

Genetic Resources at Risk:

Scientific Issues,
Technologies,
and Funding Policies

Proceedings of a Symposium
American Association for the Advancement of Science
Annual Meeting • San Francisco • January 16, 1989

Genetic Resources
Conservation Program
Report No. 5
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PREFACE

Genetic resources at risk was the subject of a half-day symposium in San Francisco, California on 16 January 1989 at the annual AAAS meeting. The goal of the symposium was to bring this important issue to the attention of a broad community of scientists, educators, research administrators, and policy-makers. In biological research, as in no other scientific field, new research is built upon access to living organisms or cloned genes discovered in previous research. Loss of any of these biological entities—animals, plants, or microorganisms—can result in a slow-down in scientific progress or, in some cases, a blockage to progress. This was dramatically illustrated on 10 May 1989 when a fire at the Jackson Laboratory at Bar Harbor, Maine devastated the facilities and about one-half of the 1700 genetic stocks of mice maintained at that laboratory. Back-up foundation stocks were not affected, so individual strains were not completely lost. The majority of genetic resources collections in the USA is far more vulnerable than the above-mentioned mouse collection, yet human welfare and productivity profoundly depend on their existence.

Genetic resources are often considered to be living biological materials of present or potential value to human populations. However, now, more than ever before, it is apparent that all biological resources have value in sustaining the world's human populations. For example, plants may harbor genes of immense value for human health care, but these genes will remain undetected until the proper assay method or financial resources are available. In the meantime, conservation of biological resources is essential to hold the gene resources in reserve for future use.

The symposium was planned to provide a broad view of genetic resources with selected examples. Obviously, this short symposium could not develop case studies for the full range of species. Noteworthy was the lack of treatment to microorganisms and issues surrounding the conservation and documentation of cloned genes. It is hoped, however, that this brief report will illustrate the main points of concern and urgency. We hope it provides a stimulus for further discussions and development of action plans—both for the conservation of genetic resources and for the creation of new institutional and financial frameworks to provide national and international security for biological resources.

We were very pleased that the speakers enthusiastically accepted their invited topics. Several agencies, including the National Science Foundation, the National Institutes of Health, and the US Department of Agriculture, have had major impact on the advancements of genet-

ics through grants for research and for maintenance of genetic stock collections. We had hoped to include a summary of how these agencies are attempting to cope with the increasing need to maintain genetic resources, but the invited speaker was unable at the last moment to participate.

The symposium was chaired by Robert W. Allard, Professor Emeritus, University of California. We are grateful for his guidance and contributions to the discussion. In addition to the speakers, the success of the symposium was assured by the dedication of Dr. Patrick E. McGuire and Ms. Roberta Hooker of the University of California Genetic Resources Conservation Program to organizational and editorial matters. Members of the AAAS annual meetings program staff were very efficient and cooperative.

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Genetic Resources – A Broad Perspective

Genes, specific sequences of nucleotides in nucleic acids (DNA and RNA), are the biological units of heredity which are common in their chemical basis to all living organisms. These genes, the biological resources of the world, packaged in virus particles and in the cells of animals, plants, and microorganisms, are natural resources, just as are the soil, air, and water, to be both used and conserved wisely by human populations. The term genetic resources encompasses nucleotide sequences, specific genes, well-defined genotypes, individuals, populations, and species at levels of organization ranging from plasmids, organelles, viruses, cells, tissues, and microbes to whole plants, animals, and fungi.

Genetic resources is a term sometimes used in a narrow sense to represent a specific component of biological resources, but it actually comprises a continuum in which three distinct categories can be distinguished by the degree of human intervention in the evolution of the resources. The optimum means of conservation differs among the three types.

Dynamic, evolving populations of species in their native environments; including wild relatives of domesticated species.

Landraces of agriculturally important species of plants and animals, modified over time usually by unconscious human selection and intervention.

Germplasm and genetic stocks ("manipulated" genetic resources) developed by breeding and selection, spontaneous and directed genetic and chromosomal mutation, or biotechnological innovation.

Conserved *in situ* by protection of habitat.

Conserved *in situ* by protection of primitive agricultural systems or *ex situ* in gene banks.

Conserved in special, controlled environments.

Human uses of genetic resources include their study by sampling for laboratory research and in native habitats to advance knowledge of the earth's biota; the domestication and breeding of plants, animals, and microorganisms for food, fiber, and energy; the creation of highly specific genotypes to serve as tools of medical, agricultural, industrial, and biological research and commerce; the genetic engineering of organisms designed to produce specific products; the harvest of individuals from native populations of a vast number of species of the world's fauna and flora for food, manufacturing, and recreational pursuits; and the stimulation of the human sense of place and aesthetics.

