AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
150 YEARS • 1848-1998

BIOPROSPECTING IN AN AFRICAN CONTEXT

ILLUSTRATION: ALLAN M. BURCH

LYDIA MAKHUBU *is vice chancellor and professor of chemistry at the University of Swaziland. She has served on numerous consulting bodies and professional societies, was president of the Royal Swaziland Society of Science and Technology, and is a Fellow of the African Academy of Sciences and president of the Third World Organization for Women in Science.*

> In the beginning, when God created the universe, the earth was formless and desolate. ...Then God commanded, "Let there be light" and light appeared....Then He commanded, "Let the earth produce all kinds of plants, those that bear grain and those that bear fruit"—and it was done. So the earth produced all kinds of plants, and God was pleased with what he saw....Then God commanded, "Let the earth produce all kinds of animal life: domestic and wild, and large and small"—and it was done....Then God said "And now we will make human beings; they will be like us and resemble us. I am putting you in charge of the fish, the birds and all the wild animals. I have provided all kinds of grain and all kinds of fruit for you to eat...." (Genesis, Chapter 1)*

Whether you believe in the biblical version of creation or not, there is no doubt that humankind is an integral part of the Earth's biodiversity. The use of biological resources, animals, and plants, for human sustenance, as explicitly stated in the biblical description of creation, asserts human stewardship over these resources and emphasizes the critical importance of exercising judicious care in their exploitation so that successive generations can derive a livelihood from nature's bounty.

The 1990s have seen a tremendous rise in the social awareness of environmental and conservation concerns worldwide, leading to numerous national and international meetings, most notably the United Nations Conference on the Environment and Development, the Earth Summit, which was held in Rio de Janeiro in June 1992 and produced Agenda 21, a blueprint for international cooperation on the environment and sustainable development. This conference also resulted in the Convention on Biological Diversity (CBD), which highlighted international commitment to the conservation of biological diversity and the sustainable and equitable sharing of its benefits arising from the use of genetic resources. Agenda 21 and the CBD represent international recognition of the need for countries to evolve national frameworks to protect and conserve the environment. A global consensus has emerged on the urgent need to understand what constitutes conservation and depletion of biodiversity, and what steps must be taken to protect genes, species, habitats, and ecosystems. The effective implementation of the provisions of the Convention will, however, depend to a large extent on the availability of national and regional capacities to interpret these provisions and apply them to specific situations.

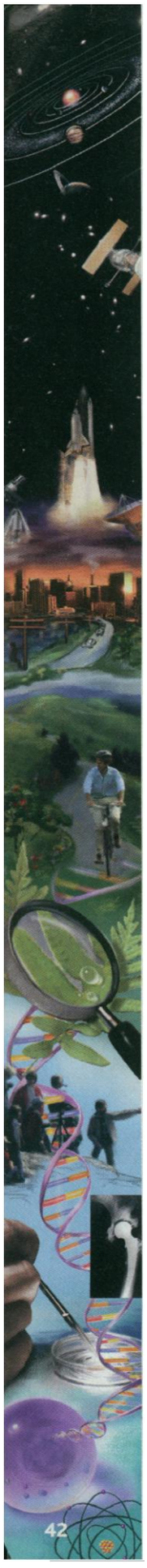
Prospecting for biological resources has taken place in all regions of the world since antiquity and is well illustrated by the exploitation of plant resources for medicinal use. Bioprospecting has been defined as the systematic search for, and the development of, new sources of chemical compounds, genes, micro- and macroorganisms, and other economically valuable biological products. This definition presupposes the existence of formal guidelines for bioprospecting. A more systematic approach has only recently arisen out of international concern for environmental degradation and the depletion of tropical forests and the genetic material, particularly in developing countries. Here, I will focus on bioprospecting for medicinal plants in Africa, a process that has spanned centuries and is strongly intertwined with sociocultural beliefs, thus pointing to a need for the CBD to be formulated and implemented in the context of the complex debate on the reconciliation of traditional and scientific perceptions of medicine. This debate is particularly significant in Africa, where phytomedicine is an integral part of traditional medical practice, and where it is estimated that up to 80% of the population resort to traditional medicine for their health needs, including those who also visit modern health facilities. A brief historical review of the evolution of traditional medicine will provide a glimpse of the intricate issues involved.

In a detailed review of the history of traditional medicine in China, Africa, and Europe,† A. Sofowora notes that one of the earliest recorded uses of herbal medicine is that of chaulmoogram oil from the species *Hydnoarpus gaertn*, which was considered effective against leprosy in the *Pharmacopoeia* of the Emperor Shen Nung of China between 2730 and 3000 B.C. Sofowora also reports that the seeds of opium (*Papaver somniferum*) and the castor oil seed (*Ricinus communis*) were excavated from some Egyptian tombs, indicating their use in that part of Africa around 1500 B.C., probably for purposes similar to ours. N. R. Fansworth makes the interesting observation that before the development of organic chemistry in the 19th century, nearly 80% of all medicines were obtained from plant materials,‡ and some of the most potent drugs used in today's conventional medicine are derived from higher plants yet represent only about 90 of the estimated 250,000 species of higher plants on earth.§

It is most regrettable that the African tradition lacks early written records such as those found in China, Egypt, and other countries. In Africa valuable information is transmitted from generation to generation, usually within the same family,

The author is at the University of Swaziland, Private Bag No. 4, Kwaluseni, Swaziland.

Good News Bible Edition with Deutorocanonicals Apocrypha (Bible Society of South Africa, 1985). †A. Sofowora, *Medicinal Plants and Traditional Medicine in Africa* (Wiley, New York, 1992), p. 9. ‡N. R. Farnsworth, O. Akerele, A. S. Bingel, "Medicinal Plants in Therapy," *Bull. WHO* **63 (6)** 695 (1985). §D. Chadwick, *CIBA Foundation Bulletin* **37**, 13 (1994). ‖L. P. Makhubu, *The Traditional Healer* (Univ. of Botswana and Swaziland Press, Kwaluseni, Swaziland, 1978). ¶OAU/STRC/DEPA/KIPO Workshop on Medicinal Plants and Herbal Medicine in Africa, *Policy Issues on Ownership, Access and Conservation* (BDCP Press, Cameroon, 1997).



through the oral tradition, a practice that holds the inherent danger of loss or distortion of critical information. This leads to the question of how early Africans identified these plant materials and certified that they were fit for human consumption and for curing disease, without some form of taxonomic records such as those that present-day scientists depend upon.

As the world has moved into a scientific and technological age, the origin of herbal medicine in many countries remains shrouded in mystery and often sounds fantastic to those trained in modern science. Traditional bioprospecting requires no scientific training but is directed by ancestral spirits and revealed to those who are spiritually endowed by their ancestors and thus selected to become traditional medical practitioners (TMPs).[†‖] How, then, do traditional medical practitioners acquire the vast knowledge of medicinal plants that enable them to go into the wild to identify plants with healing power and prepare life-giving potions to heal the sick and the dying? There are several theories to explain this mystery. One theory purports that information about plants is communicated to the TMP by ancestral spirits in a dream[†‖] after the training ritual has been completed. The TMP retains in his or her memory the names and uses of plants throughout his or her life, constituting a massive amount of knowledge. This spiritual guidance is also seen as the basis for diagnosis and prescription, indicating a strong link between traditional medicine and the belief in the powers of the departed over the living. It is this dimension that distinguishes traditional medicine from modern science.

Communication with the world of spirits and the use of plant and animal products in religious rituals emphasize the holistic nature of traditional medicine, which addresses the spiritual, the physical, and the social-psychological problems that affect people's daily lives.[‖] Contrary to common belief, witchcraft is not considered the sole cause of sickness and disease. The environment (referred to as the "air") and surroundings are considered critical in determining a person's state of health.[‖] There is thus a strong and complex relationship between the living and the dead and the physical environment. Traditional bioprospecting is intertwined with sociocultural and religious beliefs that must be understood by those engaged in modern conservation and protection of Africa's biodiversity.

"TRADITIONAL BIOPROSPECTING IS INTERTWINED WITH SOCIOCULTURAL AND RELIGIOUS BELIEFS THAT MUST BE UNDERSTOOD BY THOSE ENGAGED IN MODERN CONSERVATION AND PROTECTION OF AFRICA'S BIODIVERSITY."

There is a yawning gap between the practitioners of traditional medicine, who possess knowledge of the plants and their use, and the scientifically trained drafters of the CBD, whose 169 signatories include African countries. For the African continent to become "an equal partner in negotiations of issues covered by the Convention,"[¶‖] issues such as ownership, access to and utilization of medicinal plants, indigenous knowledge of their use, and the sharing of benefits derived from them, must be resolved. The evolution of policies and legal frameworks that can be adopted by African governments to regulate and conserve biodiversity—medicinal plants in particular—is of paramount importance. Intellectual property rights in a situation where TMPs are key players in the use of biological resources must be reconciled with the provisions of the CBD. While most African countries have signed the CBD, many issues remain unresolved in the Convention and demand scrutiny by the Africans themselves. An equally important issue is the role of biotechnology, in particular genetic engineering, in the development of the plant-based pharmaceutical industry in Africa. African experts are already engaged in discussions of these issues. For example, ethnobotanical surveys have been initiated in African countries to document medicinal plants in order to assess the extent of the continent's vast plant resources. These surveys attempt to address the following concerns:[¶]

Ownership, access to medicinal plants, and indigenous knowledge. In Africa, traditional medicine often serves as an alternative system, but is sometimes used in conjunction with Western medicine. The escalating cost of drugs and the strong cultural beliefs associated with traditional practice and land tenure systems have to be considered in any discussion of bioprospecting for medicinal plants. Medicinal plants may be found on individually owned land, on communal land, in conservation parks, and in nurseries, and extensive knowledge of their use lies with TMPs, who guard it jealously for commercial and cultural reasons. There is, consequently, limited access to information about the traditional medical system, knowledge that is vital for countries wishing to adopt modern scientific strategies. On the other hand, the healers feel unprotected since many countries lack laws recognizing their existence and knowledge, which gives rise to the questions of who owns medicinal plants in situ, and who owns the indigenous knowledge that is possessed by individual healers.

To further complicate this problem, in addition to the locations listed above, there are many collections of plant species in herbaria, gene banks, and botanical gardens in Europe, America, and elsewhere that were originally gathered from different African countries. There is currently no law guiding African access to these genetic resource, which are African by right. The lack of national laws and policies addressing these issues is a major concern. Many countries still retain Witchcraft Acts promulgated during the colonial era, which negate the proclaimed recognition of the traditional medical systems and will make the CBD a thorny issue in many countries.

Medicinal plants and intellectual property rights. While Africa has a rich and acknowledged biodiversity, many countries have no legal framework to link sustainable utilization of natural resources, conservation of biodiversity, and exploitation of plants for economic gains. Should indigenous knowledge of the use of medicinal plants be protected as intellectual property? Who should be custodian of intellectual property rights? At the present time, in many countries, different government ministries grant permission to bioprospectors and biopirates, with few conditions attached and with no contract with the collectors. Existing national policies on medicinal plants are grossly inadequate to control foreign bioprospectors and biopirates alike, and do not promote local development of processes and technologies targeting these important resources.

The complexity of the African situation requires diverse input and expertise to understand the sociocultural circumstances and merge them with the scientific requirements of the international demand for bioprospecting. These sources should include specialists to address intellectual property rights, patent registration, studies of relevant sections of the agreement on Trade-related Aspects of Intellectual Property Rights on pharmaceutical products, and scientists to confront issues pertaining to developments in biotechnology. Regardless of differences in religion, culture, international conventions, and publications, the preservation of biodiversity rests squarely on human shoulders. Humanity must exercise stewardship of its diverse biological resources so that future generations may receive their rightful inheritance. The African tradition can complement modern scientific approaches in this aim.

ILLUSTRATION: TERESE WINSLOW