Folk Taxonomies and Biological Classification

Abstract. *A sample of 200 native plant names from the Tzeltal-speaking municipio of Tenejapa, Chiapas, Mexico, was found to consist of 41 percent that comprised more than one botanical species, 34 percent with a one-to-one correspondence, and 25 percent that referred to only a part of a botanical species. Cultural significance was least for the plants in the first group, greatest for those in the last group. Over half (60 percent) of the names for which there was one-to-one correspondence were plants associated with Hispanic culture, introduced as named entities following the Spanish conquest.*

The finding that lower-level categories of native folk taxonomic systems sometimes correspond with biological species in a one-to-one relation has often been used as evidence that biological species reflect objective natural groupings of organisms (*1*). Unfortunately, most of the data contributing to our understanding of the structure of folk taxonomies are casually collected, nonsystematic, incomplete, and anecdotal (for an exception, see *2*). These deficiencies tend to obscure the relation between folk and biological classification. They also make the solution of many questions of great interest difficult, such as the correspondence between lexical differentiation and cultural significance in a well-defined semantic domain.

Our data have been drawn from nearly 10,000 botanical collections made with one to several native informants. The research was done over an 18-month period in and near the Tzeltal-speaking municipio of Tenejapa, Chiapas, Mexico. This region, approximately 160 km^2 in area, ranges from 900 to 3000 m in elevation; it lies on a sloping plane of north-south orientation. Speaking generally, vegetation of the municipio includes cloud forest at the highest elevations; mixed pine-oak-liquidambar forest at the more temperate middle regions; legume-deciduous forest on drier slopes of the lower elevations; and tropical evergreen forest in more moist areas, such as along rivers, at the lowest elevations. More than 1500 species of vascular plants probably occur in the municipio of Tenejapa.

Repeated interviews with native informants suggest that our sample of more than 1100 Tzeltal plant names, at least 1000 of which are Tzeltal specifics, is nearing completion. We have defined a Tzeltal specific as any taxon which includes no other taxa. For the purposes of this report we have taken a sample of about 20 percent of our data by including the first 200 Tzeltal specific names in our alphabetical files. We have no reason to believe that such a procedure biases the results in any significant manner.

Table 1. Examples of the three categories of Tzeltal specific plant names.

Tzeltal specific name	Botanical classification
	Underdifferentiation
ʔahate ʔes	*Archibaccharis flexilis* Blake (Compositae) *Gaultheria odorata* Willd. (Ericaceae) *Ugni montana* (Benth.) Berg (Myrtaceae) *Vaccinium leucanthum* C. & S. (Ericaceae)
ʔičil ʔak'	*Clematis dioica* L. (Ranunculaceae) *Clematis grossa* Benth. (Ranunculaceae) *Serjania* spp. (Sapindaceae)
	One-to-one correspondence
balamk'in	*Polymnia maculata* Cav. (Compositae)
kašlan bok	*Brassica oleracea* L. (Cruciferae)
¢aʔteʔ	*Ateleia pterocarpa* Sessé & Moc. (Leguminosae)
weʔbalil ¢ib	*Marattia weinmaniifolia* Liebm. (Marattiaceae)
	Overdifferentiation
¢ahal ščuʔil čenek' *k'anal ščuʔil čenek'* *ʔihk'al šlumil čenek'* *¢ahal šlumil čenek'* *sakil šlumil čenek'*	*Phaseolus vulgaris* L. (Leguminosae)
k'atk'at bohč *sepsep bohč* *¢u* *čahk'oʔ*	*Lagenaria siceraria* (Mol.) Standl. (Cucurbitaceae)

In examining the extent to which the Tzeltal taxonomy of plants corresponds with standard botanical classification, we first divided Tzeltal specifics into three categories. The first category, which we refer to as underdifferentiated, is composed of Tzeltal specifics which include two or more botanical species. Category 2 includes those Tzeltal specifics which correspond in a one-to-one fashion with botanical species. Category 3, which we refer to as overdifferentiated, includes those Tzeltal specifics which exhibit a many-to-one relation with botanical categories—that is, when more than one Tzeltal specific maps to one botanical species. These three categories are illustrated in Table 1. Using these standards of classification for our sample of 200 names, we find that 82 are underdifferentiated, 68 map in a one-to-one fashion, and 50 are overdifferentiated. Tzeltal specifics clearly do not correspond in a predictable way with botanical species.

In an effort to identify the reasons for the different lexical treatment accorded various plant species, we scored the 200 Tzeltal specifics in terms of high, moderate, and low cultural significance. Assignment was made as follows: category 1, plants of low cultural significance, includes plants of little or no utility for the Tzeltal; category 2, plants of moderate cultural significance, includes species used for food, firewood, or other purposes but not cultivated; and category 3, plants of high cultural significance, encompasses all plants intensively cultivated by the Tzeltal—such as corn, beans, chilis, and squashes. These plants are primarily food or cash crops and clearly are of great importance.

The relation between lexical diversity and plant utilization is shown in Table 2; about a third of the Tzeltal specifics in our sample fall in each of the three groups of cultural significance. There is a strong positive correlation between cultural significance and degree of lexical differentiation; for example, 40 of the 50 species which were overdifferentiated were judged to be of high cultural significance.

In analyzing the degree of correspondence between Tzeltal specific names and botanical species, it is useful to consider the examples of overdifferentiation in greater detail. The simplest case is exemplified by "white zapote," *Casimiroa edulis:*

ba¢'il ʔahateʔ *¢ahal ʔahateʔ* *k'anal ʔahateʔ* *¢elum ʔahateʔ*	} *Casimiroa edulis* Llave & Lex.

Linguistically, the Tzeltal specific lexemes comprise an attributive plus a head, the attributive referring to frequency of occurrence or dominance (*ba¢'il* "true"), color (*¢ahal* "red," *k'anal* "yellow"), or shape (*¢elum* "elongated"). The head, *ʔahateʔ*, is also a free form which acts as the including taxon at the next taxonomic level. The four Tzeltal specifics are, therefore, "kinds" of *ʔahateʔ*, and in this case, the higher level taxon, *ʔahateʔ*, would stand in a one-to-one relation to *Casimiroa edulis*.

Although the example of *Casimiroa* represents a common case of overdifferentiation, it must be noted that more complicated situations are often encountered. For example, the Tzeltal plant name *čenek'* (see Table 1) includes all varieties of *Phaseolus vulgaris*. In addition, however, it includes some (but not all) other species of *Phaseolus* as well as *Vigna sinensis* (L.) Savi ex Hassk., *Vicia faba* L., *Pisum sativum* L., *Arachis hypogaea* L., and *Lupinus* sp. Thus there is no complete correspondence between *čenek'* and any recognized botanical category.

The Tzeltal classification of the common bottle gourd, *Lagenaria siceraria*, presents a less common situation. We note the following Tzeltal specifics.

k'atk'at bohč *sepsep bohč* *¢u* *č'ahk'oʔ*	} *Lagenaria siceraria* (Mol.) Standl.

Although the first two forms, *k'atk'at bohč* and *sepsep bohč* are "binomials," each being a "kind-of" *bohč*, there remain the specifics *¢u* and *č'ahk'oʔ*. These forms are clearly, from the Tzeltal point of view, not "kinds-of" *bohč*. They are likewise distinct from one another. There is, then, no named Tzeltal higher level taxon which corresponds in a one-to-one fashion with *Lagenaria siceraria* and which includes as well all Tzeltal specifics which are identified as *Lagenaria siceraria*.

There are good morphological grounds to justify each group of the above Tzeltal categories, given the specialized attributes which characterize the Tzeltal system of classification. Thus the fruits of *bohč* are large and round and are used, for example, as containers for tortillas and drinking water; those of *¢u* are long-necked gourds used mainly as carrying vessels for liquids; the small oval fruits of *č'ahk'oʔ* have no known utility. Nonetheless, these groupings do not correspond to botanical categories in any meaningful fashion.

An unexpected result of our investigations was the realization that a high proportion—40 out of 68—of the plants for which there was a one-to-one correspondence were introduced to Tenejapa after the Spanish conquest. Twenty-four of the 27 species of high cultural significance for which there is a one-to-one correspondence belong to this group. All 40 species came as a part of Hispanic culture and the majority of their Tzeltal names are derived from Spanish (see Table 3). Presumably the one-to-one relation in the names of these plants exists because they were introduced as named entities. They are invariably used today for the same purposes for which they were originally introduced and in many instances retain the same names.

The data presented in this report show that although botanical species may be recognized in folk systems of classification, this is not necessarily reflected linguistically in a one-to-one fashion. One native category may correspond to several species, genera, or families, or portions of these taxa, or one species may correspond to several native categories. Even though about a third of the species in the total inventory of Tzeltal specifics map in a one-to-one fashion onto botanical species, some 59 percent of these correspondences are best thought of as artifacts of Hispanic culture. Only 14 percent of the Tzeltal specifics in our sample refer to native plants and exhibit a one-to-one correspondence with botanical species.

What is the basis for the correspondence, or lack of correspondence, between the lower levels of native folk taxonomic systems and biological species? Many groups of organisms do occur in nature in well-defined clusters, often separated by clearly recognizable discontinuities in the pattern of variation. When species of plants occur in the same place, they are usually easily separated; when they do not, the assignment of populations to the category "species" often becomes more arbitrary.

Taking these facts into consideration, there are still several possible sorts of classificatory systems for organisms. Among these, most biologists would understand a *natural* taxonomic grouping to be one which reflects the phylogenetic and genetic relations of the organisms being classified. This is quite apart from the use of the term "natural" in logic. On the other hand, a system of classification is said to be *general* ("natural" in a logical sense) insofar as its members possess many attributes in common, and *special* ("artificial" in a biological sense) when it is based on a few attributes that are of special interest for a particular purpose.

In a general or, as it is sometimes called, a "general-purpose" classification, the members of a group share many correlated attributes; the information content of the group and, by implication, the classificatory scheme

Table 2. Relation of cultural significance to differentiation (in terms of botanical categories) of Tzeltal specific plant names. Numbers in parentheses indicate number of plants which were presumably introduced into Tenejapa after the Spanish conquest.

Underdifferentiation	One-to-one correspondence	Overdifferentiation
	Low cultural significance	
49	10 (2)	5
	Moderate cultural significance	
31 (1)	31 (14)	5
	High cultural significance	
2	27 (24)	40

Table 3. Examples of Tzeltal specific plant names which are of high cultural significance, show one-to-one correspondence, and are introduced flora.

Tzeltal specific name	Derivation and botanical name
waneš	<OSp./rábanoș/rabanos "radishes" *Raphanus sativus* L.
wéna	<Sp./yérba buéna/yerba buena "mint" *Mentha* sp.
ʔašuš	OSp./ášoș/ajos "garlics" *Allium sativum* L.
kašlan bok	(Lit. "Castillian vegetable") <OSp./kaštilyáno/*castillano* "Castillian" + *bok* "vegetable" *Brassica oleracea* L.
šʔawaš čenek'	(Lit. "broad-bean bean") <OSp./ábaș/abas ("broad-bean" + *čenek' Vicia faba* L. ("bean")
kašlan č'opak'	(Lit. "Castillian soaproot") <OSp./kaštilyáno/*castillano* "Castillian" + *č'opak'* "soaproot" *Ricinus communis* L.
ʔíko	Sp./ígo/*higo* "fig" *Ficus carica* L.

which gave rise to it, is high (*3*). On the other hand, a general classification can never be perfect for all purposes. As emphasized by Sokal and Sneath (*4*), when we put together entities with the highest proportion of shared attributes, we debar ourselves from insisting that these entities share any one particular attribute. Thus a special classification is demonstrably the best one for the limited purpose for which it was constructed, a general one the best for a wide range of potential purposes.

Viewing the problem in this light, we can readily comprehend the distinction between our usual Linnaean system of classification and any particular folk system of classification. The former, by continual review, is consciously made more and more general (*4, 5*); the latter, perhaps unconsciously, is made more and more special—hence specific—and with the highest possible predictive value with respect to the operations for which it is employed. It is hardly surprising that the special classification will often be concerned with characteristics that are also reflected in the general one and, insofar as this is true, mirror it. This clearly tells us nothing about the structure of nature itself, but a great deal about our own view of this structure.

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Norepinephrine Methylation in Fetal Rat Adrenals

Abstract. *The activity of phenylethanolamine-*N*-methyl transferase, the enzyme that methylates norepinephrine to form epinephrine, increases rapidly in the fetal rat adrenal during the day preceding epinephrine accumulation. The developmental increase in enzyme activity and the accumulation of epinephrine are prevented by fetal hypophysectomy (decapitation). Administration of adrenocorticotrophic hormone or cortisol acetate largely reverses the effect of fetal decapitation.*

The probable regulation by the adrenal cortex of adrenal medullary production of epinephrine in the adult, first proposed 15 years ago (*1*), has long been studied in rat and rabbit fetuses (*2*) in our laboratory. Concurrent with the initiation of adrenocortical function, there is a rapid accumulation of epinephrine in rat and rabbit fetal adrenals (*3*). Moreover, an intact hypophyseal-adrenocortical system is required for normal levels of epinephrine to accumulate in the fetal adrenal (*4*). Thus fetuses deprived of their hypophyses by decapitation, prior to the onset of accumulation of epinephrine, manifest at term only about one-fourth of the normal adrenal content of epinephrine. By contrast, norepinephrine accumulates to above-normal levels following fetal decapitation, although the total content of epinephrine-plus-norepinephrine diminishes almost to half of normal. This effect can be obviated if at the time of operation one injects either adrenocorticotrophic hormone (ACTH) or cortisol acetate into the fetus (Table 1). These results prompted our investigation (*5*) of the enzyme phenylethanolamine-*N*-methyl-transferase (PNMT), which methylates norepinephrine to epinephrine in the adrenal medulla (*6*), and of its regulation by the fetal hypophyseal adrenocortical axis. Similar studies of the adult rat have been reported (*7*).

Pregnant female rats of the Sherman strain were killed by cervical fracture at various times post coitum, and adrenals from fetuses of the same age were pooled for the determination of PNMT activity (*7, 8*). To study the effect of the fetal hypophysis on PNMT activity, fetuses were deprived of their hypophyses by decapitation *in utero* 17.5 days post coitum (*9*). At 19.5 days these pregnant females were reoperated for administration of ACTH (1 unit in olive oil) or cortisol acetate (0.5 to 1.0 mg in 0.9-percent NaCl) intraperitoneally to the decapitated fetuses. In several instances females containing decapitated fetuses received subcutaneous injections of cortisol acetate (25 mg twice daily from day 17 to day 20 of gestation). At term (21.5 days), females were similarly killed, and extracts of fetal adrenals were prepared for PNMT determination or catecholamine assay (*10*); untreated littermates from operated (uninjected) females served as controls.

Our results indicate that the fetal adrenal gland at 17.5 days contains slight but significant PNMT activity, as well as traces of epinephrine (Fig. 1). The enzyme activity increases eightfold between days 17.5 and 18.5 while the epinephrine content doubles; thus the initial rate of increase of enzyme activity is faster than the rate of accumulation of epinephrine. Thereafter, epinephrine accumulation and PNMT activity increase rapidly.

The possibility that the increase in PNMT activity in the fetal rat adrenal during gestation was caused by the appearance of an activator or by the disappearance of an inhibitor, rather than by an increase in enzyme protein content, was con-

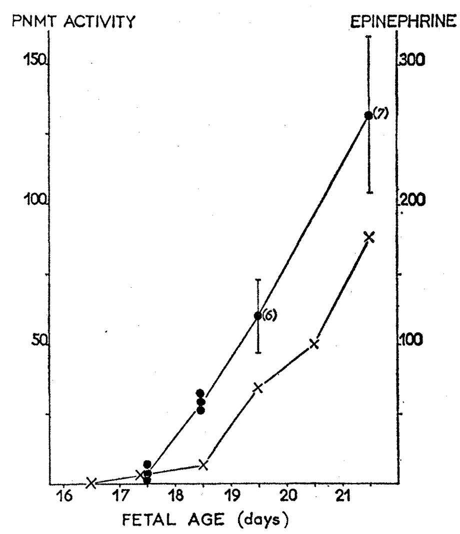

Fig. 1. Activity of PNMT (solid circles; micromicromoles per hour) and content of epinephrine (*3*) (crosses; nanograms) in pairs of fetal rat adrenals during gestation. Numbers of independent determinations are in parentheses; confidence intervals calculated for *P* .05.