

Perspectives in ethnopharmacology: forging a closer link between bioscience and traditional empirical knowledge[☆]

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Received 23 October 2000; received in revised form 10 February 2001; accepted 14 March 2001

Abstract

To what extent do ethnopharmacologists from diverse disciplines share a vision of what ethnopharmacology is and what it might become? This question was explored several years ago through content analysis of the *Journal of Ethnopharmacology* (JEP), the official journal of the International Society for Ethnopharmacology (ISE). The analysis revealed that although the published articles represent the breadth of natural and social sciences, most studies are themselves not synthetic or interdisciplinary. For the present study, analysis was extended through the most recently published issues of the JEP and compared, for the same time period, to the subject matter of another natural products journal, *Pharmaceutical Biology*. Whereas research published in the JEP better represents the interdisciplinary objectives of that journal, the difference is not striking. By way of illustration, several studies are reviewed that represent the unique, synthetic perspective that is highlighted in the mission statements of both the JEP and the ISE. The conclusion underscores the lack of clarity in research objectives and suggests that ethnopharmacologists of all backgrounds can enhance their work by projecting pharmacologic data against a backdrop of medical ethnography and by enriching cultural interpretations of medical actions by exploring the physiologic potential of plants. © 2001 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: Interdisciplinary studies; Ethnopharmacology; Methods; Application

1. Introduction

The year 2000 International Congress on Ethnopharmacology provided a forum for reflection on what intellectually constitutes the domain of ethnopharmacology, what the representative vehicles are for publishing findings and what the literature suggests about research objectives. The Congress theme — Challenges for the New Millennium — suggested an opportunity to improve the substance of our research and to promote the application of our findings. Identifying challenges necessarily invites us to reflect on what we have accomplished up to this point. Most researchers agree that significant advances have been made in the technical domain — including the characterization of plant

constituents and activities and a better understanding of the interactions among elements of complex botanical preparations, as well as between plants and pharmaceuticals. In all likelihood, technical progress will characterize the next decades as well. On another positive note, our ethnographic field skills remain solid: drawing largely on anthropology, we have at hand already-tested methodologies to reveal the cultural construction of health and healing in diverse cultures. But these skills have been underused, as most researchers spend little or no time with the local people and ecologies from which test materials (plants) are drawn.

What has not kept pace are developments in the theoretical domain, and slower still is progress in the application of our research findings, both to advance bioscience and to make our work meaningful for local populations. These are important deficits, as concept and context are what position ethnopharmacology research, both intellectually and in practice. The relative lack of progress in interdisciplinary and applied domains derives in part from the fact that ethnopharma-

[☆] Based on a plenary lecture presented to the Sixth International Congress on Ethnopharmacology, 'Ethnopharmacology 2000: Challenges for the New Millennium,' which convened 4–7 September, 2000 in Zurich, Switzerland.

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Table 1
Comparative content analysis of the *Journal of Ethnopharmacology* (JEP) and *Pharmaceutical Biology* (PB)

Thematic category	JEP 1979–1996 <i>N</i> = 1276 (%)	JEP 1996–2000 <i>N</i> = 634 (%)	PB 1996–2000 <i>N</i> = 279 (%)
Ethnography alone	15	4	1
Pharmacology alone	54	47	71
Primarily pharmacology	16	38	17
Interdisciplinary	6	4	4
Ecology, taxonomy	<1	<1	0
Safety, regulation, CAM	5	6	4
Miscellany	3	1	2

cologists represent diverse intellectual traditions — most prominently pharmacology, anthropology and botany. In addition, some are connected to commercial enterprises, including the pharmaceutical industry and the rapidly expanding market for ‘herbals’ and medicinal foods. Will it be possible in the future to use those combined voices to forge a more interdisciplinary field of inquiry, i.e. how realistic is the vision that calls for an ethnopharmacology that yields collaboration among different researchers as well as the application of that knowledge to practical ends for both the scientific and indigenous communities?

2. Methods

2.1. Content analysis of the *Journal of Ethnopharmacology* and *Pharmaceutical Biology*

Content analysis methods have a long history in social science research. In the abstract, these techniques reduce the tangible ‘artifacts’ of human behavior to a unit-by-variable matrix that is analyzed quantitatively in order to discern patterns. These artifacts are highly varied and include medical interviews, political rhetoric and texts, such as research journals (or newspaper editorials, song lyrics, history books). The content analysis reported here is framed by an anthropological perspective that examines text as a ‘window into the human experience’ (Bernard and Ryan, 1998), the fenestration in this case casting light on perceptions and objectives in ethnopharmacology research. The specific objective of this content analysis was to discern the extent to which ethnopharmacologists from diverse disciplines share a vision of what ethnopharmacology is. The issue of shared perspectives in ethnopharmacology was explored preliminarily several years ago through content analysis of the *Journal of Ethnopharmacology* (JEP), which is widely regarded to be a key gauge of topical concern in ethnopharmacology. The JEP is unique among journals that publish research on natural products because its mission statement and scope highlight a commitment to interdisciplinary research and a breadth of interest in both phytochemical characteriza-

tion and the cultural context of indigenous drugs. It serves as the official journal of the International Society for Ethnopharmacology, a professional association whose membership coheres around interdisciplinary research on the physiologic actions of plant, animal and other substances used in indigenous medicines of past and present cultures.

More than 1200 JEP articles were reviewed, from volume 1 in 1979 through volume 50 in 1996, to judge how closely particular studies represent the intellectual fusion implied by the compound term ethno-pharmacology (Etkin and Ross, 1997). That retrospection suggested that whereas the published articles represent the breadth of natural and social sciences, most studies are themselves not synthetic or interdisciplinary. Very few combined pharmacologic data with sufficient ethnographic depth to make substantive statements about how specific plants influence the health of a particular population.

These findings do not reflect the policy of either former or current JEP editors and Editorial Boards. Instead, the topical distribution of articles is a complex artifact of the boundedness of disciplinary training and funding, as well as who actually submits manuscripts to the JEP. In fact, the editors and Board responded to the study’s findings by reaffirming their commitment to an interdisciplinary ethnopharmacology that resonates the complex circumstances of diverse medical cultures who interpret and physically manage biodynamic materials.

Now, 4 years later, the intellectual waters have been retested by extending JEP content analysis and comparing that to another natural products journal, *Pharmaceutical Biology*. A cursory review suggested that the same thematic categories are relevant. The journals’ contents were then systematically examined and each article was assigned to one of seven mutually exclusive categories, based on a judgement of best fit (Table 1)¹.

¹ Only 8% of all articles fall into the thematic categories ‘ecology and taxonomy’, ‘safety and regulation’ and ‘miscellany’ (e.g. laboratory methods) and are not part of this discussion.

3. Results and discussion

3.1. Topical themes

The category 'ethnography alone' includes medical ethnographies and historical treatments based in literature review. These articles address the cultural, not the pharmacodynamic, characteristics of plants. This is apparent, for example, in an article that outlines the cultural context of Amazonian rituals, with an appended list of medicinal plants and their preparations. Other authors listed medicinal plants and uses in Dadeldhura, Nepal and for the Tacana of Bolivia. Similarly, other authors itemized medicinal plants for Badajoz Province of Spain and selectively compared the use of several species with their medicinal applications in other parts of the Mediterranean. These works represent folklore and ethnography, but are not *ethno-pharmacology*. Their contribution to the larger enterprise could be even greater if the meaning of medicinal plants, their transactions and social negotiation was taken into account, as well their biodynamic attributes.

'Pharmacology alone' is the predominant thematic category and includes pharmacologic and phytochemical studies that characterize plant constituents and activities without reference to the pharmacopoeia and culture of the people who use the plants. For example, one research group reports testing extracts of *Barleria prionitis* for antifertility effects, but notes in the opening paragraph that mediating fertility is not among the various applications of the plant in Indian indigenous medicine (where it is used for fever, cataract and boils). Similarly, other researchers report anti-cancer (apoptosis-inducing) action for tanshinone IIA isolated from *Salvia miltiorhiza*, having stated that the plant is used in 'traditional oriental medicine' (but which 'oriental' tradition?) for angina pectoris. These studies are acontextual pharmacology, rather than *ethno-pharmacology* that takes into account how people identify, prepare and administer plants, and how they judge efficacy. These cultural aspects of medicine are as important as, and overlap, the biological actions of the plants.

Many studies are defined by the 'primarily pharmacology' theme, which still centers on phytochemistry but includes some ethnographic data as well. Ascription of articles to this category is generous because in most, the ethnographic information is thin and is not well integrated with laboratory findings. For some of these studies, ethnographic aspects are drawn from old published sources, which are not salient for the contemporary culture that bears the same name. In many cases, the ethnographic data are used selectively as researchers focus on a medicinal application that corresponds to their current interests and existing laboratory protocols. Lately, for example, many laboratories are interested in anti-inflammatory, antioxidant and antinociceptive ac-

tions. Although a wide range of disorders would benefit from such actions, it is not clear what implications these findings have for the cultural group identified in the study.

Examples of the 'primarily pharmacology' theme include studies that tested for angiotensin-converting enzyme (hypotensive) or for antiplasmodial activity. In both cases, the applications tested are only remotely related to those for which indigenous populations use the plants. Further, there is insufficient ethnographic content to ensure that the dilution and extraction mode in which the plants are laboratory-tested corresponds to how indigenous healers prepare and administer those plants in preventive and therapeutic medicine. In these cases, readers cannot judge whether traditional therapeutic objectives overlap biomedical ones — for example, these plants may not be intended to reduce blood pressure and parasite load, but instead to cause sweating to chase the disease agents from the body. However, it is encouraging that more of the studies published in the JEP make reference to some ethnographic reality. In this 'primarily pharmacology' category, we begin to see the potential complementarity of aspects of ethnography and pharmacology.

In the 'interdisciplinary' category, ethnopharmacology is framed by a biocultural perspective that lies at the heart of a truly integrated, not just multidisciplinary, ethnopharmacology. 'Interdisciplinary' works differ from the 'primarily pharmacology' studies by including ethnographic data of sufficient depth to generate and test hypotheses and to make substantive statements about medicinal plant use in actual human populations. Such papers include systematic information about disease etiology, plant preparation, mode of administration, therapeutic objectives and other germane details that equip the researcher to understand how local cultures understand and mediate the biodynamic potential of medicines and, to a large extent, anticipate the physiologic outcomes of plant use. Here, researchers regard indigenous peoples to be, similar to Western scientists, competent interpreters of their physical environments. They, like their counterparts who mediate the culture of Western science, embellish the cultural meaning of botanicals by marking and managing biodynamic substances through such attributes, such as action, taste, efficacy and odor.

One interdisciplinary study presented the cultural presuppositions of Zulu medicine, discussed the social organization of healing, problematized the study to a subsample of the pharmacopoeia that is used to treat headache and specific inflammations, detailed the preparation of medicines and tested extracts for prostaglandin-synthesis inhibition (Jäger et al., 1996). Another interdisciplinary study used extensive ethnobotanical and ethnomedical data to examine Zapotec medicinal plants, especially for dermatologic and gas-

Table 2
Comparative content analysis of the *Journal of Ethnopharmacology* (JEP) and *Pharmaceutical Biology* (PB) — research objectives

Objectives	JEP 1979–1996 <i>N</i> = 1276 (%)	JEP 1996–2000 <i>N</i> = 634 (%)	PB 1996–2000 <i>N</i> = 279 (%)
Bioprospecting	28	12	42
Biodiversity	3	<1	1
Indigenous use	NA	3	7
Ethics	NA	0	0

trointestinal disorders (Frei et al., 1998). Further, these researchers showed how this population distinguishes medicinal from nonmedicinal species (including foods) by smell and taste, noting especially astringent, aromatic and/or sweet characteristics. These culturally defined clues not only encode information about which symptoms a particular plant treats best, but also juxtapose cultural salience to bioactivity — e.g. constituents (polyphenols) present in the plants used for digestive complaints are responsible for both astringent taste and efficacy in the treatment of intestinal disorders (Brett and Heinrich, 1998; Ankli et al., 1999).

The point is that interdisciplinary studies effectively combine ethnography and pharmacology to formulate meaningful conclusions regarding how local healers effect cure, how chemosensory properties of plants influence their indigenous medicinal uses and how phytochemical knowledge might be applied in the formulation of new pharmaceuticals that could serve local needs, as well as those of Western science. They reveal the complementarity of ethnographic and pharmacologic data, to offer insights into how healing is constructed and efficacy evaluated in particular human cultural contexts.

3.2. Comparison of the JEP with Pharmaceutical Biology

A systematic content analysis was engaged for the journal *Pharmaceutical Biology* (PB), for the same time period. This journal was formerly (until 1996) titled *International Journal of Pharmacognosy* and still is expressly devoted to pharmacognosy — i.e. inquiry on the botanical sources and chemico–physical characterization of crude drugs. Although the scope of *Pharmaceutical Biology* resonates more strongly the laboratory aspects of ethnopharmacology, it does publish papers that overlap the range of thematic foci covered in the JEP and thus, serves as a basis for comparison.

Data comparing the contents of the JEP and PB are summarized in Table 1. Compared to the earlier analysis, the number of ‘ethnography alone’ studies in the JEP has diminished appreciably, while the number of ‘pharmacology alone’ studies has decreased fractionally, from 54 to 47%. This means that most of the JEP articles still represent an uninflected pharmacology

rather than ethno-pharmacology. Predictably, given PB’s different mission and scope, the percent of ‘pharmacology alone’ articles published in that journal is significantly higher, 71%. The number of JEP papers that embellish pharmacology with at least a little ethnography has more than doubled, increasing from 16 to 38%, while the comparable figure for PB is half of that percentage.

Overall, then, the JEP publishes fewer ‘pharmacology alone’ studies and more articles that include some ethnography. While we can be encouraged that more attention is paid to the cultural contexts of plant use, the number of truly interdisciplinary papers remains very low. Only a few synthetic studies appear in both phases of JEP analysis; and for the latter phase, the percentage is the same as for PB, a journal in which one does not expect to encounter interdisciplinary perspectives.

3.3. Research objectives

It seems clear, then, that many authors still position their research in a Western pharmaceutical frame without considering the implications for populations from whom plant knowledge originates and who continue to use those plants. This observation led to the next stage of research, the extension of content analysis beyond topical foci, to identify research objectives. Authors specified one or more of these aims:

- Bioprospecting, i.e. advancing pharmaceutical science by seeking leads for new drugs that will be added to the biomedical pharmacopoeia
- conservation and preservation of biodiversity
- promoting the indigenous use of local botanicals, including in combination with pharmaceuticals and other biomedical technology
- ethics and intellectual property rights

The potential was high that any given article would have more than one objective although, curiously, most stated none at all (Table 2). Judging from these percentages, it appears that ethnopharmacology has not been appreciably influenced by the very public and political attention to biodiversity, ethics and intellectual property rights. Because the debate on these issues has permeated the literature of anthropology, economic botany and other disciplines for the last decade or so

(e.g. Lempert, 1997; Myer, 1998; Nair and Jayakumar, 1999; Porembski and Barthlott, 2000), it seems odd that it would not have reached ethnopharmacologists — who overlap those other sciences and who are not immune from moral conscience.

In view of its mission and scope, it is not surprising that bioprospecting is the research objective of 42% of articles published in *Pharmaceutical Biology*. By contrast, in the earlier JEP content analysis, 28% of authors specified pharmaceutical leads as an objective and in recent years, 12%. A possible, and obvious, interpretation of this downward trend is that research objectives have shifted. However, this analysis does not support that conclusion.

For the early content analysis it was troubling, distasteful even, that bioprospecting would predominate among research objectives. After all, from an anthropological perspective, it is more important to know what local people will gain, or at least how their circumstances will be better understood, from the study of their medicines. On some level, this is less troubling now. Drug discovery and other entrepreneurial ventures are, after all, legitimate — even those that do not qualify as ethnopharmacology. What is more disturbing now is that most researchers appear to have no objective at all, at least most authors do not state what the purpose of their research is. Perhaps they assume that all ethnopharmacologists are part of the same enterprise and that statements of purpose are therefore unnecessary. Still, one is left with the sense of discrete bits of research emerging from various laboratories with nowhere to go and no one to pull them together. By all appearances, no one seems to reflect much on what the larger picture might be.

3.4. *Ethnopharmacology for whom?*

But if these researchers are indeed interested in drug development, who are their findings for? With whom will they collaborate? Pharmaceutical companies, after a spate of energy and significant expenditure in the early 1990s, have since been losing interest in natural remedies (e.g. Williams, 1997). In part, this reflects that drug development requires substantial capital and a long approval process, some estimate 10–20 years of research; and only a very small percentage of candidates reach the market as effective drugs (Cragg et al., 1995).

The pharmaceutical industry's declining interest in natural products also has something to do with the 1992 Convention on Biological Diversity (Convention, 1992) which positions indigenous peoples as the rightful owners of indigenous medicinal plant knowledge and its applications. Despite the sincere efforts of the Convention and other professional associations to establish

codes of ethics², the extension to indigenous populations of intellectual property rights is complex and difficult to implement. It is politically nuanced and multi-cultural and involves actors who represent diverse constituencies that are highly asymmetrical with respect to access to authority and resources. When intellectual property rights are further extended by profit-sharing and contractual privileges, this makes prohibitively expensive what was already a very costly venture. Liability, cost-containment and profit motive have had an impact on drug development and many pharmaceutical companies now see their future in genetic engineering, rather than botanical medicines (Gwadz, 1994; Melton, 1999).

If the pharmaceutical companies will not use the findings of natural products researchers, who will? One could speculate that some of the former interest in natural products would be transposed to the development of botanical complementary and alternative medicines (CAM), but these have proven to be marketable and profitable without much, or even any, scientific validation. In the US, the 1994 Drug Supplements Health and Education Act (DSHEA, 1994) has had a profound effect on the regulation and marketing of botanicals, which can be sold as 'dietary supplements' that are not subject to the strict regulation that applies to FDA supervision of drugs. Market expansion is well ahead of substantiation and has driven these unregulated and non-standardized products into readily accessible markets, such as conventional drug, grocery and 'health foods' stores, internet sites and multi-level and other marketing schemes (e.g. Ernst, 2000). Given the profit margin and rapidity with which these products can be put on the market, there is no apparent incentive for CAM marketers to collaborate with legitimate phytochemists to characterize and standardize their products.

3.5. *Applying research results*

At the same time that the pharmaceutical companies' interest in natural products wanes, health care providers in the developing world are calling for practical implementation of research results. How can we reconcile that research conducted during the last two decades has yielded an enormous amount of information on plant constituents and activities with virtually no practical application? As disconnected primary findings continue to accumulate, our knowledge base expands. Ten more, 70 more lists of 'they use this for that' (from ethnographers) and 'this contains that' (from pharmacologists) does provide a foundation, but

² For example, the International Society for Ethnobiology, American Anthropological Association, Society for Economic Botany (ISE, 2000).

the challenge now is to direct more attention to using that as a basis from which to formulate analysis and application.

Is it true, then, as the popular media suggest, that the 'tropical rain forest is a pharmaceutical failure' (e.g. O'Connor, 2000)? Decidedly not, and this question raises other issues in the application of research findings. Who will be the primary recipient of whatever benefit natural products research offers — the West, where much of the pharmacologic research is conducted, or peoples of the developing world who continue to bear the greater disease burden at the same time that they are the source of many of the botanicals being tested? Today, the interest that many pharmaceutical companies have in primarily developing-world diseases has more to do with implications for Western travelers than with indigenous populations who cannot afford expensive prophylaxis and therapy.

Ethnopharmacologists could accept a challenge to turn this around. It would be provident at this juncture to address how the results of sophisticated medical ethnography and rigorous bioassays can be meaningfully integrated, translated and applied to the traditional populations who use those plants. At minimum, once a catalogue of promising leads has been identified, those botanicals should be further studied, at least through preliminary clinical observation. Especially in resource-poor settings in the developing world, the use and sustainable cultivation of those plants should be encouraged.

4. Conclusion

I think that every few years it merits taking the pulse of our discipline, to track us intellectually and gauge our future. I encourage a recommitment to an integrated ethnopharmacology, both to advance the field and to ensure that the JEP does not lose its unique focus. Specifically, I recommend that ethnopharmacologists of all backgrounds project pharmacologic data against a backdrop of medical ethnography (e.g. by addressing therapeutic objectives, specific contexts of use, preparation, etc.). We should also enrich cultural interpretations of medical actions by exploring the physiologic potential of plants — consulting literature outside their own professional disciplines and collaborating where necessary.

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