

Culture, Perception and the Environment: The Role of Chemosensory Perception*

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Summary

The perception of plant derived natural products by humans is a theoretically and practically relevant interface of botany/phytochemistry and the cultural sciences. This paper offers a theoretical overview of the field and points to the shortcomings in our knowledge about this topic. It thus focuses on the interpretation of chemosensory signals by a culture and on the way in which this sensation is cognitively structured and named, on the hedonic evaluation of particular sensations as good and bad and on the assignment of use value to particular chemosensory inputs. Simultaneously it provides the frame of reference for the four subsequent papers in this series.

Introduction

This collection of four papers is united by several theoretical and methodological themes. In this article we give an overview on the topic and want to explore in greater detail the conceptual issues that unite these papers. First, there is an important exploration of the biological perception of plant-derived natural products (phytochemicals) mediated and translated through culture to characterize and select these plants (and the contained chemicals) as medicines. Second, the relatively little studied role of taste and smell in exploring the environment (but see CLASSEN, 1992; 1993; CLASSEN et al., 1994; HOWES, 1987; JOHNS, 1990; O'MAHONEY and RIE, 1986; STOLLER, 1989). While physiologists, psychologists and psychobiologists have explored taste and odor perception in great depth (for example, GETCHELL et al., 1991), there has been little attention paid to the role of culture as a factor affecting the interpretation of chemosensory input (but see O'MAHONEY and DEL CARMEN, 1980; O'MAHONEY and MUHIUDEEN, 1977; ROZIN, 1982). Interpretation in this context can mean the way in which the chemosensory environment is cognitively structured and named, the hedonic evaluation of particular sensations as good or bad, and assigning a use value to particular chemosensory inputs. These papers begin this process. Third, impressive collections of documented plant uses as medicine are available (MORTON, 1981), but ethnobotany has not yet explored in any detail the process and rationale for the use of plants as medicines. Ethnobotany has remained largely a descriptive science with only a few exceptions of integrating, for example, linguistic and biological information (BERLIN and BERLIN, 1996), or medico-botanical and cultural data (ORTIZ DE MONTELLANO, 1975). These papers thus broaden the theoretical basis of ethnobotany. A fourth theoretical theme in these papers examines the historical processes by which populations define which plants are medicinal and which are not and how new plants are evaluated and selected as new medicinal resources. These cultural criteria may also be a basis for studies on bioactive compounds from plants by identifying species that warrant examination in the laboratory.

The methodological issues are closely tied to the theoretical. There is an inherent requirement in these kinds of studies to explicitly move

between inductive and deductive data. On the one hand, a society's knowledge and perceptions of the environment can only be explored using a broad, open-ended strategy characteristic of much of traditional ethnography. This involves collecting plants known to healers along with attendant data on use, preparation, illnesses treated, etc., attending healing events, conducting unstructured interviews with a range of people involved with medical plant use, and related approaches. On the other hand, emerging hypotheses must be tested using more structured, replicable methods that are appropriate to database and/or statistical management. It is in this way that we can avoid the largely interpretive approaches of some anthropologists in this field or the rigid, uncontextualized work of the psychobiologists as noted above. In the first instance, the works are rich, interesting descriptions of the role of taste and smell in particular societies, while in the second, there is no reason to believe that many of the findings have any bearing on how individuals or populations perceive and manage the chemosensory environment in the messy, uncontrolled circumstances outside the lab. We are trying to maintain that delicate balance between rich contextual data and quantifiable, replicable data that may make cross-cultural comparison and generalization possible.

Perception as a biological phenomenon

In this theoretical paper our primary goal is to situate this collection of papers, first presented at the annual meeting of American Anthropological Association in 1994, in a larger context. At a basic level, these papers are concerned with perception as a biological phenomenon, especially chemosensation (taste and odor), and the interpretation or translation of the basic information input via culture into knowledge about the environment, broadly defined.

We have a tremendous and rapidly increasing body of knowledge about the anatomy, physiology and function of the olfactory and gustatory systems and their relationships to one another (see GETCHELL et al., 1991 for a review). What are generally called the chemical senses serve primarily the direct (taste) and remote (smell) detection of potential food items. Smell in particular probably serves also in the protection of the organism from noxious or poisonous environmental substances. Taste is traditionally viewed as a mixture of four elementary taste qualities: salty, sweet, sour and bitter. Some characteristic odor qualities defined in the western cultural tradition are floral, ethereal, musky, camphor, putrid, and pungent. Equally, we know a tremendous amount about the psychophysical responses of people from the western world to chemosensory stimuli, with some early, tentative cross-cultural, comparative explorations (see review in BRETT, 1994).

The cultural meaning and use of chemosensory information

What we are lacking almost entirely is research on the meaning and use of chemosensory information for any populations. We have tremendous knowledge on how information is acquired, but almost nothing on what gets done with it once acquired. Important exceptions can be found in the work of psychologists ENGEN (1991), ROZIN (1990), and WYSOCKI et al. (1991), the chemical ecologist JOHNS (1990), and

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the cultural anthropologists CLASSEN, HOWES, and SYNNOTT (1994), HOWES (1987), CORBIN (1986), and STOLLER (1989).

These papers begin to ask how this olfactory and gustatory information is used and how meaning is attributed to it. There are several reasons why this perspective is important:

We are, as primates, primarily a visual and auditory species. It is useful to think of vision and hearing as operating at a macro-level, serving to orient us in space, in relation to other parts of the larger external environment. It is a truism that as primates adapted to an arboreal environment, visual acuity (especially stereoscopic and color vision) was increasingly important. Although we are now primarily a ground dwelling species, we still rely heavily on vision as the primary method of learning about the environment. Likewise, the complex communication that arose with language puts additional emphasis on the auditory channels as important to an understanding of the world around us.

But, operating at the micro- or individual-level of the internal biochemical milieu, olfaction and gustation are fundamental. These senses detect and monitor the chemical environment and serve, in a very real sense as "Guardians of the Gut"; serving to mediate that which is allowed into the body. In the normal course of things, nothing passes into the body without first being "sampled" by the olfactory and gustatory systems. Although we speak of them separately (the "five senses"), taste and smell are intimately linked in the perception of environmental chemicals. This is especially the case with anything that is taken in through the mouth (GARCIA et al., 1985; JOHNS, 1990).

There is strong evidence to indicate that detection of bitter and perhaps pungent compounds is probably associated with avoidance of toxic or dangerous substances, and that detection of sweetness is probably associated with identification of food sources (calories) (JOHNS, 1990). These two responses appear to be innate and present at birth. The picture is less clear for other tastes (for example, sour and salty), and for odors.

But, these base level, apparently universal biological responses do not occur in isolation, or necessarily form the basis for action (except in the case of acute stimuli that trigger autonomic responses). Like most other biological processes, these are filtered through a cultural lens of interpretation, evaluation, and valuation, with resulting definitions of particular taste and odor stimuli as good/bad, strong/weak, useful/not useful, etc. If past experience is any indicator, we can expect variations cross-culturally (see example, O'MAHONEY and DEL CARMEN, 1980; O'MAHONEY and ISHI, 1986).

We can take this a step further in an examination of the relationship between individuals and their environment via the cultural interpretation of chemosensory stimuli by examining two examples. Paul ROZIN (1982, 1990) is a pioneer in examining the role of culture and society in defining the value of chemosensory stimuli. In his work with chilis he has demonstrated how a highly aversive flavor, the stimulation of the pain receptors of the oral and nasal cavities, that results from the consumption of chili peppers, becomes defined as a valued, liked, even necessary flavor/food. How is it that roughly 25% of the world's population considers hot chilis to be essential to the diet? How is it that a food item that is universally disliked by young children and which causes pain and discomfort even among seasoned consumers has come to be regarded as a central, even desirable food item?

A variation on this can be found in the work of one of the authors in this collection (JB). Among the Tzeltal Maya of Highland Chiapas, Mexico, plants perceived to be particularly valuable, strong medicines for gastrointestinal problems often are extremely bitter-flavored. In contrast to Rozin's work, there is no "conversion of aversion to liking" (ROZIN, 1982) in this case. The medicines are still intensely disliked and no one takes them willingly because of their intense bitterness and the unpleasant sensations produced upon consumption. But, because of cultural interpretation, via the medical system, a medicinal plant that may be intensely disliked biologically, is nevertheless highly valued and sought out in the context of particular kinds of gastro-

intestinal illness (BRETT, 1994). It is this intersection of biology and culture that provides a focus for the papers in this collection.

Conclusions

In ethnopharmacology and ethnomedicine there has been much effort directed toward the empirical basis of indigenous and traditional medicinal plant use. Is there a pharmacological basis to the use of medicinal plants? (See for example, the contributions in ETKIN, 1986; HEINRICH, 1996; ORTIZ DE MONTELLANO, 1975). The answer is a qualified yes, but there are still many methodological issues to be resolved (COTTON, 1996; HEINRICH et al., 1998).

Considering chemosensation in the context of the cultural interpretation of medicinal plant use adds another, potentially fruitful, layer to this exploration. A useful example of this perspective is a consideration of TROTTER and LOGAN's (1986) widely used "cultural consensus" model for determining the best plants to evaluate for possible pharmacological significance. While this approach is useful for identifying the "best candidates" for pharmacological testing, it does nothing to explain all those other plants that are used but not widely so. An examination of the underlying chemosensory properties revealed, in the case of research by BRETT (1994) and HEINRICH (1994), a very strong pattern of plants with particular chemosensory properties being used for treatment of particular kinds of illnesses. This links both widely and uncommonly used plants into a single conceptual sphere by identifying the biocultural logic that defines plants as medicines. This is a different order of analysis than just identifying the ones most frequently used. (See HÖR et al., 1995 for a similar discussion involving tannin-containing plants used for gastrointestinal illness.)

Also, this perspective gives us an avenue through which we can begin to explore the relationship between the use of medicines, usually from plants, and often derived from a strong empirical base, and the theories of disease, illness and healing as embodied in the medical systems of particular groups. We know a great deal about the mechanisms by which various cultures define ill health and set about treating it. What we don't know much about yet is the way in which the essentially empirical basis of medicinal plant use articulates with the cultural definitions of etiology and treatment.

For example, we could usefully examine this in the context of the so-called great tradition medical systems: Tibetan, Chinese, Ayurvedic and their variants, where the concept of humoral balance is considered the basis of the illness and therapy is designed to treat ill-health by restoring the humoral balance. But, there is also a strong tradition of medicinal use which does not appear to be particularly well articulated with the dominant medical philosophy and in many cases predates the formal medical philosophy. The definition of these various plants, animals and minerals as medicines is often based on chemosensory properties, only partly and incompletely standing in opposition to the humors out of balance.

Some obvious questions arise: are medicines chosen or identified independent of, or parallel to the dominant medical philosophy? Were plants widely used in a "folk system" grafted onto the emerging formal medical philosophy because of strong empirical evidence of their efficacy? Similarly, we need to examine the role of food items in their role as medicinal substances. The chemosensory evaluation of foods is undoubtedly similar to that used for medicinal substances but interpretation differs. Bitter flavors, for example, may have very different meanings in the context of medicine or foods. ETKIN and ROSS (1983; 1991) have examined the considerable definitional overlap between plants defined as medicines and the same plants defined as foods. Interesting questions on the similarities and differences in chemosensory sampling and subsequent cultural evaluation of food items and medicinal plants emerge.

On a more abstract level, we can entertain questions of biocultural evolution. In introductory courses in biological anthropology we talk

about culture as the primary adaptive strategy of humankind. For non-human animals, the issue around consumption of environmental chemicals is basically one of avoidance of toxins while maximizing access to nutritional resources. Humans too have this concern, but we can be concerned with, by virtue of culture and language, such questions as: Is it toxic, or is it merely unpalatable (bitter vegetables, chilies)? Is it possible to ameliorate the toxicity through processing (potatoes, cassava)? It is also possible to recognize the toxicity and do something else with it. Medicines, fish or arrow poisons are some of the more obvious examples.

These papers open as many questions as they address because they are entering into the relatively unexplored territory of human biological and cultural interaction in relation to environmental chemicals.

Zusammenfassung

Kultur, Wahrnehmung und Umwelt:

Die Bedeutung von Geruchs- und Geschmackswahrnehmungen

Die Wahrnehmung von pflanzlichen Naturstoffen durch den Menschen ist eine aus theoretischer und praktischer Sicht wichtiger Schnittstelle von Botanik/Phytochemie und den Kulturwissenschaften. In diesem Beitrag wird ein theoretischer Überblick über das Gebiet gegeben und er zeigt die Lücken im wissenschaftlichen Verständnis hierüber auf. Der Artikel konzentriert sich somit auf die Interpretation von Geruchs- und Geschmackseigenschaften durch eine Gesellschaft (Kultur) und somit auf die Art und Weise wie diese Wahrnehmung durch eine Kultur kognitiv strukturiert und benannt wird, auf die kulturspezifische Evaluierung der Vorzüge und Nachteile eines bestimmten Geschmacks oder Geruchs (hedonistische Evaluierung) und auf Zuordnung von Nutzwerten zu einer galenoleptischen Wahrnehmung. Gleichzeitig bildet diese Arbeit den theoretischen Hintergrund der vier nachfolgenden Beiträge.

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