

## **ETHNOPHARMACOLOGY: AN OVERVIEW**

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### **Summary**

Although ethnopharmacology is an amalgam of perspectives, the biocultural perspective on ethnopharmacology underscores the point that health and healing are culturally constructed and socially negotiated. The multiple disciplines that contribute to ethnopharmacology research methodologies are diverse, reflecting the discrete and overlapping investigational objectives of those disciplines. The chapters on ethnopharmacology in EOLSS offer a window on this methodologic diversity and this overview previews their contents.

Traditional use of plants is often complex and multi-contextual. The contexts of medicinal plant use are discussed, as well the criteria used in selecting and preparing plant-based medicines. Finally, since it depends on cultural constructs of health and disease, what is regarded as significant benefit or unacceptable unwanted effects vary. We discuss the complex evaluation of the efficacy of (plant) drugs and treatments.

### **1. Introduction**

This opening chapter of the EOLSS/UNESCO Theme on ethnopharmacology offers a working definition of the field and introduces the individual chapters by previewing their contents. Beyond that, we identify several recurrent themes that resonate throughout the volume, and draw attention to how different authors have addressed these issues.

### 1.1. Defining Ethnopharmacology

Rather than a discrete discipline whose practitioners share an intellectual vision and methodology, ethnopharmacology is an amalgam of perspectives, primarily those of pharmacology, pharmacognosy, anthropology, and botany. Contributions are also made by historians of science, clinicians, agronomists, biochemists, and researchers in veterinary medicine. The uniquely biocultural perspective on ethnopharmacology offered by medical anthropology underscores that health and healing are culturally constructed and socially negotiated. Local, including Western, knowledge both emerges from and undergirds the complex relations among people, ideologies and material cultures, plants and other species, and the physical environment. A key concept for understanding cultural differences is the explanatory model—a complex narrative that embodies the etiology, symptom recognition, prognosis, and meaning of a particular illness or illness category. Knowledge of this is fundamental to understanding why people use medicines and how they judge their efficacy. Further, it is important to understand that, like illness, healing is not an event but a process. All components of this process, and their sequencing and intersections, are relevant to ethnopharmacology. In this spirit, the definition of ethnopharmacology that frames this volume is: the study of indigenous medical systems that connects the ethnography of health and healing with the physiologic relevance of its medical practices.

## 2. Methods

Reflecting the many disciplines that contribute to ethnopharmacology, research methodologies are diverse. They encompass the discrete and overlapping investigational objectives of those disciplines, and range from a reductionistic clinical-science perspective, whose aim is drug discovery (largely for Western pharmacopoeias), to theory-driven social science inquiry that connects medical ethnography to the physiologic action of (primarily botanical) medicines. The chapters in this volume offer a window on this methodologic diversity.

For example, Stepp and Thomas (*Managing Ethnopharmacological Data: Herbaria, Relational Data Bases, Literature*) instruct us in the literature reviews, preparation of voucher samples, and the creation of relational databases. Etkin and Ticktin's (*Ecological and Ethnographic Guidelines for Ethnopharmacology Field Research*) transdisciplinary approach illustrates how rigorous ethnographic field methodologies can be applied to characterize medicinal plant use within communities, and how those methods can be integrated with ecological field studies to build theoretical robustness in ethnopharmacology and contribute in tangible ways to the conservation of biocultural diversity. To evaluate specific medicinal plant uses within communities from a clinical point of view, Ortega (*Medicinal Plants in the Evolution of Biomedicine*) exemplifies (with ascariasis infestation) how a cost-effectiveness analysis can be applied to compare traditional and pharmaceutical treatments.

Several chapters (*The Search for Plants as Anticancer Agents*, *Botanical Anti-Parasitic Agents*, *Plants against AIDS and other Antiviral Agents*, *Botanical Analgesics and Anti-Inflammatory Drugs*, *The Search for Plants to Manage Diabetes*, *Medicinal Plants for the Prevention and Treatment of Coronary Heart Disease*, *The Search for Plants to Manage Neurodegenerative diseases*) in EOLSS review the contributions of natural products in general, and medicinal plants in particular, in developing drugs for treating specific disorders. Ethnopharmacologic and ethnobotanic investigations conducted around the world have been the basis for these studies and achievements. Approaches to select traditionally used species for further laboratory scrutiny have been described by Merlin and Gilbert (*Botanical Anti-Parasitic Agents*), King and Limbach (*The Search for Plants to Manage Diabetes*), and Houghton and Howes (*The Search for Plants to Manage Neurodegenerative Disorders*). Usually a variety of *in vitro* and *in vivo* assays, the so-called pre-clinical assessment, are used to characterize the pharmacologic properties and mechanism of action of plant extracts or isolated compounds. Methods used for pre clinical assessment have been exemplified for areas such as anticancer (*The Search for Plants as Anticancer Agents*), antiviral (*Plants against AIDS and other Antiviral Agents*), analgesics and anti-inflammatory (*Botanical Analgesics and Anti-Inflammatory Drugs*) and drugs useful for treating diabetes (*The Search for Plants to Manage Diabetes*), and neurodegenerative diseases (*The Search for Plants to Manage Neurodegenerative diseases*). Enough pre-clinical and clinical data exist for some medicinal species, indicating that these botanicals may represent viable strategies to reduce the prevalence and mortality of cardiovascular diseases, as indicated by Mahady (*Medicinal Plants for the prevention and treatment of coronary heart disease*), and parasitic diseases or their transmission to humans, as discussed by Merlin and Gilbert (*Botanical Anti-Parasitic Agents*).

Plants alone, and plant-based remedies, constitute a complex mixture of compounds, and identifying the compounds that are relevant for pharmacologic properties and/or therapeutic effects is not an easy task. Nevertheless, the interest in identifying the active compounds lies especially in the fact that new molecules, sometimes with unique pharmacologic properties, are lead compounds for developing new drugs. Identifying key compounds is also crucial for quality control for herbal drugs or simpler galenic preparations, such as tinctures and ointments. Given the significant economic and ethical implications of drug development based on plant species identified as having medicinal value by traditional communities and their specialists, Bannister (*Professional Ethics: Permits, Permissions, and Other Protocols*) reviews standards of professional ethics in this context.

It is typically a single compound in a traditional remedy that is of interest for drug development or quality control. The primary strategy for separating out that compound is bioactivity-guided isolation, in which pharmacologic or biological assays are used to guide the isolation of bioactive constituents. Queiroz, Marston and Hostettmann (*Chemistry and Pharmacology of Natural Products: Methodological Perspectives*) discuss how hyphenated techniques, such as LC/UV, LC/MS and LC/NMR, can be used to accelerate the structural determination of bioactive compounds. Gottlieb and Borin (*Insights into Evolutionary Systems via Chemobiological Data*), using the approach of quantitative chemo-biology, focus on the evolutionary mechanisms responsible for plant bioactivity.

Given the high value of the pharmaceutical market, and the ever-increasing cost of drug discovery and development, the international trade of species for botanical or

pharmaceutical markets raises distinct conservation and equity issues that are discussed by Laird (*Indigenous Knowledge and the Preservation of Biodiversity*).

### **3. Contexts of Medicinal Plant Use**

The choice between consuming medicinal plants or western pharmaceuticals cannot be reduced to a matter of availability and efficacy. Kutalek and Prinz (*Ethnopharmacology and Health Care in the Developing World*) discuss the role of ethnopharmacology in health care, and how inadequate drug use is associated with skepticism towards western pharmaceuticals. On the other hand, the question of adverse effects of plants used in indigenous medicine and their impact on public health is discussed by Heinrich (*Safety Issues in Traditional Remedies*), especially considering acute and chronic toxicity, drug interactions, adulterations and the quality of botanical products.

An integrated, biocultural approach to ethnopharmacology takes into careful account the varied, complex, and overlapping contexts of plant use. These contexts are characterized by: 1) the social relations of healing; 2) criteria used in the identification of medicinal species; 3) preparation; 4) interactions among plants and between plants and pharmaceuticals, and 5) judging outcome.

#### **3.1. The Social Relations of Healing**

The social negotiation of healing is shaped by who treats whom, including self-treatment, and by access to knowledge and medicines and the sociopolitical circumstances of their circulation. In addition to self- and community-identified medical specialists, ethnographic research includes a representative sample of the adult population of the study community so that the knowledge base recorded reflects the heterogeneity that invariably exists, even within small populations, regarding how people perceive illness and how they organize and evaluate treatment. The significance of exploring the sociopolitical relations is that we comprehend that medicines are not defined by their pharmacologic potential alone, but are subject to processes that engender differential access to knowledge and tangible resources. From an ethnopharmacologic perspective, it signifies that social relations impact who is likely to have access to and be exposed to pharmacologically active species.

#### **3.2. Criteria Used in the Selection of Plant Medicines**

While historical foundations of herbal medicine are presented by Moerman (*History/Foundations of Botanical Medicines*), Shepard (*The Role of Psychoactive Botanicals in Ritual and Ceremony*) explores how the integration of religious and medical functions—often involving the use of psychoactive plants—has led to significant findings in neuroscience. In the co-evolution of plant–animal relationships, several animal species began to utilize plants rich in bioactive compounds for protection against predators and parasites. It is arguable that the origins of herbal medicine can be traced to the animal kingdom; recent findings in animal self-medication are discussed by Huffman and Vitazkova (*Primates, Plants and Parasites: the Evolution of Animal Self-medication and Ethnomedicine*).

The reasons that people select certain medicinal species over others are complex, and include a variety of factors, both ideational (based in ideas or beliefs) and tangible. The signs that plants make are important elements, and include organoleptic qualities: information is conveyed by the smell, taste, texture, appearance, and even sound of plants. Sensory experience is not merely receptive but interpretive as well, and refined by the interrelations among polysensory and cognitive factors that are influenced by genetics, age, sex, diet, circumstances of health (including medication), individual and group experiences, and cultural constructions of the meanings of organoleptics. Growth form and plant origin, maturity, and growing location may impart information as well.

The ideational component of species valuation includes the characterization of plants via principles of binary opposition, among which hot-cold, wet-dry, sweet-salty, and ying-yang find many parallels transculturally. These principles are part of explanatory models that emphasize balance and proportion, in both the tangible and metaphoric sense—qualities such as hot and wet may have nothing to do with physical temperature or hydration.

How plants affect human and animal physiology, in health and disease, are tangible qualities that guide the use of particular species. Symbol-oriented interpretations of these classificatory schemas that focus only on what plants mean miss essential elements of the therapeutic exercise which is, at base, a deliberate conjunction of sign and physiologic action (e.g. anti-inflammatory, hypotensive). Thus, the red color of plants used in Native American medicine to treat wounds may well be a signature that identifies plants by the color of blood (e.g. redwoods, *Taxodiaceae*; redbud, *Cercis canadensis* L., *Fabaceae*). It also signifies, however, that the red quinones that impart color to some of these plants are hemostatic and antimicrobial—properties that users of those plants could identify through their own experiences. Indeed, those physiologic actions may be the primary criteria for selection, with red color being simply a mnemonic tool for the identification of wound-healing plants.

Because pharmacologic action varies among individuals of a species and among plant parts, it is possible to manage the activity of medicinal preparations by specification to: plant part (flower petal, leaf, seed); developmental stage of plant organ (new leaves, flower buds); time of year and growing location (pharmacologic activity may vary with soil composition, rainfall, altitude, and other features of the local ecology). For example, in Yemen, market vendors of qat (*Catha edulis*, *Celastraceae*) adjust (lower) prices throughout the day, and by source of product, reflecting that psychotropic activity drops off post-harvest and fluctuates with only small shifts in microecologies.

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## Biographical Sketches

**Nina Etkin** is Professor and Graduate Chair, and directs the Medical Anthropology Program, at the University of Hawai'i at Manoa. Her research centers on two domains that are linked through a co-evolutionary theoretical perspective: (1) Studies of ethnomedicine juxtapose ethnographic data on the cultural construction and social negotiation of health to pharmacologic assessments of indigenous plant medicines and foods, in northern Nigeria, eastern Indonesia, and Hawai'i. (2) Investigations of human biological variability focus on the pathophysiology of inherited red blood cell disorders and their protection against malaria infection. Professor Etkin has published extensively, forging intellectual and practical links to understand the dialectic of nature and culture in diverse ecologic and ethnographic settings. She has just completed a book entitled *An Ethnopharmacology of Foods*. Her edited volumes include *Eating on the Wild Side* (1994, University of Arizona Press), *Plants for Food and Medicine* (1998, Kew Royal Botanic Garden), *Medicines: Meanings and Contexts*. 1994, University of Amsterdam Press), and *Plants in Indigenous Medicine and Diet* (Gordon and Breach Science Publishers, 1986). Professor Etkin is past President of the International Society for

Ethnopharmacology.

**Dr. Elaine Elisabetsky**, Ethnopharmacologist and Professor at the Federal University of Rio Grande do Sul (Porto Alegre, Brazil) researched and taught for ten years at the Brazilian Amazon. Her focus of research includes ethnopharmacology among cablocos (rural peasants), Amerindian Peoples (Guajajara and Kayapó), and rubber tappers (extractive reserves) communities, conservation and sustainable development. She has given specific notice to locally held concepts of health and disease, and stressed that a culturally relativistic perspective is necessary in conducting ethnopharmacologic field and laboratory work. She has developed plant selection criteria that combine traditional knowledge and working hypothesis for pharmacologic scrutiny aiming to maximize the potential for successful drug development based on ethnopharmacologic collections. She specializes in identifying and characterizing psychopharmacologic properties of medicinal plant extracts or isolated compounds. She has been President of the Brazilian Society of Ethnobiology and Ethnoecology, and International Society for Ethnopharmacology, and was a founding member for the International Society of Ethnopharmacology and the International Society of Ethnobiology. She is part of the editorial board of the *Journal of Ethnopharmacology*, *Phytomedicine*, *Pharmaceutical Biology* and *Revista Brasileira de Plantas Mediciniais and Evidence Based Alternative and Complementary Medicine*.