OTA study of institutional frameworks for maintaining genetic diversity. In addition, he has made presentations or participated in panels on biodiversity issues at the American Association for the Advancement of Science, at the Seminario Panamericano de Semillas, and at the African Centre for Technology Studies. He has also published extensively on intellectual property issues and on international technology transfer. He is a member of the District of Columbia Bar and a fellow of the American Association for the Advancement of Science.

5 **DR. QUENTIN D. WHEELER**
Professor of Insect Systematics
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Dr. Wheeler received his B.S., M.S., and Ph.D. degrees in Entomology from The Ohio State University in 1976, 1977, and 1980. He joined the faculty of the Department of Entomology at Cornell University as Assistant Professor in 1980, where he is currently Professor of Insect Systematics. He is a Research Associate of the American Museum of Natural History in New York City, a joint-appointed professor in the Liberty Hyde Bailey Hortorium, and a member of the graduate fields of entomology and zoology at Cornell. He served as Acting Director of the Bailey Hortorium for two years and as Chairman of the Department of Entomology at Cornell for four years. He is currently President of the Association of Systematics Collections and in the past has served as President of the Coleopterists Society, Vice-President of the Hennig Society, and an Associate Editor of Systematic Zoology. He has published more than 50 articles on Coleoptera taxonomy, fungus–beetle associations and theory of systematics, has compiled an extensive electronic database of fungus–beetle associations, and is co-editor of three books: *Fungus-Insect Relationships* (with Meredith Blackwell), *Extinction and Phylogeny* (with Michael Novacek), and the forthcoming *Species Concepts and Phylogenetic Theory: A Debate* (with Rudolf Meier). His extensive lectures and writings on the role of systematics in biodiversity studies include a plenary address to AIBS and invited presentations to the Linnaen Society of London and the French Academy of Sciences. His biodiversity-related committee service has included the National Academy of Sciences/National Research Council Committee on the Formation of the National Biological Survey, the steering and writing committees of the Systematics Agenda 2000 initiative, the organizing committee for a National Biodiversity Information Center, and the agriculture committee of the Office of Technology Assessment.

6 **DR. ERIC P. HOBERG**
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Dr. Hoberg's degrees include a B.Sc. from the University of Alaska in 1975, an MSc. from the University of Saskatchewan in 1979, and a Ph.D. from the University of Washington in 1984. Subsequent research positions include Postdoctoral Senior Fellow in the Department of Pathobiology at the University of Washington, Research Associate in the College of Veterinary Medicine at Oregon State University, and Assistant Professor of Veterinary Parasitology at the Atlantic Veterinary College, University of Prince Edward Island. Since 1990, he has held the position of Zoologist and Associate Curator of the U.S. National Parasite Collection, Biosystematics and National Parasite Collection Unit, Agricultural Research Service, U.S. Department of Agriculture. Concurrently, he holds the titles of Research Associate at the Burke Memorial Washington State Museum at the University of Washington, Adjunct Professor at the Western College of Veterinary Medicine at the University of Saskatchewan, and Associate Editor for Systematics and Phylogeny for the Journal of Parasitology. Dr. Hoberg's awards include the Henry Baldwin Ward Medal (granted by the American Society of Parasitologists in 1992) and the Outstanding Early Career Scientist Award (bestowed by the USDA Agricultural Research Service in 1994). His publications exceed 95 papers and invited book chapters on parasite systematics, biodiversity, taxonomy and biology; cospeciation analysis; and historical biogeography of high-latitude host-parasite systems.

7 **DR. AMY Y. ROSSMAN**
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Dr. Amy Y. Rossman is Research Leader of the Systematic Botany and Mycology Laboratory, USDA-ARS, and Director of the U.S. National Fungus Collections, Beltsville, Maryland. After receiving her Ph.D. from Oregon State University specializing in systematic mycology, she was awarded the Anna Jenkins Fellowship at Cornell University. Before accepting her current position, she held a research position at the New York Botanical Garden. She conducts research on the systematics of agriculturally important fungi, specializing in the hypocrealean Ascomycetes and their anamorphs. This group of fungi includes those that cause diseases on plants as well as fungi that are useful in the biological control of plant pathogenic fungi. In addition to publishing over fifty scientific papers, she has co-authored three books including the 1,252 page publication *Fungi on Plants and Plant Products in the United States*.

8 **DR. HENRY L. SHANDS**
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Dr. Henry L. Shands is Associate Deputy Administrator for Genetic Resources, National Program Staff, Agricultural Research Service, U.S. Department of Agriculture. In that capacity he serves as Director of the National Genetic Resources Program, authorized by Congress to acquire, preserve, and utilize genetic resources of animal, plant, microbial, and insect life forms. Genome mapping research projects for these life forms are part of the program thrust to identify genes and genetic systems of future importance to food and agriculture. Dr. Shands coordinates the National Genetic Resources Advisory Council, advisory to the Secretary of Agriculture. Prior to his current assignment, he served as National Program Leader for Plant Germplasm, National Program Staff, and he remains responsible for the Agency's network of plant germplasm collections located across the country.

8 **DR. ALLAN K. STONER**
Research Leader
National Germplasm Resources Laboratory, USDA, ARS
Building 003, Room 225, BARC-West, Beltsville, MD 20705

Dr. Stoner has been employed by the USDA-ARS Beltsville Agricultural Research Center since 1965. For 15 years he conducted research evaluating tomato germplasm for insect and disease resistance and other useful traits and breeding multiple pest resistant, high quality, widely adapted lines. In 1980, Dr. Stoner was named Chairman of the Plant Genetics and Germplasm Institute, with responsibility for coordinating and providing leadership to Laboratories involved in the acquisition, documentation, evaluation, and enhancement of germplasm of many plant genera. Since 1989, Dr. Stoner has served as the Research Leader of the National Germplasm Resources Laboratory with responsibility for several activities that support the U.S. National Plant Germplasm System including the Germplasm Resources Information Network, the Plant Exchange Office, the Plant Germplasm Quarantine Office and facilitation of 40 Crop Germplasm Committees.

9 **DR. NATALIA J. VANDENBERG**
Entomologist
Systematic Entomology Laboratory, USDA, ARS
c/o National Museum of Natural History
NHB 168, Washington, DC 20560

Dr. Vandenberg is a world authority on the systematics and biology of lady beetles. Receiving her Ph.D. in 1987 from the Division of Biological Control, University of California, Berkeley, she graduated with honors and a rare departmental citation. She regularly publishes on both larval and adult lady beetle systematics, and has described seven new species, two new genera, and a new tribe from the Neotropical fauna. Dr. Vandenberg has been invited to give presentations both nationally and internationally on the use of lady beetles in biological control. She has given talks at scientific meetings in Brazil and the United States, and she has presented a short course at the thirteenth international symposium of the Brazilian Entomological Congress on "Lady beetle biology, systematics and evolution." Dr. Vandenberg actively works with foreign colleagues and has served as scientific editor of the English-language versions of several important Russian publications including *Mesozoic Coleoptera* by L.V. Arnol'di et. al. and *Lady Beetles of the Russian Far East* by V. Kuznetsov. For the last five years she has been working with the USDA, Agricultural Research Service, Systematic Entomology Laboratory (SEL), carrying out research, collection management of the National Coleoptera Collection, and service identifications of both larval and adult beetles.

10 **DR. JENNIE C. HUNTER-CEVERA**
Director
Center for Environmental Biotechnology
Lawrence Berkeley National Laboratory
MS 50A-5131, One Cyclotron Road, Berkeley, CA 94720

Dr. J.C. Hunter-Cevera received her Ph.D. in Microbial Biochemistry from Rutgers University in 1978. She has 22 years of diverse industrial microbiology experience in the fields of microbial physiology, ecology, taxonomy, pharmaceutics, agrobiologicals, biocatalyis and biotechnology. She is a member of the American Academy of Microbiology and Past-President of the Society for Industrial Microbiology. During her employment at E. R. Squibb and Sons, Inc., she was part of the group responsible for the discovery of a new class of antibiotics, the monobactams. At Cetus Corporation, Dr. Hunter-Cevera worked on developing screens to discover new classes of enzymes. Since November, 1994 she has served as the Director of the Center for Environmental Biotechnology at the Lawrence Berkeley National Laboratory. She is currently working on enhancing the biotransformation of metals by microorganisms using electrokinetics, the biodegradation of synthetic polymers used as barrier materials for containment, the bioavailability of weathered hydrocarbons for intrinsic biodegradation, and on the potential biodegradation of DNAPL's in fractured rock systems. She is author of several publications on microbial ecology and enzymology and holds two patents on biocatalysis.

11 **DR. VICKI A. FUNK**
Director
Biological Diversity of the Guianas Program
Department of Botany, MRC 166
National Museum of Natural History
Smithsonian Institution, Washington, DC 20560

Dr. Funk received a B.S. in 1969 and an M.S. in 1975 in Biology at Murray State University, Murray, Kentucky. In 1980, she was awarded a Ph.D. in Botany at the Ohio State University. She currently serves as Director of the Smithsonian Institution's "Biological Diversity of the Guianas" Program. This is a field-oriented project with the goal of to "study, document, and preserve the biological diversity of the Guianas." The program is currently focused on using existing collections and museum specimens to investigate the patterns of diversity. Dr. Funk is a plant taxonomist interested in the origin and evolution of the flowering plant family Compositae, especially in the Andes Mountains and on island systems. She specializes in the theoretical and practical applications of cladistics to questions on biogeography, hybridization, and speciation.

12 DR. ROGER H. LAWSON

National Program Leader, Horticulture and Sugar Crops
USDA, Agricultural Research Service
Building 005, Room 234, BARC-West
Beltsville, MD 20705-2350

Dr. Lawson's interest in floriculture began in grade school. In Oregon, he operated his own greenhouse where he grew and sold more than 3,000 tuberous-rooted begonias. At 10 years of age, he was the youngest licensed nurseryman in Oregon. At Oregon State University he obtained a B.S. in Floriculture and Botany and a Ph.D. in Plant Pathology. After graduate school, Dr. Lawson received a Fulbright Graduate Fellowship and performed research in the Netherlands at the Bulb Research Center in Lisse and the Agricultural University in Wageningen. In 1964, he was appointed as a plant pathologist at the USDA-ARS facility in Beltsville. He has conducted research on virus diseases and has authored more than 240 scientific and popular publications. In 1981, he was appointed Chief of the Florist and Nursery Crops Laboratory. During his tenure, seven new permanent scientific positions were added to the laboratory. In cooperation with industry he established a new crops program, and he expanded the financial base of the laboratory in an agreement with the American Floral Endowment and the Society of American Florists, which has resulted in matching fund contributions with a total of $500,000 for new crops development for a 5-year period. Dr. Lawson has established germplasm exchange programs with public and private institutions in Australia, Denmark and Holland and has collected plants from these countries as well as Asia. He serves on advisory and review panels for the National Science Foundation and the Agency for International Development and has consulted on a variety of foreign assignments. In 1989, Dr. Lawson received the ARS Scientist of the Year Award for his outstanding research.

13 DR. MAXINE M. THOMPSON

Professor Emeritus
Department of Horticulture, Oregon State University, Corvallis, OR 97331

Dr. Thompson received her B.S., M.S. and Ph.D. degrees at the University of California, Davis. Undergraduate and M.S. programs emphasized botany and pomology. The Ph.D. degree was in Genetics, with an emphasis on fruit breeding and cytogenetics. The major portion of her career was as a Professor of Horticulture at Oregon State University, where her responsibilities included fruit breeding research and teaching a class in Fruit Systematics. An active user of germplasm, she has long had a keen interest in plant variation and has been involved with the USDA-ARS National Plant Germplasm System throughout her career. She was on the National Planning Committee for the Clonal Germplasm Repositories and, subsequently, on the local planning committee and the Technical Advisory Committee for the Clonal Repository in Corvallis. Recently, as part of the evaluation program at this Repository, she determined chromosome numbers of the *Rubus* accessions held there. International Germplasm activities began with two assignments from the International Board for Plant Genetic Resources to assess and establish priorities for collection of fruit and nut genetic resources, first in Pakistan and then in Syria. Since retiring from the University in 1986, she has participated in five ARS-sponsored international plant exploration trips to collect fruit and nut germplasm in Pakistan, Ecuador, Central Asia, China, and Kyrgyzstan. In 1996, she will return to China for her sixth exploration trip. Currently, she is a volunteer plant collector for "The Oregon Flora" project in the Department of Botany and Plant Pathology, Oregon State University.

14 DR. FREDERICK M. SHELDON

Associate Curator
Museum of Natural Science, Louisiana State University, Baton Rouge, LA, 70803-3216

Dr. Frederick Sheldon has been Associate Curator of the Museum of Natural Science and Adjunct Associate Professor in the Department of Zoology and Physiology at Louisiana State University since 1994. Under his charge is LSU's Collection of Genetic Resources, the world's largest collection of wild vertebrate tissues and tissue extracts (ca. 40,000 individuals, 100,000 samples). This collection has particularly large holdings of tissues from birds (mainly North American and Neotropical) and reptiles and amphibians worldwide. Before moving to LSU, Dr. Sheldon spent seven years as a curator at the Academy of Natural Sciences of Philadelphia, which also has a large collections of bird tissues. Dr. Sheldon's primary research interests are the molecular systematics, biogeography, and historical ecology of birds. His recent studies include analyses of the evolution of seed-caching and associated behaviors in chickadees and titmice, nest-building behavior in swallows, and the mechanics of DNA hybridization as a method of phylogenetic inference.

15 DR. IGNACIO H. CHAPELA

Founder and Scientific Director
The Mycological Facility: Oaxaca, Oaxaca, Mexico
Apdo. 24-4, Col. Reforma, Oaxaca, Oax. 68051, Mexico
Assistant Professor
Dept. of Environmental Science, Policy and Management
College of Natural Resources, University of California
Berkeley, CA, 94720-3110

Dr. Chapela received a Ph.D. in Fungal Ecology from the University of Wales in Cardiff. Subsequent professional positions include that of Scientist at Sandoz Pharma/Sandoz Agro, Ltd. in Basel, Switzerland, where he discovered novel pharmaceutical and agrochemical products from fungi. In addition, he served as a Visiting Scientist in the Center for the Environment and Section of Neurobiology and Behavior at Cornell University, where he focused on the application of the benefits from biodiversity discovery to promote conservation efforts. He is presently an Assistant Professor in the Department of Environmental Science, Policy and Management at the University of California-Berkeley and is Founder and Director of The Mycological Facility: Oaxaca. Dr. Chapela has been involved as an activist as well as an analyst in the use of novel products of biodiversity—particularly fungal products—as tools for the preservation of biodiversity resources. Because he believes that conservation cannot be achieved without the promotion of sustainable development of human communities, Dr. Chapela, as part of a wider group of scientists and managers, has been studying and implementing novel ways of making scientific and technological know-how available to communities in close contact with biodiversity resources. His role as founder of The Mycological Facility, Oaxaca, reflects this interest. Dr. Chapela is also advising various conservation initiatives in Latin America on the use of bioprospecting as a conservation tool.

16 **DR. MAURICE M. IWU**
Executive Director
Bioresources Development and Conservation Programme
Senior Research Associate
Walter Reed Army Institute of Research
Washington, DC 20307-5100

Professor Maurice Mmaduakolam Iwu received a Master of Pharmacy in 1976 and a Ph.D. in 1978 from the University of Bradford in Bradford, England. He was a World Health Organization Visiting Scholar at the University of Oxford (1980) and a Fulbright Scholar to Ohio State University and Columbia University (1983). He is the Executive Director of the Bioresources Development and Conservation Programme, a nongovernmental organization with primary focus in the sustainable utilization of African genetic resources, and is a Senior Research Associate at Walter Reed Army Institute of Research (WRAIR). He also serves as the Chief Scientific Officer and Head of Research and Development at Tom's of Maine. Formerly Professor of Pharmacognosy at the University of Nigeria, he is currently Adjunct Professor in the College of Health Sciences of Enugu State University in Nigeria. He is also a member of the Scientific Strategy Team and Scientific Adviser at Sherman Pharmaceuticals, Inc, South San Francisco, California. His honors include an Original Achievement Award from the Students' Union of the University of Nigeria, the Vice-Chancellor's Research Leadership Prize of the University of Nigeria, Nsukka, and a Gold Medal awarded by the University of Nigeria. Dr. Iwu has presented over 100 papers at scientific meetings and has given many public lectures on African traditional medicine, industrial utilization of medicinal plants, and the conservation of biodiversity. He has published more than 60 research papers and is the author of two books on African Medicinal Plants and African Ethnomedicine. He played a key role in the establishment of the International Cooperative Biodiversity Group (ICBG) program based at WRAIR.

17 **DR. JACQUES SURPRENANT**
Program Manager, Crop Protection
Eastern Cereal and Oilseed Research Centre
Agriculture and Agri-food Canada, K.W. Neatby Building
Room 4101B, Ottawa, Ontario K1A 0C6, Canada

Born in Montreal in 1953, Dr. Surprenant obtained a B.Sc. degree in Biology from the University of Sherbrooke in 1976, an M.Sc. in Plant Pathology from Laval University in 1979, a Ph.D. in Plant Genetics from the University of Minnesota in 1984, and a Master's degree in Public Administration in 1994 from l'Ecole Nationale d'Administration Publique. He joined Agriculture and Agri-food Canada (AAFC) in 1980 as plant geneticist at the Soil and Crop Research Centre in Quebec City, where he worked until 1994. His research on the development of forage grass varieties led to the support of registration of many forage grass varieties. In January 1995, he joined the Centre for Land and Biological Resources Research Centre (CLBRR) as program chair for the Biological Resources Division. After a major restructuring of this research centre, he became, in April 1996, Program Manager in Crop Protection with the Eastern Cereal and Oilseed Research Centre (ECORC). The Crop Protection Program of ECORC covers most systematic activities of AAFC. Until April 96 it also included the Canadian seed genebank activities of AAFC.

18 **LIC. CARLOS MANUEL RODRÍGUEZ ECHANDI**
Legal Consul
Instituto Nacional de Biodiversidad
3100 Santo Domingo, Heredia, Costa Rica

Lic. Rodriguez is a lawyer at the University of Costa Rica in San Jose. He served on the Advisory Committee for the development of the Wildlife Conservation Law in which he had considerable experience. He is a member, consultant and advisor to a number of conservation-oriented non-governmental organizations in Costa Rica. In addition, he is advisor for projects that affect wildlands in Costa Rica that are under the jurisdiction of the Ministry for Development and Energy. Lic. Rodriguez is member of INBio's Executive Board and is Subdirector of the National System of Conservation Areas.

19 **DR. GEOFFREY C. HAWTIN**
Director General
International Plant Genetic Resources Institute (IPGRI)
Via delle Sette Chiese 142, 00145 Rome, Italy

Dr. Hawtin studied Agricultural Sciences, Genetics and Plant Breeding at Cambridge University, England and completed his field work at Makerere University, Uganda, specializing in the genetic resources of soybean. In 1974, he began working with the International Development Research Center (IDRC) in Canada and the Ford Foundation's Arid Lands Agricultural Development Program based in Lebanon and Egypt. In 1976, he was appointed Program Leader of the Food Legume Improvement Program of the International Center for Agricultural Research in the Dry Areas (ICARDA) in Aleppo, Syria. In addition to establishing ICARDA's food legume breeding programs, he undertook plant collecting missions in West Asia and North Africa, helped establish the world collections of lentils and faba beans, and developed genebank systems for managing them. In 1981, he was appointed Deputy Director General for International Cooperation at ICARDA. Later at IDRC, as Associate Director for the Crops and Animal Production Systems Program based in Vancouver, and in his next position as Director of the Agriculture, Food and Nutrition Sciences Division of IDRC in Ottawa, Canada, he gained broad experience in research management and administration. Dr Hawtin took up his position as Director of IBPGR on 1 August 1991 and became Director General of IPGRI on 1 January 1994.

19 **DR. JAN ENGELS**
Director of Genetic Resources
International Plant Genetic Resources Institute (IPGRI)
Via delle Sette Chiese 142, 00145 Rome, Italy

Dr. Engels was graduated from the Agricultural University of Wageningen, the Netherlands, specializing in Plant Breeding and Taxonomy. He joined IPGRI (at that time IBPGR) in 1988 as Coordinator for South and Southeast Asia. Prior to that he was employed by the German Agency for Technical Cooperation (GTZ) on a variety of projects including establishment of a plant genetic resources unit at CATIE in Costa Rica. He also served as a project manager in the International Plant Genetic Resources Center of Ethiopia and as a technical advisor on plant genetic resources conservation and use to several programs.

19 **DR. WOLFGANG E. SIEBECK**
Consultant
Consultative Group on International Agricultural Research
The World Bank
2555 Pennsylvania Ave. NW #1010, Washington, DC 20037

Dr. Siebeck holds a law degree from the University of Hamburg and an economics degree from the University of Oxford. He consults on public policy aspects of intellectual property protection, especially as they concern genetic resources. In 1991, Dr. Siebeck retired from the World Bank, where he had held various management positions for the Bank's operations in North Africa, the Middle East and South Asia, including that of Head of the Bank's Resident Mission in Pakistan. From 1985–89 he was the Bank's special representative to the United Nations in Geneva, where he established the Bank's advisory function to developing country negotiators in the GATT multilateral trade round (the Uruguay Round), which included the negotiating group on intellectual property rights.

20 **DR. BARBARA N. TIMMERMANN**
Professor
Department of Pharmacology and Toxicology, College of Pharmacy, University of Arizona, Tucson, AZ 85721

Dr. Timmermann is a Professor in the Department of Pharmacology and Toxicology at the College of Pharmacy of the University of Arizona. Her educational background is interdisciplinary with degrees in Biology (B.S., Universidad Nacional de Córdoba, Argentina, 1970) and Botany (M.S. and Ph.D., University of Texas, 1977 and 1980). Her research in chemistry involves the discovery of bioactive molecules from natural sources for the development of pharmaceutical agents. Therapeutical areas of potential target application include the central nervous system, the cardiovascular system, intermediary metabolism, allergy and inflammation, the gastrointestinal system, cancer, antivirals and antimicrobials. Other projects are related to the prevention of photocarcinogenesis by natural products from dietary sources. Dr. Timmermann is Principal Investigator/Project Director of an International Cooperative Biodiversity Group (ICBG) project funded jointly by the NIH, NSF, and USAID. This five-year multidisciplinary program consists of public institutions of higher education, private pharmaceutical corporations and environmental organizations in the United States, Argentina, Chile and Mexico. This project addresses biodiversity conservation and the promotion of sustained economic activity through drug and agrichemical discovery from natural plant products. She is the author or co-author of over 60 papers, co-editor of proceeding volumes and book chapters, and co-author of the chemistry book *Sesquiterpene Lactones: Chemistry, NMR and Distribution*.

21 **DR. SHIRLEY A. POMPONI**
Director
Division of Biomedical Marine Research
Harbor Branch Oceanographic Institution, Inc.
5600 U.S. 1 North, Fort Pierce, FL 34946

Dr. Pomponi received her Ph.D. in Biological Oceanography in 1977 from the University of Miami, Rosenstiel School of Marine and Atmospheric Science. From 1979 through 1984, she was on the research faculty at the University of Maryland, Center for Environmental and Estuarine Studies, Horn Point Environmental Laboratories. In 1984, Dr. Pomponi joined Harbor Branch Oceanographic Institution (HBOI) as a consultant to their sample acquisition program in support of the SeaPharm Project. She became Senior Scientist/Group Leader of this program in 1986 and then Group Leader of the sample acquisition program for HBOI's Division of Biomedical Marine Research (DBMR) in 1988. She has organized and participated in research expeditions in the Caribbean, eastern Atlantic, Galapagos Islands, the Indian Ocean, Australia, and New Zealand. Dr. Pomponi was appointed Director of DBMR in 1994. She leads a multidisciplinary team of scientists in the discovery of novel, marine-derived natural products with potential as human therapeutic agents. In addition to directing this group, Dr. Pomponi conducts research on sponge systematics and marine invertebrate cell biology. Her primary research interest is the development of marine invertebrate cell culture models to study production of bioactive metabolites and the factors that control expression of their production (including the role of microbial symbionts in the production of bioactive metabolites). In response to the need to develop strategies for sustainable use of marine resources, her group is actively involved in research to develop biological alternatives to large-scale collections for supply of bioactive compounds for drug development.

22 DR. OSCAR R. DORADO RAMIREZ

Director
Centro de Educación Ambiental e Investigación Sierra de Huautla (CEAMISH)
Professor, Universidad Autónoma del Estado de Morelos
Ave. Universidad No. 1001, Colonia Chamilpa
CP 62210 Cuernavaca, Morelos, México.

In September 1986, Dr. Dorado began monographic studies of the legume genus *Brongniartia* at Rancho Santa Ana Botanic Garden and the Claremont Graduate School, California, where he obtained an M.A. in 1989 and a Ph.D. in 1992. Dr. Dorado is the founder of a 31,000-hectare ecological reserve (Sierra de Huautla) of tropical deciduous forest in southern Morelos. In addition, he is the founder and current director of the Center for Environmental Education and Research at Sierra de Huautla (CEAMISH) and a professor of biology at Universidad Autónoma del Estado de Morelos (UAEM). He maintains strong research interests in the molecular systematics and evolution of Mexican legumes and in the domestication of Mexican trees. He is married to Dulce Ma. Arias, Ph.D., with whom he shares an optimistic vision for the future of Mexican conservation and botanical science. They have two children, Oscar Ivan and Leticia Isabel.

23 DR. THOMAS D. MAYS

Director
Office of Technology Development
National Cancer Institute, National Institutes of Health
Executive Plaza South, Room 450, 6120 Executive Blvd.
MSC 7182, Bethesda, MD 20892-7182

Thomas D. Mays is currently Director, Office of Technology Development (OTD), NCI. He received his law degree (J.D.) from The Columbus School of Law, Catholic University of America in 1991, a Ph.D. in Microbiology from the Virginia Polytechnic Institute and State University in 1978, and M.S.(1975) and B.S.(1971) degrees in Microbiology from The Ohio State University. As Director of OTD, he is responsible for coordinating the management of the intellectual property portfolio of the NCI, including the negotiation and review of agreements involved in the transfer of technology from the NCI. Furthermore, the Director, OTD assists NCI inventors in the identification of inventions as well as assessing and analyzing the patentability of inventions. Dr. Mays registered to practice before the U.S. Patent and Trademark Office (PTO) and is currently admitted to practice law before the following Bars: State of Maryland, District of Columbia, and the U.S. Federal District Court for the District of Maryland. He is a member of professional societies and has several recent publications in the area of intellectual property law and technology transfer. Mays's previous appointments included Primary Examiner for the U.S. PTO and Vice President of Research and Development for IGI Biotechnology, Inc.

24 DR. RAUL O. CASTILLO

Director
Departamento Nacional De Recursos Fitogeneticos y Biotecnologia (DENAREF)
National Institute of Agricultural Research (INIAP)
E.E. Sta. Catalina Panamericana Sur km. 17
P.O. Box 17-01-340, Quito, Ecuador

After Dr. Castillo received a Bachelor's degree in Agronomy from the Central University of Ecuador, he attended the University of Birmingham (United Kingdom). At this institution, he earned an M.Sc. in Plant Genetic Resources Conservation and Utilization and a Ph.D. in Plant Breeding, focusing on plant biodiversity studies. He is currently Director of the National Department of Plant Genetic Resources and Biotechnology (DENAREF) in the National Institute of Agricultural Research (INIAP). Dr. Castillo has participated in several collecting expeditions, assembling more than 5,000 accessions of different crops. He is the national delegate to the FAO Technical Conference on Plant Genetic Resources.

25 DR. WALTER V. REID

Vice President for Program
World Resources Institute
1709 New York Avenue, N.W., Washington, D.C. 20006

Dr. Reid is Vice President for Program at World Resources Institute, a private, non-profit, policy research and capacity-building organization focusing on environmental and economic development issues of international importance. Since joining WRI in June 1988, Dr. Reid has conducted policy research in the fields of biodiversity conservation, sustainable agriculture, biotechnology, and human health and the environment. Dr. Reid has written or co-authored numerous reports and articles while at WRI, including *Keeping Options Alive: The Scientific Basis for Conserving Biodiversity* (1989), *Conserving the World's Biodiversity* (1990), *Drowning the National Heritage: Climate Change and U.S. Coastal Biodiversity* (1991), and *Biodiversity Prospecting: Using Genetic Resources for Sustainable Development* (1993). He is one of the principal authors of the Global Biodiversity Strategy (1992).

26 **DR. RAYMOND H. CYPESS**
President and CEO
American Type Culture Collection
12301 Parklawn Drive, Rockville, MD 20852

Dr. Raymond H. Cypess is President and CEO of the American Type Culture Collection, Rockville, MD. He holds a B.S. degree in Biology from Brooklyn College, a D.V.M. degree from the University of Illinois, and a Ph.D. degree in Parasitology from the University of North Carolina. In the course of his extensive professional career, Dr. Cypess has been an Associate Professor of Epidemiology and Microbiology at the University of Pittsburgh School of Public Health, Professor and Chairman at the New York State College of Veterinary Medicine, and Dean of the College of Graduate Health Sciences, as well as Professor of Microbiology and Immunology and Comparative Medicine, and Vice Provost for Research and Research Training, at the University of Tennessee, Memphis. Dr. Cypess was recognized as a Fogarty International Fellow in 1975 and received an NIH Career Development Award (1975–1979) and the UT Memphis College of Medicine Outstanding Teacher Award for the years 1989–1993. He is a former participant on NIAID scientific review boards and various NIH Study Sections. He is also a past member of the Board of Directors of the American College of Epidemiology and numerous editorial boards. Dr. Cypess is a Fellow of the Infectious Disease Society, a member of the American Epidemiology Society, and the author of more than 60 chapters, reviews, and journal articles.

26 **DR. SHUNG-CHANG JONG**
Director
Mycology and Protistology Program
American Type Culture Collection
12301 Parklawn Drive, Rockville, MD, 20852-1776

Dr. Jong received a B.S. degree in plant pathology from the National Taiwan University in 1960 and an M.S. degree in biological sciences from Western Illinois University in 1966. Upon completion of his Ph.D. in Mycology at Washington State University in 1969, he joined the ATCC staff. He is presently Director of the ATCC Mycology and Protistology Program, which is in charge of the collections of fungi, yeasts, plant tissue cultures, and seeds. Dr. Jong is a Fellow of the American Academy of Microbiology and the Washington Academy of Sciences, an Honorary Professor of the Wuhan University and the Shanghai Teachers University, and an Honorary Director of the Shanghai Association of International Exchange of Personnel in China. He has served as a Technical Advisor to the Yamazaki Baking Co. in Tokyo since 1984, the L.F. Lambert Mushroom Spawn Co. in the U.S. since 1983, the Food Industry Research and Development Institute in Taiwan since 1983, the Shanghai Institute of Edible Fungi in China since 1985, and various biotechnology-related establishments. He has also served on the Executive Committee of the International Mycological Association (1983–90) and the Executive Board of the World Federation for Culture Collections (1988–92), and as Chairman of the WFCC Committee to Safeguard Endangered Collections (1988–92). Currently, he is a member of the International Commission on the Taxonomy of Fungi of the International Union of Microbiological Societies and the Advisory Board of the International Culture Collection of VA Mycorrhizal Fungi. His research interests include the scientific, medical, agricultural and industrial applications and cryopreservation of fungi and yeasts in culture.

POSTER ABSTRACTS

Beltsville Symposium XXI
May 19–22, 1996

P1 Partnership for Genetic Conservation and Use: The International Rice Genebank at the International Rice Research Institute (IRRI)

MICHAEL T. JACKSON, GENOVEVA C. LORESTO and FLORA DE GUZMAN, Genetic Resources Center, International Rice Research Institute, Los Banos, Laguna, Philippines

Since 1962, IRRI has maintained a collection of rice genetic resources, held in trust for the rice-producing and consuming nations of the world. The collection comprises more than 80,000 accessions from 113 countries, mostly landrace varieties and breeding lines of *O. sativa*, *O. glaberrima*, the 20 wild rices, and 11 genera in the tribe Oryzeae. The International Rice Genebank ensures the conservation and continued availability of genetic resources for rice improvement and research, and germplasm is freely available on request. The Genebank will not seek intellectual property protection on germplasm, in accordance with its Policy on Intellectual Property Rights, approved in September 1994. In October 1994, IRRI signed an agreement to place the collection under the auspices of FAO in an International Network of Ex Situ Collections. Since September 1995, a Material Transfer Agreement (MTA) has been used for the exchange of germplasm. Between 1991 and 1995, the Genebank distributed almost 123,000 samples worldwide. IRRI continues to restore valuable germplasm to national collections. In 1994 and 1995, restoration included 5,311 accessions of the Assam Rice Collection to India, 110 to Mexico, 969 to Pakistan, and 298 to Thailand. Duplicate "blackbox" storage is provided at the National Seed Storage Laboratory, Fort Collins, Colorado.

P2 The Beltsville Collection of Exotic Pathogens of Citrus

C. GOUIN-BEHE, Fruit Laboratory, USDA, ARS, Beltsville, MD 20705, **S.M. GARNSEY** USDA, ARS, Horticultural Research Laboratory, Orlando, FL 32803, and **J.S. HARTUNG**, Fruit Laboratory, USDA, ARS, Beltsville, MD 20705

A collection of exotic citrus pathogens has been established and maintained under quarantine *in planta* at Beltsville since 1984. The collection contains 368 isolates of pathogens that incite 12 different diseases, obtained from 31 countries or citrus-growing regions. Citrus infected with 275 different strains of the Citrus Tristeza Virus (CTV) comprise a large portion of the collection. Other pathogens in the collection include strains of the citrus greening pathogen *Liberobacter*, strains of *Xylella fastidiosa* which incite citrus variegated chlorosis, several viroids, and strains of citrus mosaic, chlorotic dwarf, tatterleaf and ringspot viruses. The CTV collection is used to compare biological, serological and molecular properties of different isolates. Nine symptom patterns have been observed using five indicator species. Isolates inducing mild symptoms are being tested in cross-protection experiments against severe strains. Cooperators include scientists at USDA-ARS in Orlando, the Universities of Florida and California, and institutions in 15 countries. We also maintain a large collection of *Xanthomonas axonopodis* pv. *citri*, the causal agent of citrus bacterial canker disease. Our extensive strain collections have facilitated the development of sensitive and specific assays for *Xanthomonas axonopodis* pv. *citri* and *Xylella fastidiosa*.

P3 Plant Variety Protection: A Consideration of Genetic Distance

J. E. STAUB, Vegetable Crops Unit, USDA-ARS, University of Wisconsin, Horticulture Department, 1575 Linden Drive, Madison, WI 53706

Increased interest and debate over ownership of intellectual property (e.g., plant proprietary rights) has arisen in agriculture because the protection of research products is necessary to provide incentive for investment. Any unique, documentable invention having potential use in commerce can be considered intellectual property. A plant variety's uniqueness can be defined by morphometric or biochemical criteria. These "distinctness criteria" can be useful for estimating genetic differences between plant varieties. A case study using cucumber (*Cucumis sativus*) shows that morphological and biochemical descriptors must be reproducible and predictive, and that the discriminatory information provided per marker may diminish dramatically beyond a critical value (threshold). Moreover, the discriminatory value of a marker may depend upon both the environment where the measurement is taken and the marker type itself. The number and type of markers required to establish distinctness is not absolute and is primarily a function of marker frequency. Marker frequency estimation is therefore a critical element in plant variety protection when markers are used to define genetic difference (distinctiveness).

P4 Conservation and Exchange of Sugarcane Germplasm

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The cultivated plants together with wild species of *Saccharum* and related genera, including *Erianthus*, *Miscanthus*, *Narenga*, and *Sclerostachya*, form the basic genetic resources of sugarcane. The genus *Saccharum* includes *S. officinarum*, *S. spontaneum*, S. *barberi*, *S. sinense*, *S. robustum*, and *S. edule*. At the recommendation of the International Society of Sugar Cane Technologists (ISSCT) Standing Committee on Germplasm and Breeding, duplicate World Collections of Sugarcane and Related Grasses are being maintained clonally at the USDA-ARS National Clonal Germplasm Repository in Miami, Florida and the Sugarcane Breeding Institute, Coimbatore, India. The world collection at Miami contains approximately 1,500 accessions, and the collection at Coimbatore contains approximately 3,500 accessions (which include many of their co-cultivars). The World Collection represents a diverse genetic resource of sugarcane. True seed of *S. spontaneum* and *S. officinarum* were produced and stored at the National Seed Storage Laboratory, Ft. Collins, Colorado, as part of sugarcane germplasm conservation effort. The germplasm is freely distributed upon request. Shipments are made once a year in September.

P5 The Programs of the USDA/ARS/National Germplasm Resources Laboratory/Plant Exchange Office

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The Plant Exchange Office (PEO) i) procures plant germplasm through international and domestic exchanges of plants and seeds, ii) documents and assigns unique identifiers to incoming material, and iii) responds to foreign requests for germplasm maintained in the U.S. The PEO also develops methods to prioritize U.S. germplasm needs, arranges for and participates in international and domestic plant explorations, conducts ecogeographic studies, and helps establish in situ conservation programs for U.S. crop plants and their progenitors.

P6 Native Crop Genetic Resources of the United States

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Many native plants of the United States are also important crop genetic resources. Two sources, "A Synonymized Checklist of the Vascular Flora of the United States, Canada, and Greenland" (John Kartesz, 1994) and the USDA Natural Resources Conservation Service's PLANTS database were searched to identify native U.S. species in the same genera as important crop plants. The search identified wild relatives of grain and cereal crops (57 species), fruit crops (362 species), nut crops (21 species), vegetable crops (199 species), forage and turf crops (556 species), and industrial crops (152 species). The species identified include the progenitors for crops such as sunflower, cranberry, blueberry, wild rice, pecan, pawpaw, and strawberry as well as the wild relatives of many other crops. The distributions of these species range from widespread, to those endemic to one state, to those limited to just a few populations. Domestic plant explorations have made germplasm of many of these species available for crop improvement, but much uncollected variation still remains untapped by plant breeders. The fact that a number of these species already occur on protected lands in the U.S. makes the designation of in situ repositories a feasible goal and an attractive complementary method for the long-term conservation of these valuable genetic resources.

P7 The New Age of Information Exchange—GRIN and the Information Highway Provide Easy Access to Genetic Resource Data in the National Genetic Resources Program

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Genetic resources necessary to improve the quality and productivity of plants, animals, microbes, invertebrates and forest trees are managed in the United States National Genetic Resources Program (NGRP). A major component of this system is the Germplasm Resources Information Network (GRIN). GRIN is a centralized computer database used to facilitate the management of the NGRP and to enhance communication with scientists regarding the location and characteristics of germplasm they may wish to obtain for research purposes. Information in GRIN consists of taxonomic nomenclature, passport data, inventory information, morpho-logical and molecular traits, pest resistances and distribution information. This information along with web links to other domestic and international genetic resource collections can be easily accessed through the GRIN page on the World Wide Web. A PC version of GRIN is also available upon request. A copy of all the data for a crop along with query software can be loaded to diskette and then placed on any MS-DOS compatible PC.

P8 Germplasm Repositories for Cultured and Endangered Species of Fish

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Among the many applications of sperm cryopreservation in fish biology, those in aquaculture and endangered species are among the most important. Aquaculture requires the development of improved stocks to increase yield and profits. This typically employs a reduction in genetic variation through breeding programs. Endangered species require protection of natural levels of diversity. This typically employs maintenance of genetic diversity at high levels. Despite these differences in overall goals, these applications have much in common. Methodologies, equipment and facilities can be similar for both applications with the differences seen in overall strategies and sampling designs. In each case, short-term storage and archiving will require development of repositories for maintenance of frozen sperm. Such repositories would integrate several basic components. Gametes would be collected in the field or hatchery from live tagged fish. Screening would be required to prevent the spread of disease, and samples should be available for research on gamete biology and genetics. Other samples would be stored at hatcheries for production of fish. Valuable samples, archived in permanent storage in a high-security environment, would be simultaneously archived at satellite locations. A compre-hensive database would assist with quality assurance, quality control and inventory control.

P9 Pathogen Surveillance of Fish Sperm Destined for Repository

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Germplasm is an important genetic component of ecosystem ecology. Threatened ecosystems are reflected in changes in species diversity, distribution, viability, and abundance. A repository of cryopreserved sperm from fishes would conserve valuable genetic resources and help to distribute improved stocks. In that regard, cryopreservation of sperm is an effective management tool. In an effort to improve selective breeding programs, fertilization with cryopreserved sperm would benefit hatchery production. The presence of pathogens in sperm samples would jeopardize valuable germplasm resources and potentiate rapid and wide dissemination of diseases from wild or hatchery sources. Therefore, pathogen detection would be a requisite for sperm samples submitted to an archival and distribution network. Quality assurance dictates accurate biological and geographic data on samples from field or hatchery broodstock. Viral, bacterial, fungal or protozoan pathogens can be detected by employing rapid, accurate, and sensitive methods. Optimized protocols would employ antibiotics and antimycotics, as well as specific handling techniques. Sperm could be certified as pathogen-free and made available for archiving and distribution. As yet no traditional approach is available for germplasm repositories for fish. These techniques will assist in the collaborative efforts of laboratory and field scientists with resource managers and ecologists in protecting this nation's resources.

P10 Yellowstone Thermophiles and Biotechnology: An Intellectual Property Dilemma.

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Sequestered populations of thermophilic (heat-loving) prokaryotes remain unmolested in refugia such as Yellowstone National Park, where 10,000 thermal features provide microhabitats for the worlds greatest concentration of thermophilic microorganisms. Protected by the National Park Service, Yellowstone's geothermal ecosystem is a focus of research on such wide-ranging studies as the origin of life on Earth, the search for life on Mars, and the science of extremazymes, the high temperature enzymes common to thermophiles, that have proven so useful in industrial microbiology. Heat-stable enzymes from Yellowstone thermophiles have led to advances in molecular biology of unprecedented proportions. The polymerase chain reaction (PCR) process which revolutionized DNA science was made possible by the enzyme Taq DNA Polymerase, from the hot spring bacterium *Thermus aquaticus* (Taq) Yellowstone type one. Thermostability imparts immunity to denaturation, a key ingredient in the economically driven fermentation and bioprocessing of foods, fuels, fiber, commodity chemicals, antibiotics and medicines. Forty microbiology research projects currently have permits to collect and study Yellowstone's thermophiles under the provisions of the Code of Federal Regulations. Half of these projects are conducted either directly by biotechnology companies or are academic projects funded by industry. Should royalties from profitable specimens be required from future researchers?

P11 DNA Banking at the Missouri Botanical Garden

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With increasing demand for sources of DNA for studies of molecular phylogenetics, requests for destructive sampling of herbarium specimens are increasing. Botanical collectors can easily gather a small additional amount of leaf material specifically to support molecular studies with little additional effort; and the methodology to collect, store, and curate this resource is relatively simple. The methodology currently used at the Missouri Botanical Garden for collecting, curating, and distributing desiccated leaf material will be presented.

P12 The Missouri Botanical Garden's Natural Products Research Policy

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Collecting and transporting biological samples across international borders for commercial development raises a series of ethical concerns that institutions supporting bioprospecting programs must address. The biological resources of countries that have signed the Convention on Biological Diversity, which entered into force in 1992, are legally viewed as sovereign possessions of individual countries and prior informed consent from appropriate regulatory agencies is required before material can be exported. The Missouri Botanical Garden, which is a participant in several natural products research programs, has recently adopted a policy that addresses the various ethical concerns and clearly states the Garden's position on these issues.

P13 The USDA Plant Genome Research Program

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The National Genetics Resource Program is the umbrella that covers several genome initiatives including the USDA Plant Genome Research Program. The Program was initiated with the 1990 Farm Bill. Under the leadership of Dr. Jerome Miksche, information management was seen to be a key component for the success of the program. Successful management for the program would require the development of a sophisticated database. The Research Program emphasized the creation of genetic and/or physical maps for economically important species. Maps provide a rapid way to locate genes of economic significance. Plentiful high quality maps are useful for accelerated crop improvement breeding. The database developed for this program would focus on the genes and their map locations. Expert geneticists were asked to identify the key data needs for their research communities and develop mapping databases. The National Agricultural Library has been designated as the central repository and public access point for all the species databases. It is the ultimate goal for the program to provide a unified cross-species indexed database. Currently the individual species databases are available in multiple formats. The National Agricultural Library provides additional information services to all interested scientists in the plant genome research community.

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