

THE ETHNOPHYSIOLOGY OF THE TZELTAL MAYA OF HIGHLAND CHIAPAS

by

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(Under Direction the of Elois Ann Berlin)

ABSTRACT

This dissertation is an attempt to describe Highland Maya concepts of internal anatomy and physiology. Physiology is the study of the functions of a living organism. A thorough understanding of concepts of physiology creates a greater understanding of any medical system. Perceptions of body function inform much of culturally defined medical behavior including practices such as behavioral and medicinal prescriptions and/or proscriptions, the perceived actions of particular medicines, etcetera. However, the ethnophysiology of indigenous peoples has not received adequate attention considering its foundational role in medical practice.

Several methods were used in this investigation. The free list task and paired comparison test were used to establish the domain of internal anatomy and to establish organ rankings. Semi-structured interviews provided rich ethnographic data. A binary fixed-response survey provided data regarding the generalizability of the findings.

The Tzeltal Maya of Ch'ixal Tontik display a high degree of physiological knowledge regarding the heart, blood and lungs and the stomach and intestines. The heart, with the lungs, pumps blood throughout the body. The blood provides the body with life force derived from air that is breathed into the heart and from food. Further, the heart is seen as the seat of thought and the soul. Some Maya acknowledge that the brain is involved in thought, but always in conjunction with the heart. The gastrointestinal system of the Tzeltal is composed of two

stomachs and two intestines. Food travels down an increasingly narrow path until all of the life force is extracted and feces is expelled through the anus. Other organs are known to the Tzeltal – liver, gallbladder and kidneys – yet, the role these organs play in the body is not known.

Finally, ethnoanatomy and ethnophysiology is informed by metaphoric processes. Knowledge of internal anatomy comes from livestock. Further, health is referred to by the semantic pair ‘walking and working’ and the heart is conceived of as a homunculus; an internal being that makes commands that must be obeyed.

INDEX WORDS: medical anthropology, metaphor, ethnophysiology, ethnoanatomy, Chiapas, Maya, Tzeltal, Tenejapa, discourse, body, cognitive anthropology, salience

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DEDICATION

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Chapter 1

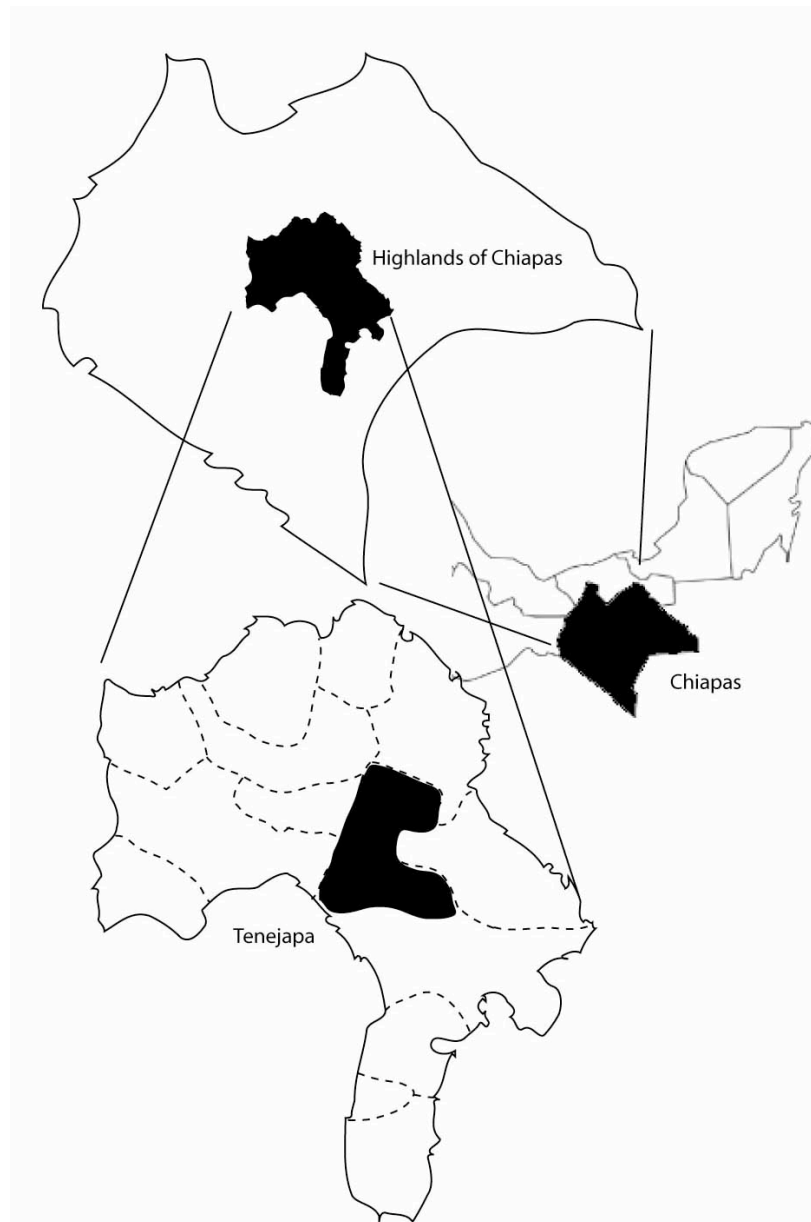
Introduction

This work is the result of research conducted during the summer of 1997, all of 2001 and part of 2002 in the municipality of Tenejapa in the highlands of Chiapas (Map 1). Chiapas is the southernmost state of Mexico and has historically been part of Guatemala and an independent country. Chiapas is a linguistically rich part of the world and the highlands, alone, are the home to two languages: Tzeltal and Tzotzil. These two languages are quite closely related and each is partially intelligible to speakers of the other. Tenejapa is a Tzeltal speaking municipality.

Virtually no attention has been paid to the physiological concepts that underlie ethnomedical systems. Yet, Browner et al. (1988) note that this is, perhaps, the most crucial body of knowledge needed in order to understand a medical system. Otherwise, the anthropological knowledge of ethnomedical systems will never go beyond the museum exhibit stage, though an admittedly rich and complex museum. Due to a great deal of research that has been done on Highland Maya medicine, it is possible to ask questions of an increasingly fine-grained resolution. Therefore, Chiapas is the ideal place from which to contribute to this ethnophysiological endeavor.

Beyond discovering the theoretical bases of an ethnomedical system, this study has a practical application. It is difficult for health care providers trained in the western biomedical paradigm to communicate effectively with indigenous peoples; the concepts just aren't all the same. Therefore, this project will provide health workers in the Highlands of Chiapas invaluable

information that will allow them to communicate effectively with their patients, increasing their effectiveness in treating the Maya.



Map 1. The location of the Municipality of Tenejapa in the highlands of Chiapas, Mexico.

Chapter 2

Statement of Objective

Research Problem

Physiology is the study of the functions of a living organism; the processes of life. Browner et al. (1988) establish that through a thorough understanding of concepts of physiology, and by extension anatomy, a greater understanding of any medical system is achieved. This is because perceptions of body function inform much of culturally defined medical behavior including practices such as behavioral and medicinal prescriptions and/or proscriptions and the perceived actions of particular medicines. However, the ethnophysiology of indigenous peoples, including that of the Highland Maya, has not received adequate attention considering its foundational role in medical practice.

Berlin (1992) Berlin et al. (1974), Bastien (1987), Lakoff (1986), Johnson (1987) and Lakoff and Johnson (1980) suggest that humans approach and categorize the world based on their interaction with it (their ecological relationships). Likewise, less visible features of the natural world may be ultimately associated, through metaphor, with previously established categories or processes (Lakoff and Johnson 1980). These cognitive metaphors then express themselves in (Bastien 1987) or are expressive of (Martin 1994), cultural systems such as medicine or religion.

As perceptions of body function are foundational to medical practice and given that the Highland Maya rely heavily on metaphor to describe and understand these functions, three objectives are proposed:

- 1) establish an inventory of Highland Maya ethnoanatomical terms
- 2) develop a model of Highland Maya physiology, which includes known organ systems and their functions
- 2) systematically analyze Highland Maya use of metaphor in their description of ethnophysiological processes

Rationale and Significance

The completion of the objectives presented above will support and link two mid-level theoretical issues in anthropology:

- 1) traditional medical practices are not just a hodge-podge of unrelated empirical observations of medicinal efficacy, but rather derive from shared theoretical perspectives that systematically underlie these practices (Browner et al. 1988)
- 2) metaphor is systematically applied and therefore plays a fundamental role in human cognitive processes (Johnson 1987; Lakoff 1986; Lakoff and Johnson 1980)

Ethnophysiology

Concepts of physiology are the most basic component of any medical system. Physiological concepts describe how the body functions and how body parts are related. Here I follow the mandate of Browner et al. (1988) to understand emic (culturally held) medical

concepts before assessing the etic (biomedically defined) efficacy of those practices. It will shed light upon the foundation of medical thought, diagnostic criteria and treatment of illness, as well as explain certain behavioral and medicinal prescriptions and proscriptions involved with health and illness.

As an example of how ethnophysiology structures medical behavior, Sobo (1993) shows how Jamaicans describe various illnesses as the violation of natural body functions, unbalanced diets, or the need for a monthly purge. Similarly, in their analyses of Latin American humoral medicine, Foster (1994) and Matthews (1983) show how disequilibrium of metaphorical "hot" and "cold" leads to illness, and how balance is restored through the opposite "hot" and "cold" foods, medicines and practices. The patients who subscribe to the humoral model often see violations of these rules by health care practitioners as deleterious, or even deadly. Berlin and Jara (1993) describe how the dysfunction of *me' winik*, a Highland Maya ethnomedical syndrome, has been discredited as a culture bound illness by biomedically-trained health providers. However, by careful medical anthropological analysis, the *me' winik* syndrome was found to closely coincide with gallbladder disease.

My preliminary research in Tenejapa, Chiapas (Adams 2000) verifies that the Highland Maya do have distinct concepts of ethnophysiology that work in conjunction with, but are distinct from, the dichotomous (hot/cold) system. Initial research into Highland Maya ethnoanatomy shows that it differs from biomedicine in a number of respects. The location in the body of organs that can reliably be translated into English often differs from that described by biomedical doctors. There are also additions and subtractions from the biomedically known organ set.

Bastien (1987) and Nichter (1991), for example, stress the importance of understanding these local concepts to the success of health care projects, citing failures due to subtle phrasings that have one meaning for the care provider and a distinctly different meaning for the recipient. Systematic knowledge of the local ethnophysiology allows for improved communication and cooperation, concerning health, between health care practitioners and indigenous peoples.

Notwithstanding Browner et al.'s (1988) position that ethnophysiology must be known to assess medical systems, this facet of ethnomedicine has not received much attention. Notable exceptions are the studies of the humoral (hot/cold), Andean and Jamaican systems described above (Bastien 1985; Foster 1994; Matthews 1983; Sobo 1993). However, the research on the Latin American humoral system is concerned primarily with the maintenance of health and ignores other general processes, such as reproduction, respiration, and food processing. Therefore, Bastien's and Sobo's work stand out as the sole complete ethnophysiological studies.

Metaphor

Sobo (1993) establishes the important role of metaphor in Jamaican ethnophysiology, as described below. Unfortunately, this is done without reference to metaphor theory. Therefore, metaphoric aspects of Jamaican ethnophysiology are merely described and not analyzed. The result of this analytical omission is that Jamaican ethnophysiological metaphors appear to be parsimonious artistic innovations, which happen to coincide with physiological processes.

Lyon and Barbalet (1994) state that, "the body may be incorporated into theory simultaneously at the...biological and cognitive domains" (48). Lakoff and Johnson's (1980) argument is that conceptual, or cognitive, metaphor structures the way we think about and approach the world. This in turn is reflected in everyday speech. These cognitive metaphors are

not immediately available to the speaker. Instead, they act as generic categories from which specific statements derive. Further, the speaker does not perceive these statements as metaphoric.

Likewise, Turner (1987) considers metaphor to be “the basic form of symbolism through which knowledge of the world is forged” (44). He, along with Nash (1963) and Levine (1995) suggests that scholars and scientists, among others, approach and understand the world through metaphor. Metaphor provides us with the theoretical bases of our observations. By extension, Maya medical theory may have metaphoric foundations.

Johnson (1987) argues that the body, through its interaction with the world (its ecological relationships), is either the ultimate origin or the locus of the majority of cognitive metaphors. Before linguistic capabilities are developed, one’s cognitive experience simply includes one’s body and how it physically intersects with the broader world. Anatomical references deriving from nature (Stross 1976) or human body metaphors projected upon the natural world (Monaghan 1995; Ortiz de Montellano 1990) are quite common.

Additionally, my preliminary research (Adams 2000) shows evidence of metaphoric associations within Maya ethnophysiology. The Maya medical system does not have any form of invasive surgery. Therefore, knowledge of internal organs may be associated with animal husbandry, specifically cattle with additional information deriving from swine and poultry (E.A. Berlin, personal communication). Because of the fact that these are the only large mammal bodies into which the Highland Maya look, it is believed, by analogy, that humans must have similar structures.

Additionally, as Casper and Koenig (1996) note, these metaphors have been, until recently, ignored in our own medical system, “...assuming it to have evolved beyond the superstition, religion, and value laden beliefs so clear to them in traditional medicine” (529; for a

detailed example see Martin 1994). These works illustrate how pervasive and invisible these metaphors may be.

Cognition

Though the human body is often invoked as fundamental to the theory of cognitive metaphor, physiologic processes, short of the observable aspects of eating and excreting, have not been explored in depth. Further, nearly all of the specific studies on the cognitive role of metaphor have been conducted in English – with occasional reference to other Indo-European languages as brief examples. This study addresses these two shortcomings by analyzing the use of metaphor to describe ethnophysiology in a Mayan language. I examine whether metaphor is used systematically by the Highland Maya when describing body function. In addition I assess whether systematically patterned metaphor is, indeed, a general phenomenon or, instead, a feature of English or Indo-European languages.

Moreover, many of the important findings of general cognitive research have not been applied to the study of cognitive metaphor. Prototype theory and ethnobiological classification have proven to be fertile sources information about human cognition. Prototypes are fundamental cognitive mechanisms that organize information (Berlin 1992; Rosch and Mervis 1975). Individual members of a domain present themselves as more representative of the group, based on salient attributes, and are thus considered more prototypical of the domain (Mervis et al. 1976).

Pinker (1997) argues that the mind allows us to function in the world by reducing complexity using redundant processes. Therefore, the coincidence of this feature in folk taxonomies and in the findings about prototypes lends strength to both arguments. Thus,

particular ethnoanatomical entities or ethnophysiological processes will exhibit increased salience. Because of their heightened salience they should be referred to with increased metaphoric reference. Though the particulars of these references will vary from individual to individual, they will consistently derive from the same taxonomic domain.

In support for this argument, preliminary research in Tenejapa (Adams 2000) shows that the heart is the most salient organ to the Tzeltal Maya. Further, the heart is invoked in everyday speech, such as in the Tzeltal equivalent to hello *bi xi a'wo'tan* (literally translated as 'what does your heart say?') or to say that one likes another *lek a'wo'tan* (literally translated as 'his heart is good'). These examples show that the heart goes beyond the role of other organs and should, likewise, be the locus of increased metaphor.

The application of general cognitive theory to the study of metaphor will enrich both by establishing whether metaphor is involved in cognitive practices, and by showing that the general patterns of human cognition as described in ethnobiology are reflected in other realms of human mental existence. In addition, the general integration of cognitive theories into medical anthropology is important to understanding universal human patterns in the multi-faceted realm of health and its maintenance.

Applied Aspects

Moreover, this project is significant to Maya health development. Berlin and Jara (1993) have shown, through an understanding of Maya ethnophysiology, that what has been previously thought to be a culture-bound syndrome by practitioners of western medicine does, indeed, have biomedical reference. Likewise, Nichter (1991) shows us how ignorance of local ethnophysiology by western health care practitioners can lead to miscommunications that render

health development projects ineffective. Therefore, this project will provide health workers in the Highlands of Chiapas invaluable information that will allow them to communicate effectively with their patients, increasing their effectiveness in treating the Maya.

Summary

Ethnopsychology is the key to a full understanding of any medical system. However, though extensive research on the Highland Maya medical system has been done, this aspect has not been properly addressed. It is also established that metaphor plays a distinct role in people's knowledge of their bodies. The majority of these metaphors are derived from the natural environment. Further, this application of metaphor is shown to be more than a linguistic elaboration. Metaphor may be a fundamental aspect of human cognition. Therefore, this study will address two important mid-level theories in anthropology: traditional medical practices are not just a hodge-podge of unrelated empirical observations of medicinal efficacy, but rather derive from shared theoretical perspectives that systematically underlie these practices (Browner et al. 1988); metaphor is systematically applied and therefore plays a fundamental role in human cognitive processes (Johnson 1987; Lakoff 1986; Lakoff and Johnson 1980). Finally, the presentation of the Highland Maya ethnopsychology will be available to local health care workers to aid in cross-cultural health care.

Chapter 3

The Tzeltal Maya of Ch'ixal Tontik (and Nabil)

Chiapan municipalities consist of the *cabecera* – ‘head’, the political, economic and, in the past, ceremonial center of the municipality – surrounded by outlying *parajes*, ‘hamlets’. *Parajes* are the smallest political divisions in the state of Chiapas and are both recognized by both the Mexican Government and the Maya populations of the region. The study reported here was conducted primarily in the highland *paraje* of Ch'ixal Tontik (literally ‘pointy rocks’), named after a prominent geographical feature of the area.

Ch'ixal Tontik is among the most rural of communities in the Highlands of Chiapas. Though the 27 km drive from San Cristóbal to Tenejapa center is a quick 30 minutes on a well-paved road, this is only a recent phenomenon. When I first began research in Chiapas, the road to Tenejapa was poor and would wash out in any significant rain. This meant that throughout the rainy season the only available route was a poor dirt track over a ridge that took about twice as long and was only passable in trucks or Volkswagen Beetles. This situation was alleviated in 1998 when a paved road opened reliable transportation to and from Tenejapa.

Now, cars and trucks acting as communal taxis travel between Tenejapa and San Cristobel regularly. The cost of these trips went from 12 to 15 pesos (approximately \$1.50 to \$2) per passenger during my stay, but the option of paying the four fares of a completely occupied vehicle to charter a taxi was always open. This option was normally only exercised by *ladinos* – the local term for non-indigenous Mexicans – or *gringos* – generally Americans but also

Europeans – in a hurry. Few Maya had the resources or the sense of urgency to make such an expenditure.

In order to reach Ch'ixal Tontik from Tenejapa, one must then travel through the neighboring *paraje* of Nabil. Two options are available. First, one may continue in a cab for the high price of 50 pesos. This option requires a further five kilometers down a paved road that links Tenejapa center to municipal center of San Juan Cancuc and then turning onto seven kilometer dirt track to the *paraje* of Nabil. This route takes between 30 and 45 minutes depending on the condition of the road. Otherwise, one must walk an exceedingly steep path that takes about 45 minutes. Most people feel that the high cost of the taxi is not worth the occasional savings of time.

From Nabil one must walk a rough four-kilometer path, which takes the generally quick Maya a good 30 minutes, to Ch'ixal Tontik. Part of this path consists of a road project to connect Ch'ixal Tontik to Nabil begun in 1994. Though it was originally planned to be finished in 1998, nobody expected its completion any time soon at the time of this research. Because the road is incomplete, no public services such as electricity or running water have arrived in Ch'ixal Tontik. The residents eagerly hope for the road to be finished to bring the amenities available in Nabil.

It is precisely this feature that most distinguishes the two *parajes*. Nabil's population is primarily concentrated along the road where water and electricity are available, requiring individuals to walk up to 30 minutes to their fields. The new home compounds along the road have cinder block structures, some with cement floors. Because of the centralized settlement pattern, unexpected, spontaneous social interaction is unavoidable.

In Ch'ixal Tontik, the old dispersed settlement pattern persists. Home compounds are close to the family fields and consist of pine plank structures with corrugated aluminum roofs or traditional adobe huts with thatch roofing — though the latter is increasingly rare. Unplanned social activity is much more infrequent in Ch'ixal Tontik as compared to Nabil as chance encounters are more rare except at the school.

Though I claim that Ch'ixal Tontik is among the most rural of the highland communities, it is still within two hours journey of San Cristóbal and all of the resources that this major cosmopolitan center offers. This has been a great improvement over the situation my key informant described from his childhood approximately 40 years ago. At that time he and his father would walk 10 hours to San Cristóbal to sell produce. Because of his exhaustion and young age my informant was reduced to tears which was the only mention I heard of a Maya man, though only a young boy, crying.

Regardless of its new closeness to the city, Ch'ixal Tontik does not have any non-domestic resources except the school. The only thing resembling a store is the home of my key informant where soda and candy are sold to students; an economic opportunity afforded by being the closest home to the school. However, no other goods, including medicines and other medical supplies are available in the *paraje*. The closest available supplies are in Nabil where five small stores operate out of people's homes, three of them providing basic pharmaceuticals (Casagrande 2002). Tenejapa center boasts pharmacies stocking a wider, yet still narrow range of medicines. For everything else one must travel to San Cristobal. However the Instituto Mexicano del Seguro Social (IMSS – the Mexican Social Security Institute) and the Secretaría de Salubridad y Asistencia (SSA—the Secretariat of Health) both have clinics in Tenejapa center but no similar health facilities are found in Ch'ixal Tontik or Nabil.

Though *parajes* are traditionally formed around lineage systems (Medina Hernández 1991), Ch'ixal Tontik petitioned the municipal government for independence from the nearby *paraje* of Nabil in order to receive government aid to build a local elementary school. The rationale for the new school and subsequent division of territory was the need limit the daily walking commute of the children. However other adult political concerns are also evident. The local positions of power have now doubled and men formerly denied these positions now have more of a chance to reach their aspirations of political and social prominence. Though consistent with Maffi (1994) who notes that to now be officially considered a *paraje*, a community must possess a school, and its ubiquitous basketball court, the fissioning of a community may indeed still be lineage based. For example, many surnames in Nabil and Ch'ixal Tontik are not shared between the *parajes*.

The role of education among the Highland Maya is of importance as exhibited by the aforementioned requirement of a school for a community to be considered an official *paraje*. Further, the highest position in the local political hierarchy is the *comité de educacion* – the ‘education official’. However, the role of the school goes beyond mere education, and the importance of the *comité* is likewise of broader scale. The school is the locus of important town meetings, vaccination programs, a government agricultural welfare program, and of other social events. Finally, the school houses the town roster.

The school is also the home to a solar powered loudspeaker on a tower connected to a turntable and microphone called *el aparato* ‘apparatus’. From as early as four in the morning to about seven or eight at night the *aparato* may be cranked up, an ancient and slightly warped album of *ranchero* music – Mexican country and western – is played and announcements broadcast over the mountains to the most remote of homes. Usually, messages will consist of

meeting or vaccination announcements but may also include personal messages such as “Antonio forgot his homework. Would his mother please bring it to the school.”

Beyond this community activity, the small, one teacher school in Ch’ixal Tontik only serves students through the fourth grade. The teacher at the time of my residence was a Tzeltal speaking Ladino from San Cristóbal. Each Monday morning the teacher would travel to Ch’ixal Tontik to live in the schoolhouse until the end of the workweek. On alternating weeks this end would come at midday Thursday, and on the others on midday Wednesday. The short weeks were to accommodate a semi-weekly Thursday meeting in San Cristóbal of all of the rural teachers. Because of this arrangement the students only received approximately six days of education every two weeks.

In order to continue schooling beyond the fourth grade a student will have to walk to Nabil to complete their elementary education. If a student wishes to attend secondary school they would have to attend school in Tenejapa center. In effect, this requires the student from Ch’ixal Tontik to take up fulltime residence in the town center and is mainly impossible for the majority of students. Though extremely rare, students may continue their education by attending university in San Cristóbal. It is virtually unheard of that a female continue beyond primary classes.

IMSS conducted a survey in 2000 for their vaccination program and found the population of Ch’ixal Tontik to consist of 48 families including 173 individuals (Casagrande 2002). As Casagrande notes for Nabil, household size is variable and ranges from two people to an extended family of up to four generations.

The family compound consists of several structures arranged around a small central plaza including a home garden (Figure 1). At least three structures are invariably included: the kitchen,

the corn-crib and a one room sleeping structure. If the family is large enough, additional housing structures may be added. Throughout Ch'ixal Tontik all of the structures have earth floors.



Figure 1: Home compound in Ch'ixal Tontik. This is the closest home to the school and will be directly on the road when it is completed. Thus, this is one of the most 'urban' homes in the *paraje*. In the foreground is the water cistern, the next structure is a dormitory and the two structures in the back are the corn-crib (on the left) and the kitchen.

The kitchen is the locus of the majority of family interaction and serves for much of other social interaction (Figure 2). It is in this structure where the battery powered radio resides. Each morning one San Cristóbal station broadcasts in Tzeltal and Tzotzil items of interest to the Maya. Typical broadcasts of music, news and politics are interspersed with personal and social

announcements and serve as a forum for communication between family members in the absence of a phone. Thus, it would be no exaggeration to claim that the kitchen is the nucleus of the family compound. Further, on cold nights, the kitchen may serve as a heated dormitory.



Figure 2. The kitchen (red structure on right) is the center of activity in the Maya home. Though most of the structures on this home compound have corrugated aluminum roofing, the corncrib (in background) has a traditional thatch roof. This was kept to, “remember the old ways.”

Married couples, teenage boys or unmarried and widowed women commonly have distinct sleeping quarters. Occasionally, young children will bunk with the parents. In the case of the home in which I lived, I was given one structure to myself while my key informant, his wife and young son shared another. The grandmother and the daughters shared a third building. As

luck would have it, three sons were away at school so only the one son was displaced. These structures are basically empty rectangles with one door and no windows. Often, shelves will be attached to the walls and a table and chair or bench ensemble may be included. Finally, a wooden bed frame with woven mats serves as a bed.

Additionally, due to the lack of running water, most compounds contain one or more cement water cisterns (Figure 3). These are filled by a gutter system arranged on the roofs of the



Figure 3. My key informant in front of one of his water cisterns. Notice the gutter system used to transmit rain from the roof of the dormitory structure to the cistern.

other structures to collect rainwater. Throughout much of the year, enough rainfall is available to serve the family's water needs, however during the dry season or drought, family members must

walk to a small spring to collect water in plastic amphorae. Unfortunately, the spring cannot supply enough water for everyone each day, so these periods are subject to increased interpersonal conflict.

The people of Ch'ixal Tontik, who are primarily monolingual Tzeltal speakers, populate these home compounds. Spanish speakers are rare and limited to children in the bilingual schools and men who have worked outside of their communities. Very few women of older than primary school age speak Spanish, but it is not unheard of.

While men generally dress in khaki pants and button down shirts in the *ladino* fashion, they will wear the local traditional dress for special occasions. This consists of knee length white cotton shorts with a distinctive red and black embroidered cuff and a black wool tunic held by an embroidered or woven belt. The women tend toward a more conservative style of wearing the traditional lightly embroidered blue skirt and woven or embroidered belt (Figure 4). The top verges from the traditional embroidered white cotton blouse by incorporating an invariably red, green or purple turtleneck with an occasional V-neck sweater.

Though other economic activities have become available, a full 99 percent of the municipal population are swidden horticulturalists meeting subsistence needs (INEGI 2001). Typical of Maya communities throughout Mesoamerica, this means *milpa*, or corn swidden, agriculture with primary emphasis on corn, beans and squash. Additionally, various greens, chiles and fruit are also grown.



Figure 4. The matriarch of my host family in Ch'ixal Tontik dressed in traditional costume.

At the end of the dry season, in February and March, fields are cleared and burned to prepare the *milpa*. When the rains start in April, the fields are planted with the help of relatives and neighbors. Planting is done with a dibble stick and a seeds of corn, beans and squash are planted in each hole. The harvest occurs in late November. According to Berlin et al. (2002) a field will be used for two years before being left to fallow. The fallow period lasts approximately eight years depending on fertility.

Other crops are planted in home gardens (Figure 5). A spirit of experimentation is expressed in these gardens. My host had a small shoot he grew from the seeds of grapes. He thought I was kidding when I told him that it would grow as a vine and that if he were to be at all successful he needed to provide a trellis or support of some kind. Needless to say, the plant did not survive in the highland climate, but other products would be tried as new favorites from the market appear.



Figure 5. A Maya homegarden. Various herbs, both culinary and medicinal, and vegetables are grown in these gardens. Further, this is where experiments with new plants will occur. There are additional orchards surrounding the compound.

Due to the climate in Ch'ixal Tontik, only one crop of corn can be grown per year. Coffee and tropical fruits do not survive at this altitude. However, in the lower parts of the municipality a greater variety of crops, including coffee, avocado, mango and banana can be grown while two crops of corn can be harvested per year. Of particular interest are the tropical fruits and especially coffee that can be lucratively sold through various local cooperative organizations. As these crops are not available to those in Ch'ixal Tontik, the inhabitants tend to be poorer than those of lower elevations. If at all possible lowland fields are sought to supplement a family's income. The family of my key informant was able to purchase land and has been cultivating coffee for personal consumption and for sale for quite some time. This access to low altitude land has secured the economic wellbeing of the family. This is not the case

for the majority of the inhabitants of the community who barely meet their subsistence needs through their agricultural activities.

Nearly every household keeps chickens and turkeys. These fowl are allowed to range as they please, feeding on seeds and small creatures during the day until penned at night. As chickens are more productive, their eggs are occasionally placed in the nests of laying turkeys and raised by the surrogate mothers. Small portions of corn dough supplement the diets of chicks until they become self-sufficient. Chicken is the food of choice for special events or church festivals. It is only in this situation that I ever saw chicken prepared. However, the eggs are eaten almost daily for breakfast and in the special dish of *juybil mats* – literally ‘ground corn gruel,’ this dish contains peas, chili, spices and hard boiled eggs – served to those who help with preparing and planting the *milpa*. Turkey eggs are never eaten, and I only heard of the flesh served once; for a first birthday party of a boy in Nabil.

A few families will raise a cow. My host family had one cow named *grinko* – the Maya version of *gringo* or ‘white guy’ – because of its yellowish pale hide. Invariably, when the cow is slaughtered the meat is sold due to lack of refrigeration. Only one cow, belonging to another family, was slaughtered while I was in Ch’ixal Tontik, however this periodic event provides the community with small amounts of meat at regular intervals. The flesh is usually cut into strips and smoked while the organs are eaten fresh in a thin broth.

In Nabil, pigs and the rare horse could be found. However, these livestock did not exist in Ch’ixal Tontik. Likewise, the ubiquitous sheep of Chamula – a neighboring Tzotzil municipality – are not raised in the Municipality of Tenejapa.

These foods are often supplemented by hunting rabbits, field rats, squirrels and other small game (Casagrande 2002). However the economic status of my host family made them consider themselves above these foods.

Men and women both participate in weeding and harvesting the cornfields. However, men are responsible for clearing and planting while women and children collect wood for fire. Further economic activities are generally gender specific.

Men clear and landscape the home site and build the structures. They also make infrastructural repairs to the home. Hunting, too, is in the men's domain. Finally, logging pine and/or cutting planks provides a good local income to young men. According to Casagrande (2002) men never participate in cooking. However this is only true concerning family meals. My key informant had built an oven that he used to bake breads for the market and to supply to Ch'ixal Tontik. This is a rare situation though one reflected in *ladino* culture where women are the cooks, but men could be found baking in commercial bakeries.

On the other hand, women prepare food, wash dishes, clean house, collect water if necessary and do the household chores. Further, most, if not all, women weave and embroider textiles in the designs typical of the municipality. These textiles can then be sold via the artisan's cooperative in Tenejapa center or in San Cristóbal. Some women have made deals with patrons for their goods and have done quite well.

Another realm of economic activity available to both men and women is the weekly Thursday market in Tenejapa center. Vendors from all over the region, including San Cristóbal, come to the market to ply their wares. This is, generally, the only opportunity for many people to acquire durable goods such as kitchenware, radios and manufactured clothing and dry goods

such as batteries and pirated music tapes and compact disks. Most importantly foodstuffs from all of the local regions arrive in the market.

Specific market tasks generally, though not exclusively, follow sexual division of labor. Men usually sell dry goods, pharmaceuticals, meat and coffee; my key informant sold shoes and boots as well as bread. Women tend to sell produce, textiles and other crafts such as baskets and net bags.

For several decades, Tenejapa has been undergoing a continuous process of religious restructuring (Maffi 1994). Protestant missionaries began to arrive in Chiapas in the 1940's (Harman and Kurtz 1982). Later, a "re-catholicization" effort by the Catholic Church has begun to gain converts from both the Protestant churches and the Traditional Maya religion based on a syncretism of Catholicism and Pre-Columbian beliefs (Carrasco 1990).

Ch'ixal Tontik is a community that is primarily, if not exclusively, Catholic. Near the school is a small, one room, stone *ermita* – chapel – where weekly and special ceremonies are held. The *ermita* is divided into three sections: the front where the altar and benches for the practitioners are located, a middle section with benches for the men to sit on, and the back where women sit on the earth floor. However, the majority of services are held on a large flat plaza outside of the *ermita* where more egalitarian seating is available; everyone stands, sits or kneels on the ground.

Generally, local lay readers conduct services while a *ladino* circuit priest periodically comes to the community to perform special ceremonies such as the annual blessing of the seeds. Further, during my tenure in the community, a small group of Catholic missionaries led by a young priest from Oaxaca city stopped in Ch'ixal Tontik while on a tour of Catholic communities in order to "revitalize the faith of the people."

However, though the community professes to be Catholic, in response to particular stresses, Traditional Maya rites are occasionally performed. For example, the bulldozer that was being used to build the road broke down, and no parts had been available for the repair for several weeks. I left for a couple of days and when I returned the following Monday, the part had arrived and the bulldozer was again working. When I commented on the good fortune, I was told that the part was available because, over the weekend, a group of elder men went to an important religious locale in the forest with a bottle of *pox* – the local cane liquor – to pray to the gods for help.

Traditionally, land is privately owned in the *paraje* and patrilineally inherited. However, population density in the Central Highlands has increased six fold since 1974 (Berlin et al. 1974; INEGI 2001). This has shortened fallow times and stressed the soil to unsustainable levels (Alemán Santillán 1989). Because of this, increased use of commercial herbicides, pesticides and fertilizers has become common.

This has led to a situation where there is insufficient land for all sons to inherit land. My key informant has begun to watch out for emerging drunks because they tend to sell their land for drink and he can buy it cheaply and insure his sons' futures. However, this is rare and most people do not have the forethought or means to engage in this ghoulish business¹.

In the absence of land most young men leave the community to find work. In Ch'ixal Tontik, men of marriageable age are rare causing a high density of old maids. Further, many married men have found work elsewhere leaving a high proportion of wage widows. Some men are able to come home seasonally, but the future of this community remains uncertain.

¹ I do not wish to paint a bad picture of my host, he is an honest, hard-working man, but he is constrained by the same pressures as everyone in the region. The land will be sold, better his sons get it than someone else's.

Summary

This report is based on a study conducted in Ch'ixal Tontik, a small community in the municipality of Tenejapa in Chiapas, Mexico. Ch'ixal Tontik is among the more remote communities in the highlands and is, therefore, not served by running water or electricity. A contrast between Ch'ixal Tontik and Nabil (the neighboring community) highlights the differences in social and economic patterns that arise from the access to a passable road.

The people of Ch'ixal Tontik are primarily monolingual Tzeltal speakers with increasing rates of Spanish-Tzeltal bilingualism among the young. Spanish is taught in the schools; however, education beyond sixth grade is uncommon. Alternatively, Spanish is learned by adult men while participating in wage labor.

The Tzeltal are a primarily agricultural people. The climate of Ch'ixal Tontik only allows for one harvest of corn per year. Further, a limited variety of crops is available to the community. Unfortunately, extreme population growth has limited the availability of land in the region. Therefore, families that have accumulated some wealth rent lowland fields to increase their agricultural production for personal use and for sale in local markets or through cooperative organizations. However, the majority of families augment their wealth through wage labor outside of their communities.

The primary goal of this study is to discover the ethnophysiological underpinnings of medical system of these people. Prior to engaging in that discussion, it will be beneficial to briefly review the literature on ethnomedicine and the body, both in general terms and specifically for the region.

Chapter 4

Anthropology of Medicine and the Body

A Short and Biased History of Medical Anthropology

George Foster (1976) proposes two distinct disease etiologies in folk medical systems: personalistic and naturalistic. All maladies fall into either one or the other of these categories. Personalistic illnesses are those that are considered to have been directly targeted at the person who becomes ill, while naturalistic illnesses are those that just occur from time to time due to unmotivated natural causes.

Personalistic illnesses can take any form from diarrhea to accidents. What defines this category is that the illness is believed to be “sent” by an antagonistic entity. The aggressors may be gods, various spirits — of the dead or belonging to features of the environment — or other people, via witchcraft. These maladies must be treated by a specialist who acts on behalf of the victim in the spiritual world (Foster 1994). This is the realm of shamans, pulsers and soul callers. Common specific etiologies are witchcraft, soul loss, evil eye and the like. As exemplified for the Highland Maya by descriptions of evil eye (Vogt 1976), and for Azande witchcraft (Evans-Pritchard 1937), the aggressor need not be aware of their harmful intentions.

The study of ethnomedicine is a focus on indigenous beliefs and practices not derived from modern medicine, and, due to the interest in the exotic tends to dwell on healers, causes of illness and relationships between illness and cosmology (Ackerknecht 1971; Rubel and Hass 1990). Because of these lines of inquiry, the field has generally paid most attention to personalistic aspects of indigenous healing systems.

As witchcraft and illness causing spirits stand out from other aspects of healing, they are commonly the primary point of discussion as the most deviant from modern medicine. In order to wrangle with these alien concepts, illness is seen by researchers to be a meaning-rich event. Thus meaning appears to be of prime importance, to the exclusion of mundane bodily processes (Good 1977; Good and Good 1981: 174).

From the perspective above, one is no longer looking at disease as a fact, but as a structural microcosm of the society as a whole (Swedlund and Armelagos 1990). It is difficult to approach illness from this perspective without being biased towards psychosomatic and psychological diseases (Fabrega 1974: 40; Rubel and Hass 1990). For illustrations, see the work of Levy (1983) who only in passing mentions Navajo herbalists, and of Harman and Kurtz (1982) who claim that Highland Maya medicine in Chiapas was all magical until the first missionaries and clinics arrived in the 1940's.

On the other hand, naturalistic illness etiology is best exemplified by biomolecular medicine, but also includes the humoral systems of Mexico and Greece (Foster 1984; Foster 1994; Matthews 1983; Messer 1981), Ayurveda and Unani of India (Bürgel 1976) and Chinese Traditional Medicine (Porkert 1976). This category of illness includes disease arising from environmental conditions, pathogens, behaviors of the victim and similar causes. Accidents lie in this category as well. The treatments of these illnesses are handled at home by family members or by herbalists, bonesetters, massage therapists, midwives and other practitioners. What sets these professionals apart from personalistic practitioners is that they claim no magical or spiritual characteristics for their methods. This is the realm of empiricism.

To counterpoint the ethnomedical approach, the ecological approach to disease tries to lay bare the environmental, as well as cultural, aspects of health (Armelagos et al. 1992: 41). The

ecological focus ultimately looks at pathogens and behavior through an adaptive, or evolutionary lens (Alland 1970). Therefore, most attention is paid to naturalistic diseases or symptom clusters.

However, the epidemiological model relied on by those in this camp tends to ignore social factors in disease events and have only set their gaze on a limited slice of the ecosystem (Armelagos et al. 1992; Singer 1996). Further, only illnesses labeled as such by the western medical system tend to be studied at the expense of illnesses not recognized by the system (Armelagos et al. 1992; Scheper-Hughes 1990).

Particular cultures may range from almost exclusively naturalistic, such as western biomedicine, to almost completely personalistic, as in the case of the Dobu (Fortune 1932) who consider even the smallest accident to be caused by a neighbor. However, it should be made clear that most populations appear to have a healthy mix of the two etiologies.

Prior to Foster's assertion that there are two categories of disease etiology the researchers in the two camps discussed above could only argue past one another. The descriptions of medical systems of non-western populations are overly doused in rhetoric on meaning while illnesses are investigated regardless of what the host culture thinks about them. The impression that a non-ordained reader would come away with is that indigenous people are busy fending off spirits and warlocks while leaving themselves open to the ravages of the diseases afflicting them. Or, stranger yet, it appears that everyone except those of European descent only suffers psychological or psychosomatic illnesses, and responds favorably to placebo.

The major effect of Foster's classification system is that it allows researchers to clearly define what it is that they are investigating while not denying the presence of other realms of health. Due to this opening of lines of communication, the shortcomings of both of the previous trends are laid bare. Therefore, recognition has grown that both personalistic and naturalistic

aspects are present in all of the world's medical systems. Likewise, strongly cultural or biological approaches to understanding indigenous health need not be incompatible.

Like Foster's description of two disease etiologies, Kleinman and Eisenberg further revolutionized the study of ethnomedical systems by clarifying the difference between illness and disease, the former defined as cultural entities of the latter bodily processes (Eisenberg 1977; Kleinman 1973; 1980). Now, behaviors regarding disease can be seen as deriving from a society's ideas about illness (Sommerfeld 1994; Young 1986). Thus is born biocultural medical anthropology, a research philosophy that attempts to integrate the complex interactions of beliefs and pathogens (Armelagos et al. 1992; Brown and Inhorn 1990; Goodman and Leatherman 1998; Hahn and Kleinman 1983; Leatherman and Goodman 1997; McElroy 1990).

Early successes of this perspective include debunking the myth of culture-bound syndromes; illnesses thought to be unique to particular populations and regularly assumed to be psychological in nature (Hahn 1995; Simmons 1985). A prime example of this achievement is the discovery that *susto* – a commonly cited Mexican culture-bound syndrome – correlated with an identifiable symptom clusters and high levels of stress (Rubel 1964; Rubel et al. 1984). In other words, *susto*, is a culture bound name for very real pathologies. Further, work on ethnomedical treatments has shown a high level of efficacy and implies critical selection based on empirical observation (Barsh 1997; Berlin and Berlin 1996; Berlin et al. 1995a; Berlin et al. 1995b; Etkin 1988; Moerman 1979).

The Anthropology of the Body

Anthropological interest in the human body may best be summed up in the idea posed by Mary Douglas (1970) that we have two bodies: the physical and the social. By this is meant that

the body exists as a physical entity and may be considered as such, but also that the body, its parts and their functions can, and are, taken into the symbolic realm. Researchers generally take the body as a subject of study to be either one or the other.

The Physical and Social Bodies

Studies of the physical body are the domain of biological, or physical, anthropologists and generally take the form of human evolution or biological differences between populations. This is the realm of the famous Bergman's and Allen's rules of limb and torso shapes, skin, eye and hair morphology, brain development in human ancestors and altitude effects on lung capacity. To do justice to this branch of the anthropological study of the body would require a dissertation in itself. Instead, I refer the reader to the *Journal of Human Evolution*, the *American Journal of Human Biology* and the *American Journal of Physical Anthropology*, among others, to review the field.

Unlike the study of the body as a physical entity, the approach to the social body is hardly unified in approach. This stems from a multiplicity of scales and of social forms that can be considered. Because of its disparity, here I will only briefly focus on some of the more important trends.

Cipriani (1966) notes that, "all primitive peoples who are habitually completely naked adorn the body in some way" (150). In addition to clothing, adornment includes "exotic" alterations such as,

scarification and tattooing; cranial deformations; tooth filing and removal; piercing of ears, nose, and lips; genital mutilation (e.g., castration, circumcision, clitoridectomy); age, gender, and status differences; special techniques and apparatus; associated beliefs; etc. (e-HRAF 2004: OCM code 304: Alteration).

Moreover, following Douglas who defines the social body as the use we make of it (1970), adornment includes,

body painting; shaving and depilation; hair styles (e.g., cutting, parting, arranging); care of the hair (e.g., washing, brushing); care of the nails (e.g., cutting filing); body painting; use of cosmetics, ointments and perfumes; age, gender, and status differences in toilet; associated beliefs and practices; etc. (*ibid.*: OCM code 302: Toilet).

Ignoring, for the time being, that Cipriani forgets that everyone else besides “primitives” adorns themselves in some way, this topic is perhaps the oldest and most cherished in the study of the social body. To exemplify this, the Human Relations Area Files (2004) contains 9,296 citations regarding body alteration (code 304) and toilet (code 302). This does not include clothing itself and is represented in the earliest ethnographies and continues to the present.

Most of these cases consider the body and its adornment to be symbols of ethnic identity; visual codes of belonging. However, one interesting perspective is that traditional forms of adornment are manipulated to define cultural authenticity to western audiences (Conklin 1997). In other words, Amazonian populations have modified how they represent themselves, based on western concepts of primitivism, as a political strategy.

Connerton (1989) goes a step further to suggest that adornment conveys decodable, abstract messages about culture. What is different here is adornment, specifically clothing, is seen to play a part in the molding of character through its influence on movement. We’ve gone from adornment symbolizing culture to adornment creating culture.

Connerton draws his idea from Mauss through Bordieu. Mauss (1973 [1935]) posits the concept of “techniques of the body,” which are cultural aspects of bodily movements. To Mauss, the way members of a population walk, swim, run, or what have you, is learned and can be

observed to be different from one culture to another. This is perhaps the earliest study of the social body in anthropology. Bordieu (1977) further refines Mauss through his concept of *habitus*. Habitus is the collection of learned bodily behaviors that are transferred from one generation to the next that define a culture's physical patterns and the limits of innovation. Bordieu and Connerton argue that bodily action is a form of cultural memory. Bordieu argues that this embodied memory is of cultural patterns not available to the cognitive memory of the actors; it is a special branch of memory unto itself. Embodied memory is further reflected in the construction and use of material goods. Further, Ferreira (1998) claims that Yoruk women attribute degenerative diseases, drug abuse and criminal behavior to a history of violence from the collection of colonizing forces; a more acute form of embodied memory. In addition to the embodied memory, history will press upon a culture's perceptions of the body itself. Hogle (1996) argues that Germans find the idea of organ transplants odious due to historical factors; namely the experiments of Mengele and company. Because of this, Germans fear the possibility of inhumane experiments.

Lyon and Barbalet (1994) take the more radical stance that the body is, itself, a cognized domain; in other words, a social construct. These authors argue that the atomization of the body in media such as billboards, television and magazines objectifies the body and leads to corporeal disenfranchisement. This position may be a little far fetched, but they go on to argue that it is through emotion that we cognize the body. This argument is used as support for the notion of corporeal disenfranchisement, but the implications may address a theory of psychosomatic illness.

Martin (1994) makes a stronger argument that our perception of the body and its processes are related to the social milieu. The outcome is that the social environment is

metaphorically mapped upon the body and its systems. Specifically, she shows how the immune system has been understood over time (from the 1950s to the present) based on seemingly unconnected sociopolitical issues. In the 1950s, skin was considered to represent the wall of a fortress that was our defense against invading germs. However, in the 1990s with the increased acceptance of the new age movement and general knowledge of alternative medical systems, the immune system is no longer understood in terms of war motifs but, instead, thought of in terms of an internal balance.

The Physical and Social Bodies Rejoined

However, Strathern (1996) warns that the social body *is*, still, the physical body and that anthropologists must not forget the latter. Though somewhat different in tone, this refers to the concept of the ‘mindful body’ that seeks to break down the Cartesian separation of mind and body in medical anthropology (Scheper-Hughes and Lock 1987). Scheper-Hughes and Lock argue that the separation of these two aspects of human nature is uniquely western and that most cultures do not maintain the duality. In order to better understand health and illness the culture bound separation must be dissolved. Though a self proclaimed advocate of the mindful body perspective, Strathern is further concerned that perspectives on the body that are simply physical or social may limit the potential of meaningful anthropological research on the body. As in the case of medical anthropology in general, the crossing of boundaries and the merging of perspectives has, indeed, proved to be fertile ground.

Linguistic anthropologists and students of ethnoscience, perhaps, made the original steps across the divide. Several works on anatomical terminology and ethnoanatomy appear (see Petruck 1986; Stross 1976 for specific examples; Swanson and Witkowski 1977). Following the

work of Berlin and associates (Berlin 1974; 1976; Berlin et al. 1968; 1973; 1974), Brown (1976) then suggests 12 principles of body part classification with four nomenclatural growth stages. He further suggests that body parts are cognized, not as a taxonomy but as a partonomy. However, Palmer and Nicodemus (1985) claim that Coeur d'Alene nomenclature proves these universals to be false. Further adventures into this subject lead Brown and Witkowski (1981) to suggest figurative universals to body part nomenclature. Specifically, higher than chance frequencies for specific figurative labels, such as 'child of the eye' for pupil, are found in discontinuous languages. This observation of linguistic universals for body parts suggest a strong link between the body itself and the cultural manifestation of body part names.

Further, body parts and the environment interact. Terms for environmental features are named with body parts (head of the river, foot of the mountain, etc). This has been noted for the Mixe who speak of soil as the flesh of the earth, rocks, its bones and rivers as its veins and blood (Monaghan 1995). Similarly, as shown in the examples leading this paragraph, the same is true for English (Porteous 1986).

However, the converse is also true; body parts are named for environmental features. For example, Bastien (1985) argues that the term for the bend of the knee among the Qollahuaya is derived from the term for a concave depression in the side of a mountain.

On the other hand, human internal organs are not an inevitable domain unless the culture has invasive surgery, regular warfare or human sacrifice (the last may keep the knowledge within a group of specialists). When this is not the case game or livestock, again, may play a role. Some Highland Maya, for example, say that everybody has two stomachs. This may be derived from the slaughter of cattle for food. These beasts have multiple stomachs and so must we (EA Berlin, personal communication).

The perception of one's body is also culturally mediated. Becker (1994) argues that core cultural values are encoded in ideals of body shape. For example, Samoans traditionally prefer a larger body than do Americans (Brewis et al. 1997). The same holds for Fijians (Becker 1994). Brown and Konner (1987) argue that both biological and cultural dimensions play into the situation. First obesity is rare in traditional populations but it increases with modernization. A biological predisposition for accumulating fat would be selected for in regions that had regular periods of food scarcity. Likewise, in such regions, fatness would be perceived as a symbol of prestige or wealth; a reflection of one's ability to secure food. Then, with modernization, food regularity and a cultural preference for plumpness would interact and lead to an obese population.

The cultural mode of understanding and reacting to variance from ideal body shape is mediated by the broader culture. A comparison of U.S. and Fijian considerations of the body is illustrative (Becker 1994). Americans have a strongly individualistic culture. Therefore, ideas of one's own body as their own responsibility leads to a sense that variation from the ideal represents one's own failing, thus, high levels of dieting and body sculpting. On the other hand, Fijians consider body shape to be representative of a community's level of care and, in the case of variation from the ideal, negligence. Fijians, therefore, do not personally cultivate their bodies. It is the job of one's caregivers and family who work as a community to modify body shape (Becker 1994).

Ethnophysiology

An altogether more fascinating realm of body research is that of physiology. Unlike body parts and body shape, the processes of the body, though having observable inputs and outputs,

occur in a ‘black box’. This is the realm where the physical and social bodies most obviously merge.

Perhaps the earliest concerted effort to understand cultural concepts of physiology is the study of the Latin American ‘humoral’, or hot-cold system (reviewed in Foster 1976; 1984; Foster 1994). Throughout Latin America much of medical discourse is held in terms of hot or cold illnesses and their hot or cold cures. The most basic aspect of this system is to maintain a balance between the hot and cold poles; a condition that is somewhat warm. Though more complex, the general rule is that cold remedies are used to treat hot illnesses and vice-versa. However, severe shocks resulting from quickly moving from a hot to a cold state, or the inverse, will also result in illness. McCollough (1978) makes the argument that the humoral rules developed to govern the pace of farm work as an evolutionary adaptation to avoid heat cramps and heat stroke. However, under increased scrutiny, the classification of remedies as either hot or cold proves to be inconsistent (Matthews 1983). Instead of a finely tuned adaptation to physical stress, the humoral system appears to be a philosophical mnemonic device to underscore empirical observations of plant efficacy (Foster 1994; Matthews 1983). This is an old, well researched and highly debated subject as will be discussed below. However, the jury is not out on this one, as evidenced by recent publications on the topic (e.g. Chevalier and Sánchez Bain 2003).

In addition to the work on the Latin American humoral system, descriptions of physiological systems commonly display themes emanating from the broader world. For example, Villa Rojas (1980) argues that Yucatecan Mayas conceive of the body as a microcosm of the universe. The organs are distributed in four quadrants around a central organ, called *típte*. This is a reflection of the universe, which is conceived as the four cardinal directions and a

central point located at the village. All of the organs are connected to the *tipte*, which is further described as regulating all organ function. Again this reflects the belief that the religious behavior of the community maintains the proper functioning of the universe.

More commonly, physiological process is described as reflecting earthly natural processes. Bastien (1985), in the first overtly ethnophysiological manuscript, develops a model of physiology for the Qollahuaya of the Andes based on the topography and hydrologic processes of the mountain. As they divide the mountain into three layers, based on altitude, so do they divide the body. Further, the process of water accumulating in caves and exiting the mountain from springs is a model for the belief that air, fat, water and blood flow to the heart and are then redistributed throughout the body. As the body reflects the mountain, so does the mountain reflect the body with the top known as its head and the bottom as its foot.

As it is for the Chewa of Malawi, the body is often perceived through agricultural metaphors (Kaspin 1996). This pattern is observable in much of the literature as agriculture is a realm of activity common to a large portion of anthropologically studied cultures.

In Jamaica, the development of the body is perceived in terms of produce (Sobo 1993). With special emphasis on women, the life cycle of youth through puberty and sexual maturity to old age is described in terms of the development of fruit. Youth is seen as fruit that is not yet ripe. This is a stage believed to be dry and hard, and unformed. Puberty and sexual maturity is likened to ripe fruit that is plump, juicy and soft yet firm. Finally, old age is like over-ripe fruit that is wrinkled, flaccid and soft. These life stages of fruit are models from which ideals of body shape are derived. They also help a woman accept different phases of her body as part of a natural rhythm.

Buckley's (1985) study of Yoruba medicine develops a three-color symbolic scheme: black, white and red. These colors are symbolically related to soil, the sky and clay, respectively and, by extension, to skin, semen and blood. The model for fertility is explained by the agricultural model of the sky (via rain) penetrating the topsoil and fertilizing the seeds in the clay. Symbolically, this is interpreted as white penetrating black and mixing with red to create life. Likewise, semen entering the black skin and mixing with the red blood inside produces offspring. Further, it explains why sex during menstruation is considered un-fertile, if not taboo. In this scenario white mixes with red as it seeps out from black. If the clay is turned out over the soil, the land is no longer fertile.

Similarly, the Mixe consider the care of their fields to be equivalent to the care of a pregnant wife (Monaghan 1995). Planting of seed and watering the field are considered to be as introducing semen into a fertile womb. As such, the produce of the field is also, symbolically, one's offspring. Therefore, a gift of tortillas is a weighty gift indeed. Of course, the symbolic landscape is reflected upon the woman's body. If she were to get too wet or too dry, too hot or too cold, the fetus is thought to suffer the same effects that a corn plant would under similar circumstance. In a similar vein, women in Sri Lanka and India explain the efficacy of birth control pills. The pills are hot and, thus, dry the uterus preventing the sprouting of the seed (Nichter and Nichter 1987)

The natural world is not the only source of physiological reasoning. Cultural artifacts and behaviors can produce a wealth of models for the working of the body. Mark and Mimi Nichter describe a Sri Lankan belief, based in mechanical models, that the uterus opens for menstruation and then slowly closes, making them most fertile after the period. The function of the *tipte'* among the Yucatec Maya is described as regulating the function of the other organs like a clock

moves its hands (Villa Rojas 1980). The process of digestion among the Mixe is described as a cooking of the food in the stomach; the smoke this produces escapes from the anus which causes its dark color (Monaghan 1995). And among Europeans, until the mid-1500s, the blood was thought to trickle to the muscles as in an irrigation system. Then William Harvey discovered that the heart delivered the blood to the rest of the body in the fashion of the recently invented pump (Harvey 1961).

Application of the Socio-Physical Body

It must be noted that once these metaphoric sources for models of physiology are established, they cease to be thought of as explicitly metaphoric. The models drive systems of health as theoretical constructs. And once established, these theories no longer need be rooted in physical or cultural environment from whence they came. For example, a long-standing debate has been waged over whether the Latin American humoral system is a Latin America construct. Foster argues that the humoral system of Mexico is derived from the Greek. The argument follows Greek thought as it mixed with that of Arabic peoples, who then brought it to Spain. This is well documented in the literature and is in evidence in Spain's colonial era folk medicine. The Spanish conquerors of the New World did much to reduce the culture of the local populations and replace it with their own. López-Austin (1988) is the main supporter of a New World origin of the hot-cold system. Foster responds that López-Austin is conflating reports of physical heat, such as fever and chills, with the metaphorical heat of the humoral system. Further, Foster makes clear that the distribution this humoral system coincides with regions of Spanish colonial influence, including the Philippines.

Similarly, Sobo's (1993) study of Jamaica shows evidence of both the humoral and Yoruba concepts. Hot and cold concepts are held along with the tripartite color symbology of black, red and white. The distinct history of Spanish and West African cultural influence lends support to this argument. In addition, a study of intestinal worms and their remedies in Dominica shows both West African and humoral influence (Quinlan et al. 2002). This evidence lends support to Foster's argument that medical concepts are theoretical constructs that can be used to explain a myriad of empirical observations. If these systems were too tied to their place of origin they would not be applicable in a new environment. However, as theoretical constructs, they become flexible enough to accommodate all medical information.

Beyond providing a theoretical framework for non-western medical systems that can travel with a people to aid in their elaboration of a new pharmacopoeia, ethnophysiological models help explain medical beliefs and practices to anthropologists and, more importantly, to rural health care providers. Early work in this realm was conducted by Foster who notes how the humoral system makes it difficult for clinicians to provide medicine via injection. Injections are considered very hot and, therefore, deleterious without a cold countermeasure; a phenomenon also described by Harman and Kurtz (1982). Bastien's (1985) dissertation was the source for the development of a clinic in Bolivia that integrates traditional medicine with biomedicine thus improving health care throughout the region (Bastien 1992). Mimi and Mark Nichter (Nichter 1989; Nichter 1991; Nichter and Nichter 1987) describe how an understanding of the South Indian concept of belly, as opposed to stomach, intestines and uterus, help to understand how pre-natal nutritional programs fail and why family planning initiatives are underutilized. Villa Rojas (1980) explains that Maya women don't want their tubes tied for fear of disrupting the *tipte'*. And, Etkin (1992) shows how the concept of side effects versus clinical activity is

culturally mediated and may alternate in the same drug (e.g. Benadryl which is either an antihistamine that causes drowsiness or a sleeping pill that causes mouth dryness).

Medical Anthropology And the Body in the Chiapas Highlands

Ethnomedicine in the Chiapas Highlands

Early studies of Highland Maya medicine very much follow the trends of medical anthropology in that the focus is overwhelmingly biased towards the personalistic. From the earliest studies, the claim is made that most illnesses are thought to arise from witchcraft (Villa Rojas 1947; 1963; 1990). Shortly thereafter, a focus on healers leads to an examination of cosmology and the nature of the human being (Cámara Barbachano 1966; Guiteras Holmes 1961; Vogt 1969; Vogt 1976). Because these studies are concerned with healers, rituals and symbolic issues, the common illnesses of everyday life are ignored. Thus, personalistic ills and cures are the sole topic of conversation and witchcraft and *nagualism* – belief in spirit helpers – take center stage as the causes of illness.

Like their predecessors, Fabrega and Silver (1973) are concerned with the symbolic and religious aspects of Highland Maya medicine. However, they do note that members of this population appear to have accurate knowledge about the biological aspects of disease. Though only a nod to the naturalistic realm of disease, this is a breakthrough in terms of acknowledging more to the story than witches and evil spirits (see also Holland 1989 [1963]). However, Harman and Kurtz (1982) claim that naturalistic disease etiology is an artifact of Protestant mission activity beginning in the 1940s.

Finally, studies of Highland Maya medical belief and practice enter the modern age of the biocultural paradigm with Berlin and Jara's (1993) study of *me' winik*. This disease has been

commonly considered to be a culture-bound syndrome. However this study shows its close relation to gallbladder disease. Like Rubel's study of *susto* as discussed above, this is a major blow to the myth of culture-bound syndromes; a giant leap for medical anthropology. Further, this has improved the health outlook of the Highland Maya as local physicians can avoid the tendency to misdiagnose *me' winik* as gastrointestinal or gynecological problems.

A similar study has been carried out by Luber (2002). This study considers an unusual illness known as second hair (*cha'lam tsots* in Maya), which also has existed in the past among the Mixe of Oaxaca. It has been made clear that this disease, though not known as second hair to biomedical practitioners, is simply malnutrition. The indigenous focus on a symptom often ignored by western doctors and their explanations of etiology, though biologically incomplete, do not invalidate the disease nor the empirical approach towards its understanding.

Likewise, Maffi's (1994) treatise on Highland Maya ethnosymptomology makes an attempt to consider the points of intersection between Tzeltal concepts and those of biomedicine. Though some of the explanations and concepts miss the target according to biomedical wisdom, they still point to real and consistent clusters of symptoms that are meaningful and precise. The ethnosymptomology, indeed, encodes particular health concerns and provides for particular and consistent responses to those concerns.

Perhaps the most productive realm of research confirming the empirical nature of Highland Maya medicine has been that of medicinal plants (Berlin and Berlin 1996; Berlin et al. 1995a; Berlin et al. 1995b; Brett 1994; Casagrande 2002; Stepp 2002; Stepp and Moerman 2001). This body of literature shows that plant selection does not exhibit random patterns of distribution and that these plants do display bioactivity for their claimed usage in clinical trials.

This is a system based on observation and experimentation, a far cry from the world of cosmology and witchcraft as described through the 1960s.

However, it is important to acknowledge that nothing relating to humans remains at rest. Likewise, the snapshot of medical belief and behavior developed above is only part of the story. There have been historical forces driving change in all aspects of Highland Maya life, including medical practice. Five centuries of European contact has provided new models of health and disease that are distinctly different than those of the Maya. Instead of replacing the old system, medical change is syncretic (Holland 1989 [1963]). A uniquely Maya blend of the two has been created.

Now, the Maya medical system is pluralistic in that individuals will use traditional and biomedicine interchangeably (Brett 1994; Casagrande 2002; Maffi 1994). People will generally first attempt to address the illness with household plant knowledge. If there is no improvement they will continue through a hierarchy of resort including pharmacies, clinics and traditional healers (Romanucci-Schwartz 1969).

It is important to note that the different categories are not thought to be exclusive. Indeed, to the Maya it is but one complex and integrated medical system. A healer may be sought to diagnose an illness through pulsing (Brett 1994; Metzger and Williams 1963). Yet, the suggested action may be more herbal remedies instead of, or in addition to, attempting a soul calling. Likewise, herbs and patent medicines may be utilized simultaneously (Casagrande 2002).

Most recently, the force of change in medical belief has taken the form of intervention of the INI (Instituto Nacional Indigenista) and Protestant missions (Harman and Kurtz 1982; Holland 1989 [1963]; Miller 1965). These two forces, taken together, have led to a reduction, or even loss, of the personalistic aspects of Highland Maya medicine. These ideas are in direct

conflict with those of European religion and biomedical practice and are denounced as primitive superstition.

At the same time, medicinal plant knowledge appears to be supported. This is due to its naturalistic focus. These ideas correspond highly with those of the outside world that come to the Maya, not only through government and religious organizations, but also through increased experience with media outlets such as radio and television and cure-all salesmen (Casagrande 2002).

However, subtle trends and correspondences are not the only forces driving this particular shift in outlook. Following Protestant missionization, accusations of witchcraft became common (Maffi 1994; Miller 1965; Nash 1967a; Nash 1973). The traditional curers were the ones targeted as witches and accusations typically bore with them death by lynching, dismemberment or burning. It became quite dangerous to be a personalistic healer in the highlands of Chiapas as evidenced by their current rarity. To illustrate the point, there are no traditional curers in the communities of Ch'ixal Tontik nor Nabil (Casagrande 2002).

The Body in the Chiapas Highlands

The earliest mention of Highland Maya concepts of the body, known to the author, is in Holland's (Holland 1962; Holland 1989 [1963]; Holland and Tharp 1964) early work on Maya medicine. A description of one healer's rudimentary concepts of anatomy and physiology are described and it is concluded that, "the Tzotzil have only vague and elementary knowledge of the human body ... The structure and function of bodily organs are poorly understood. The material components of the human body are [thought to be] simply flesh and bone" (Holland and Tharp 1964: 44).

Shortly thereafter, Nash argues that physiology plays no role in a curer's initial diagnosis of disease (Nash 1967b). This claim is echoed by Fabrega, Metzger and Williams (1970) who claim that, "the knowledge that underlies disease diagnoses and cure does not appear to depend in any significant way on an articulated set of native ideas about the structure and function of the body" (621). Fabrega and Silver add that healers don't think about illness in terms of physiology, the way a body is built and functions is not important to the medical system and that traditional healers do not have specialized knowledge about the body.

It would appear that a study of Highland Maya ethnophysiology would be a labor of futility. In truth, Maffi (1994) also notes this, "fundamental agreement in the literature that the body is not what healers centrally focus on" (23). However, as is argued above, the story is incomplete when attention is given exclusively to curers. The situation is made more clear when Maffi continues, "and that closely heeding bodily symptoms in diagnosis may even detract from their reputation as experienced practitioners" (*ibid.*: 23). Traditional healers have a vested interest in ignoring or downplaying physiological symptoms when they profit from dealing with personalistic causes of illness such as witchcraft and soul loss.

Support for this argument is provided by Stross (1976) who shows that the general population does have a broad vocabulary for body parts and that they show a distinct partonomy. He further notes that there may be in excess of 100 terms for emotions that include 'heart' as part of the term. This suggests a sense that part of the heart's role is in producing internal states such as emotions; a step towards collecting an ethnophysiology. Finally, Berlin and Castro (1988) make the case for a high level of detail in Highland Maya knowledge of body parts that extends into the body and, therefore, a pursuit of Highland Maya ethnophysiology may not be so futile

after all. A collection of body-based metaphors (Laughlin 1988) further suggests that the study of body parts and metaphor will also prove enlightening.

Summary

George Foster argues that there are two aspects to any medical system. The personalistic aspect concerns illnesses caused by aggressive agents – witches, spirits and gods – and their cures. The naturalistic aspect concerns illnesses that have natural and unmotivated causes and their cures.

Before Foster's model, the vast majority of medical anthropology uncritically concerned itself with what would come to be known as the personalistic aspects. This led to the illusion that cultures around the world relied exclusively on priests and witchdoctors to maintain health. However, there were a number of researchers concerned solely with biomedically known diseases in exotic locations. By delineating these two facets of medicine, Foster made it possible for these two camps to communicate and this much improved the objective reporting of ethnomedical systems.

Likewise, the study of the body has been segregated into two camps. One camp studies the physical body: lung capacity, cold resistance, limb length, physical evolution. The other camp is concerned with the social body: adornment, disembodiment. However, as in the case of medical anthropology in general, the combination of these two facets has proved fruitful.

From this unification comes ethnophysiology. This is the study of indigenous concepts of body function. As stated in chapter one, ethnophysiology provides the key to a full understanding of the theories underlying ethnomedical concepts. However, little research in this topic has been done.

In terms of highland Chiapas, the body and ethnophysiology has been mostly ignored. What little there is has been biased by a focus on personalistic aspects of Maya medicine and by a reliance on traditional curers as informants. Therefore, an illusion is projected of the Maya's complete lack of physiological knowledge. This study remedies that glaring hole in the literature.

As concepts of ethnophysiology are shown to be ripe terrain for metaphor, this aspect of Tzeltal Physiology will be addressed. However, a better understanding of metaphor is important prior to proceeding.

Chapter 5

The Role of Metaphor in Human Cognition

Introduction

Lakoff and Johnson (1980) argue that conceptual, or cognitive, metaphors structure the way we think about and approach the world. This in turn is reflected in everyday speech. For example, statements such as “they are in love” or “they fell out of love” suggest the cognitive metaphor, ‘love is a container’. Their study lays the foundation for an approach to metaphor from an empirical standpoint. However, the source of these cognitive metaphors is not suggested.

Johnson (1987) suggests that the root of metaphor is to be found in the human body. Specifically, it is the fact that we are bipedal beings that are primarily visual which defines our experience of the world. Also, it is argued that cognitive metaphors are pre-linguistic in nature. Therefore containers, with substances entering and exiting, are suggested by the corporeal body which must eat and excrete, happy is up while sad is down are suggested by our posture as associated with these emotions, and sacred is up while profane is down is suggested when rationality is associated with visual experience and base emotions are associated with the genitalia and excretory functions lower in the body.

It should be noted that it is implicit in the argument that the environment plays a role in structuring these metaphors. Cresswell further elaborates the bodily and environmental nature of metaphor. He argues that metaphor is central and active to our understanding and to the way we react to and live in the world. Cresswell suggests that three metaphors — “weed,” “disease,” and “secretion” — are used to label people and actions as “out-of-place.” Not only do the metaphors

label but also define the appropriate reaction to the offending agents; they should be removed, treated and prevented.

Effects of metaphor in science

Turner (1987) considers metaphor to be “the basic form of symbolism through which knowledge of the world is forged” (*ibid.*: 44). He suggests that scholars and scientists, among others, create the world through metaphor. Specifically

“metaphor has and continues to be the pregnant mother of science and seminal thought; but failure to understand the reproductive process of language and its offspring will give birth to numerous reifications of metaphors, a miscarriage of theory” (*ibid.*: 59).

Through this extended metaphor, Turner argues that science, as does all knowledge, changes via metaphor. Also, he warns that if scholars and scientists do not become aware of the metaphors they are using, they will become trapped in an unproductive intellectual environment. For example, the analysis of culture as if it were an organism has led to many discoveries and insights. However, this metaphor has run its course and is no longer useful. Unfortunately, this metaphor occasionally is still invoked but provides no new insight (Levine 1995).

Similarly, Nash (1963) observes that metaphor has helped generate theory. Although metaphoric thinking is thought of as primitive and unscientific, much of science has been promoted and hindered by metaphor. Though a scientist may be unaware of the role of metaphor in their work, it does provide three functions for theory: 1) communication, 2) generation and elaboration, and 3) analysis. For example,

“blood was once thought to trickle to the tissues much as rainwater trickles to and irrigates a field. Replacement of this agricultural metaphor by a mechanical one (the pump) marks the beginning of modern theories of cardiovascular and respiratory action” (*ibid.*: 336).

In a more specific study Levine (1995) describes the presence of the organism metaphor in the social sciences as discussed above. Levine, like both Nash and Turner, warns us of the dangers of abusing metaphors in social science. By abuse, he means uncritical use. Using a metaphor unconsciously or uncritically, he warns, can lead to stagnation and unproductive research. However, intelligent and critical use can lead to new discoveries.

Metaphor in the Ethnographic Record

The discussion of metaphor use cross-culturally suggests that it is not a western trait, but a human universal. If metaphor use is a human universal, it then follows that the role of metaphor in cognition may also be universal.

Scoditti (1984), Pannell (1989), and de Boeck (1994) provide us with description of metaphor in cross-cultural settings that address the first part of the equation. Scoditti (1984), working among the Kitawa in Northern Massim argues that the rite of initiation into the profession of prow carving “embodies metaphorically the aesthetic philosophy of Kitawa carvers” (*ibid.*: 50). In Mayawo marriage rituals and discourse, according to Pannell (1989), metaphor explains and facilitates the transformations in social identity which marriage rituals are supposed to effect. And de Boeck (1994) suggests that the political structure of the Aluund of Zaire is related to a complex metaphor of trees and knots (features of a particular tree in the region). The tree metaphor is also used in healing by integrating the corporeal, the social, and the cosmological.

Ahlers (1997) suggests that, after preliminary work among Hupa speakers, the discovery of cognitive metaphor is quite possible in an exotic language if a good local collaborator is trained and worked with carefully. Further, Ahlers argues that “it is metaphor that makes a language distinct from other languages — it reflects the culture of the speakers more clearly than morphology and syntax can” (*ibid.*: 70), and that, “it is through metaphor that values and worldview show up most strongly in language” (*ibid.*: 71). For example, Keen (1995), claims that the use of the term “clan” to describe Yolngu kinship groups suggests images of external boundaries and taxonomic hierarchy. These understandings held by western peoples do not capture the Yolngu sense of family, which follows their sense of place in extending outward from a focal person or feature.

However, Keesing (1985) assesses the dangers of over-interpretation by ethnographers. He asks, “are we prone to attribute deeper salience to other peoples’ way of talk than they in fact imply?” (*ibid.*: 201). He argues that if our everyday talk is pervaded by metaphor then so is everyday talk everywhere else. He rebukes ethnographers suggesting metaphysical beliefs or cosmologies that do not, indeed, exist. Keesing insists that “we cannot assume other peoples’ ways of talking have qualitatively different depths of meaning for them than our ways of talking have for us” (*ibid.*: 202). The belief that native conceptual metaphor is metaphysical, he argues, is ethnocentric because it contrasts their primitive state to our sophistication.

In response to Keesing, researchers have turned their attention on western populations and have found that metaphor, though not necessarily metaphysical, certainly provides structural constructs. Lakoff (1995) has studied the role of metaphor in American politics. He suggests that the strength and unity of conservatives in this country is based on shared metaphors. However, liberals are less attuned to their organizing structure than are conservatives. Therefore, liberals

are more easily split against themselves. Further, McCloskey (1995) explains how economists make use of both a market metaphor and a life cycle metaphor and likens models to metaphors. It is suggested that disagreements between economists often turn on metaphorical choices.

These studies showing the power of metaphor in thought are conducted in English. In fact, the discovery of conceptual metaphors may be greatly eased by careful study of a language in which the researcher is fluent. Therefore, methods and theory are most effectively fine-tuned in the researcher's native tongue.

Summary

Lakoff and Johnson propose that metaphors are not merely the stuff of literature, but rather a fundamental aspect of how the human brain works. There is now sufficient evidence to suggest that the hypothesis proposed by Lakoff and Johnson (1980) and further elaborated by Johnson (1987) and Lakoff (1986) is reasonable and bears further research in cross-cultural settings. Research on this issue will provide important information about how the mind works. Cross-cultural studies, once compared, can shed light on which aspects of metaphorical cognition are human universal and which are baroque trappings derived from the environment and other sources.

Chapter 6

Methods

Introduction

The two main objectives of this research are to describe, systematically, Highland Maya ethnophysiology (objective 1) and to describe the use of metaphor as applied to its description (objective 2). Objective 1 is addressed by two procedures:

- 1) Establish and describe the domain of ethnoanatomy, from which physiological processes and relationships in the human body stem.
- 2) Describe these physiological processes and relationships.

Objective 2 is addressed by procedure 3:

- 3) Discover the structure of Highland Maya metaphor as applied to physiological processes and relationships

Five distinct methods are utilized in this study: free listing, paired comparisons, triadic comparisons, the semi-structured interview and the binary fixed-response questionnaire. Each of these methods is described below under each of the procedures to which it relates.

Procedure 1: Establish and Describe the Domain of Highland Maya Ethnoanatomy

Free Lists

In order to begin the study of ethnophysiology, or the processes supporting life, one must begin with knowledge of all of the body parts that play a role in these processes. As described above, the anatomical bases of Highland Maya ethnophysiology differ from those established by biomedicine.

To this end, free lists are used to define the domain of internal anatomy (Weller and Romney 1988). To build upon unpublished data collected by Elois Ann Berlin, informants, stratified by age and gender are asked, “What is the name of everything inside the body?” Resulting data establish the this portion of the shared domain of ethnoanatomy. The free list further provides data on the salience of each organ (Romney and D'Andrade 1964). Cultural salience is found by the frequency with which each item is named or by determining the average placement of each item across all informants’ responses. In the case of ethnoanatomy, where inclusion in the domain is highly agreed upon, the latter will play a greater role in determining salience.

Then a multidimensional scaling (MDS) plot derived from the free lists is constructed (Borgatti 1996b; D'Andrade et al. 1972; Gower 1967). This provides for a physical representation of the cognitive geography of Maya anatomy. Finally, each item in the domain will be used to construct a paired comparison instrument and a series of semi-structured interviews.

Procedure 2: Describe Physiological Processes and Relationships Contained in Highland Maya Ethnophysiology

Paired Comparisons

Paired comparison experiments follow. Informants are asked to judge which of each pair of items, as derived from the free list, is most important to the maintenance of life. By calculating the frequency with which each item of the domain is deemed more important, these allow the ranking of each ethnoanatomical feature in terms of how vital it is considered for human survival.

Moreover, these experiments provide dichotomous data adequate to perform a consensus analysis of the informants' responses (Romney et al. 1986). Consensus analysis is used to develop a composite of all of the informants' knowledge through an aggregate matrix of all responses. The reliability of each informant is then calculated based upon the frequency with which they respond similarly to the aggregate (Weller and Romney 1988).

Semi-Structured Interviews

Knowledgeable participants, as established through the consensus analysis, are then selected as key informants for a series of semi-structured interviews. This method allows for goal oriented interviewing while allowing the research subject to elaborate and expand on each ethnoanatomical entity and their interrelationships.

These interviews are aimed at collecting in-depth information about Maya concepts of physiology and anatomy. Each informant participates in a series of interviews. For each item, each informant is asked: "Where is the [X]?" (*banti ay te [X]*); "What does [X] look like?" (*bi yu'un k'ilat te [X]*) and ; "What is [X] job?" (*bi a'tel te [X]*). Each item's relationships with other

items are explored with probes derived from the free list interviews and the MDS plot arising from the free list.

Each interview is transcribed and translated with the help of a Tzeltal collaborator. These data provide for a systematic description of the Highland Maya ethnophysiological system.

Binary Fixed-Response Questionnaire

The model derived from the semi-structured interviews is the foundation for a 123 question binary fixed-response (true/false) survey. Statements such as, *te ja' ya skap sba sok jch'ich'eltik ta tsukum* ('the water mixes with the blood in the stomach') are read to the informant and they are then asked to decide whether the statement is true. This instrument is given to 100 individuals from the municipality of Tenejapa. The responses to this instrument are aggregated into a similarity matrix and a consensus analysis, as described above, is performed.

Procedure 3: Discover the Structure of Highland Maya Metaphor as Applied to Physiological Processes and Relationships.

All of the responses from the semi-structured interviews are coded for metaphoric references. All overt metaphoric usage is categorized and aggregated into categories. These categories are analyzed for redundant themes and again aggregated to create a taxonomy reflecting the source of the metaphoric referents. For example, Villa Rojas (1980) describes the *tipite*, an organ that controls body function and functions like the ticking of a clock. This metaphoric reference would be placed in the taxonomy culminating in the cultural, as opposed to natural, environment.

Chapter 7

Results of Cognitive Methods

Free List

Thirty informants were asked to list all of the organs inside of the body. The demographic profile of the informant pool consisted of 13 males and 17 females ranging from 19 to 75 years of age². Each person was asked, *binti sbil jujuten ta util te baketal* ('what is the name of everything that is inside the body?') and the responses noted in order. These data were input into the ANTHROPAC (Borgatti 1996a) free list data function and analyzed for item salience, cultural consensus, and item inclusion in the domain. Then a multi-dimensional scaling (MDS) plot was constructed from these data.

The informants collectively named fourteen organs. The following table (Table 1) lists each organ and its frequency of response out of thirty informants, the percentage of informants who named the organ, the organ's average rank in the lists and the organ's cultural salience.

The eigenvalues of the input matrix are calculated by ANTHROPAC in its consensus function. It is held that two large eigenvalues suggest the presence of two or more "cultures" at play in the data. Thus a ratio of 3 or higher suggests a shared model (Romney et al. 1986). As the ratio between the first and second eigenvalue is 6.105 there is strong evidence for cultural consensus for these data. Thus, I do not need to segregate the informant pool by age or sex to

²While younger informants were generally consistent in the reports of their age, the older one became, the more fluid their age became in numerical terms. While a 19 year old would become an 18 year old, or vice versa, over a 2-week period, a 50 year old could become 55. Age appears to be more strongly correlated with social role than with chronological time thus, to give or take 5 years among the senior citizens is of no grave consequence.

Table 1: Summary of free list data

Item	Item in Tzeltal	Frequency	Response Percentage	Average Rank	Smith's S
Heart	<i>o'tanil</i>	30	100	2.533	.760
Liver	<i>sejkubil</i>	30	100	3.067	.712
Large intestine	<i>mukul bikil</i>	30	100	4.167	.549
Large stomach	<i>mukul tsukum</i>	27	90	4.000	.524
Lung	<i>putz'il</i>	22	73	4.000	.415
Gallbladder	<i>ch'ajil</i>	21	70	4.286	.372
Kidney	<i>k'inil</i>	19	63	5.684	.214
Blood	<i>ch'ich'el</i>	11	37	4.545	.208
Small stomach	<i>ch'in tsukum</i>	9	30	6.333	.102
Small intestine	<i>ch'in bikil</i>	7	23	6.286	.090
Vein	<i>ch'ial</i>	1	3	6.000	.015
Bone	<i>bak'el</i>	1	3	9.000	.004
Pancreas	<i>kaxal</i>	1	3	7.000	.005
Throat	<i>tutubil</i>	1	3	2.000	.029

find meaningful cultural models. Accepting the suggestion of consensus, I then produced a multi-dimensional scaling (MDS) plot of these data based on the dissimilarities matrix produced by the cultural consensus application (Figure 6). However, I removed the four items that were mentioned by only one informant.

I have taken the liberty to rotate the image to facilitate the following discussion. When graphed, instead of forming a cluster centered on the heart, a reasonable expectation based on its high salience, the plot displays a spatial orientation to the free list data. What I have found is an analog organizing structure that supplants the patterns found in larger, less constrained domains. Here, the organs are listed from the highest to the lowest in the body. The heart, which is highest organ was named first, except in the one case where the throat was named.

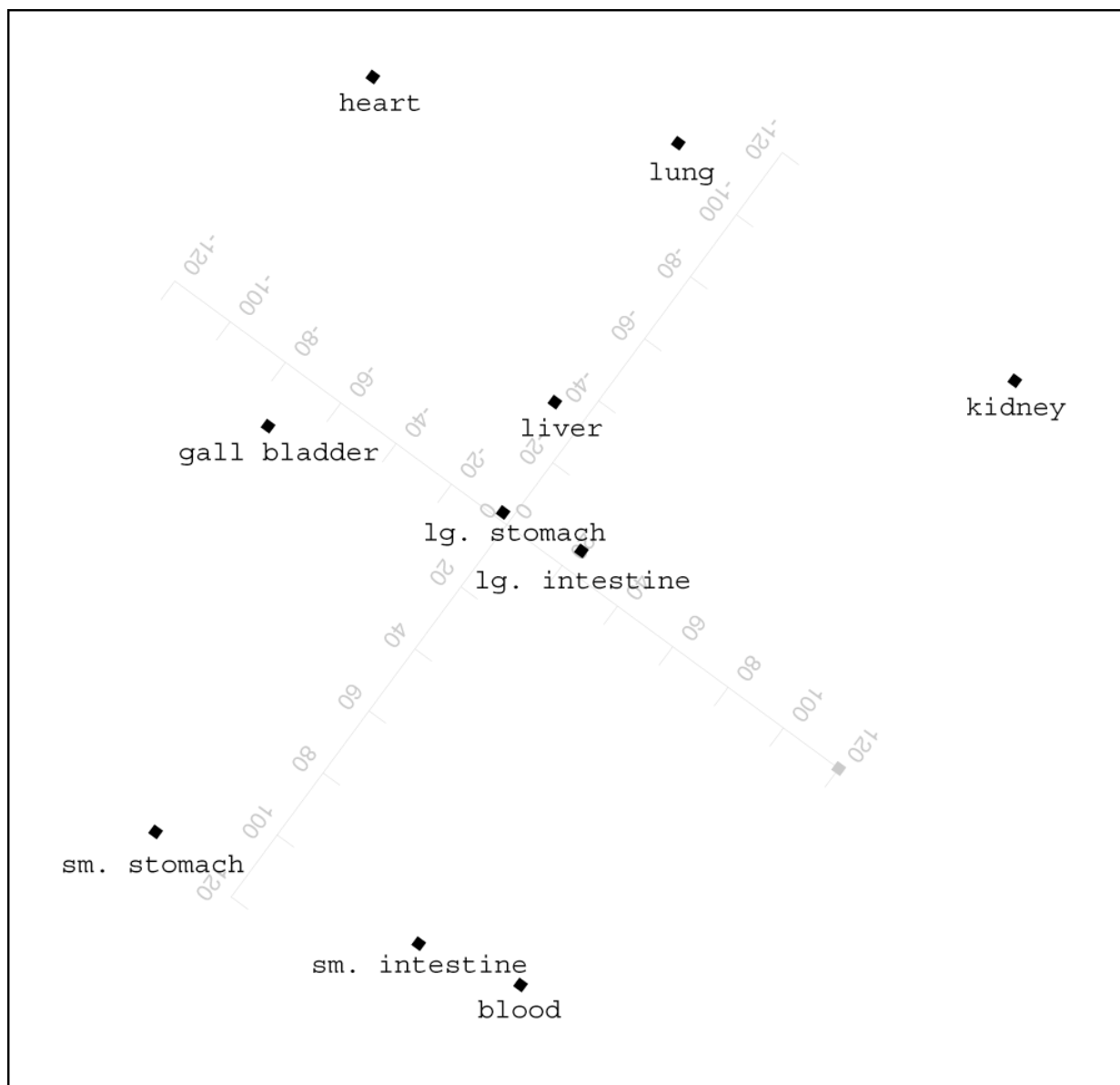


Figure 6. Multi-dimensional scaling plot of free list data displaying a geographical orientation of organs in two dimensional space. Stress = .108.

Three exceptions to this model are found; the kidney, the small stomach and blood. In terms of the kidney, there are two different widely held beliefs and will be described below. In short, there may be one or two and this bears on their location. The position of the kidney in this graph better corresponds to the position of the kidney when there is thought to be one, but is still

relevant to the position of two. The small stomach is an organ not believed to be present by all. When thought to be present the small stomach is thought to be found between the large stomach and the large intestine. Here it appears quite low, probably due to its infrequent naming. Finally, blood flows throughout the body and thus cannot be placed by this type of graph.

Of course the organization could have been bottom up, or central, radiating out. I think that it may be based in common natural processes. The most natural and healthy flow associated with the body also has this top down pattern: eating and drinking. Food and liquid go into the mouth. Then down they go to the inevitable outcome via the anus or urinary tract. This natural process is experienced every day and in the case of the Highland Maya an often rather well felt and rapid process due to the high incidence of diarrhea. It follows that thoughts about the invisible aspects of the inner body will be organized by this charismatic course.

However, I do not want to unseat the heart's reign as the most salient of the organs. The other data collected, and discussed below, proves this without a doubt. On the other hand, the liver does not prove to be at all salient in terms of known function and importance in the maintenance of life.

Paired Comparisons

Twenty-nine informants (15 male, 14 female reported ages 18 to 73) were given paired comparison tests developed from the free list data described above (see Appendix A). The informant was asked to judge which of each presented pair is the most important for the maintenance of life.

Demographic Profiles

These data are variously aggregated into three main groups – everyone, males, females – each of which was further re-aggregated in three different configurations - all, 25+, 35+. These various aggregations are used to explore age and sex effects³.

The demographic profile of each of these aggregations is as follows: everyone/all (see above), everyone/25+ (12 males and 8 females ages 26 to 73), everyone/35+ (8 males and 6 females ages 35 to 73), males/all (15 males ages 18 to 73), males/25+ (12 males ages 25 to 73), males/35+ (8 males ages 35 to 73), females/all (14 females ages 19 to 65), females/25+ (8 females ages 26 to 65) and females/35+ (6 females ages 35 to 65).

Results

Table 2 shows the relative rankings of items, based on the pairing responses, for all of the subgroups. All of these rankings are produced from the aggregate matrix output of the paired comparisons function of ANTHROPAC software (Borgatti 1996a). The numbers presented in the following table are approximate interval scores for each item derived from averaging each informant's response matrix. The zero line is merely a median marker with positive and negative results merely describing variance from the mean. Figure 7 is a graphical representation of these data.

³ I am fully aware of the body of research that denies the role of biological sex in ordering of social realities. According to these researchers, it is social expectations and chosen roles that define one's gender, which in turn defines their interface with the constructed social world. It is not my goal here to argue the pros and cons of this research paradigm. Instead, it is plainly obvious to me that, in the context of the Highland Maya, biological 'sex' does, invariably, coincide with 'gender' roles. Therefore, in the absence of further inquiry into this fascinating issue, I have actualized my research based on empirically observed biological sex, as opposed to the scintillating arabesques of socially derived gender.

Table 2. Approximate interval scores for each ethnoanatomical item of the paired comparison task. Each informant was asked, “which of each pair is most important for maintaining life?”

Organ	All	All 25+	All 35+	Male	Male 25+	Male 35+	Female	Female 25+	Female 35+
Blood	.62	.75	.81	.77	.93	.99	.56	.68	.65
Heart	.46	.53	.72	.58	.65	.98	.39	.51	.70
Lungs	.17	.18	.19	-.02	.02	-.02	.31	.47	.47
Sm. Stomach	.06	.14	.22	-.08	.03	.17	.21	.31	.37
Lg. Intestine	.02	.06	.17	.13	.08	.33	-.11	.10	.15
Lg. Stomach	-.09	-.06	-.11	.03	-.01	-.07	-.19	-.12	-.22
Liver	-.23	-.34	-.37	-.24	-.28	-.33	-.23	-.53	-.58
Gallbladder	-.32	-.42	-.64	-.42	-.60	-1.02	-.21	-.21	-.32
Kidneys	-.32	-.53	-.69	-.35	-.52	-.88	-.33	-.73	-.66
Sm. Intestine	-.37	-.32	-.30	-.39	-.30	-.15	-.40	-.48	-.56

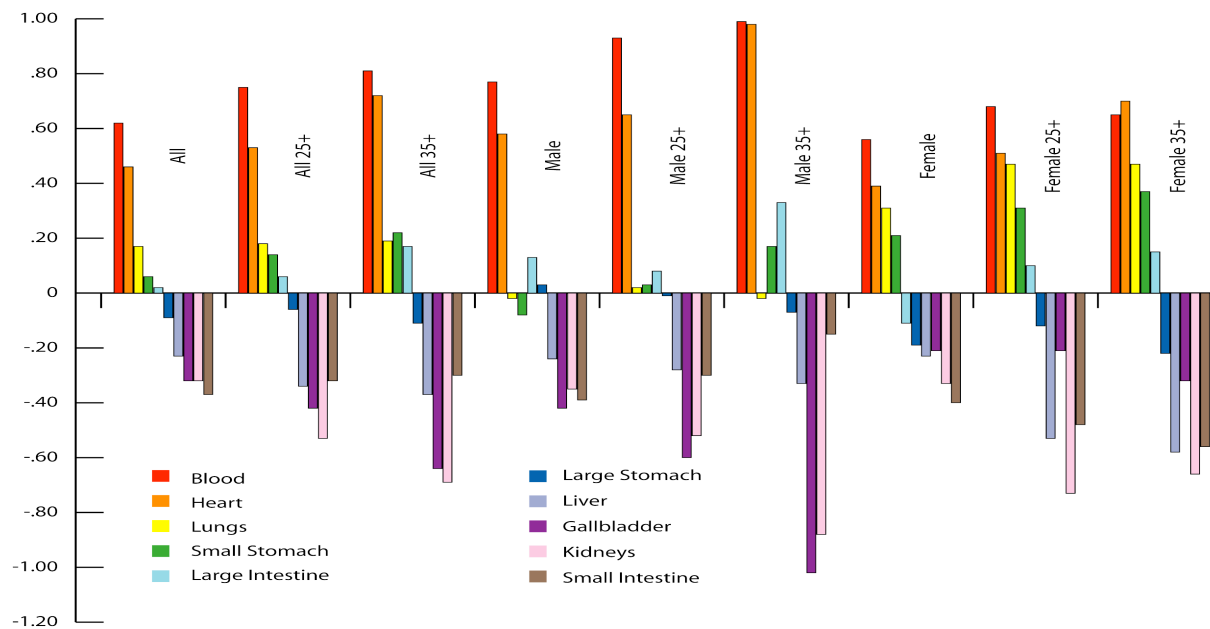


Figure 7. Graphic representation of the data presented in Table 2.

None of the subsets could be definitively said to meet the minimum requirements of consensus as the ratio of the first to the second eigenvalues is less than three in all cases (Romney et al. 1986). However, the eigenvalue ratio does come close in four of the population

clusters: everyone 25 and over (eigenvalue ratio = 2.529), everyone 35 and over (eigenvalue ratio = 2.532), all males (eigenvalue ratio = 2.787) and females 35 and over (eigenvalue ratio = 2.625). This, coupled with strong patterning across the distributions allows for a meaningful analysis regardless of eigenvalue performance.

By aggregating the above data by item, the pattern across groups is made clear (Figure 8). First, the blood and the heart are distinctly the most important for the maintenance of life. The cluster is consistent in that the blood is ranked higher than the heart for all groups but one. Further, this cluster is separated from the next by an average of 40 points.

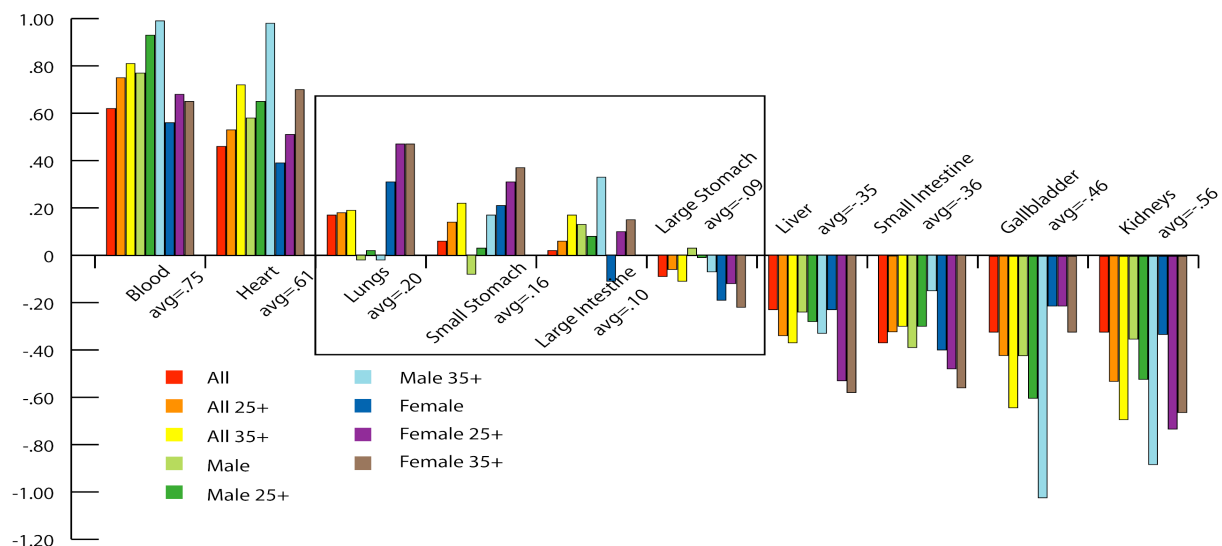


Figure 8. Paired comparison data aggregated by item. The average rank of each organ across all groups is presented. Three distinct partitions are evident.

The next cluster – lungs, both stomachs and the large intestine – make up the second tier of items. This cluster does not follow a distinct pattern in ranking, with each of the four items, except for the large stomach, possessing the highest rank in at least one demographic grouping.

However, the large stomach was ranked lowest in the cluster by all groups with the exception of the all males group. Additionally, all items in this cluster hover around the median line with each item variably ranked above or below the median depending on demographic grouping.

Finally there is a third tier of organs: the liver, small intestine, gallbladder and kidneys. Each of these organs falls distinctly below the median line. Like the second tier cluster, there is variation in the rankings of individual organs across demographic groupings. However, the liver is never ranked last, and the kidneys are never ranked highest among the organs in this cluster.

The average ranks of the liver and small intestine are quite close, differing by only one point. The highest and lowest rank of the small intestine and the liver respectively are: -.15, -.56 and -.23 and -.58. On both of these metrics, the small intestine ranks higher than the liver. It is perhaps chance variation that has led to the liver's higher average ranking.

The apparent lack of consensus regards the relative importance of specific organs , but a consistent pattern of broader organ systems is evident. It is clear that, to the Tzeltal, the heart and blood are definitively the most important elements of the body in the maintenance of life. With the exception of the lung, the second tier cluster is composed of the alimentary canal. However, the small intestine falls in the third tier. The third tier cluster of organs, with the exception of the small intestine, is composed of organs that do not move or, “do anything” in the words of a number of informants as presented below.

If the average ranking of three systems – cardiovascular (heart, blood and lungs), gastrointestinal (stomachs and intestines) and organs that “do nothing” (liver, gallbladder, kidneys) – derived from interviews, as discussed below, is calculated the pattern is very clear (Figure 9). The cardiovascular system is highly ranked, the gastrointestinal system is near the median and the other organs are ranked lowest.

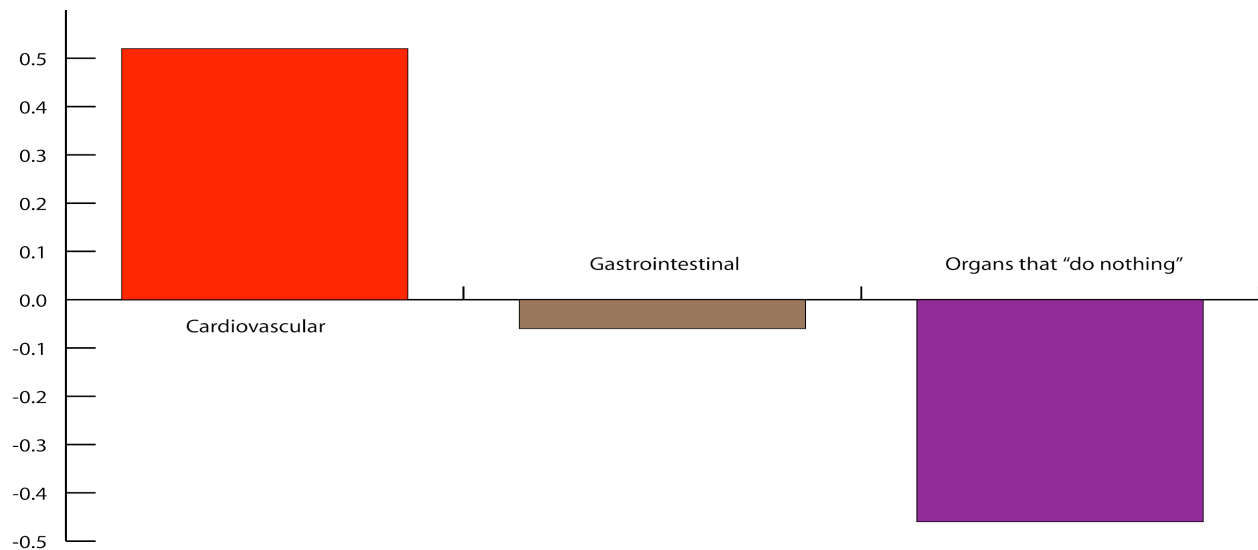


Figure 9. Paired comparison data aggregated by body system. The the average of the average rank of each organ in each system is used to calculate the ranking.

It can be predicted from these data that the cardiovascular system will be the primary system of body maintenance with the gastrointestinal following in importance. Finally, the third tier organs will be the least well known. As will be seen below, these predictions bear out in the other experiments.

Summary

The first two methods used in this study are the free list and paired comparison tasks. The free list establishes the domain of internal anatomy. Ten items were named by more than one informant: the heart, the lung, the large and small stomachs, the large and small intestines, the liver, the gallbladder, the kidneys and blood. A multi dimensional scaling plot derived from the free list suggests that the inside of the body is cognized spatially and items are listed from the top down.

The paired comparison task developed from the free list data show a distinct bias towards the importance of the cardiovascular system as defined by the Tzeltal. The gastrointestinal system is of middling importance, while the rest of the organs are considered the least important. These findings parallel the data collected in the semi-structured interviews as discussed below.

Chapter 8

Ethnoanatomy of Internal Organs

Based on the findings from the free list task and the paired comparison experiment, semi-structured interviews were developed. A series of questions was developed for each organ, as named in the free list, including location, appearance and function. As informants responded to questions, follow up inquiries were developed from the responses. Interview time varied from one to four hours, depending on informant interest and tolerance.

A total of 47 interviews were conducted with 25 females and 22 males between the ages of 15 and 70. All of the interviews were taped except for 13 who declined. The taped interviews were then transcribed and translated by two bilingual Tzeltal speakers from Tenejapa who lived in San Cristobal. The transcriptions were then coded and analyzed by topic. No real differences by age or sex emerged so the discussions below are based on the entire sample.

O'tanil: The Maya Heart

The heart, as known to biomedical science, is a fist sized muscle located behind the ribcage just over the solar plexus (Figure 10). It is in the center of the body with two thirds extending to the left of the median line. It has four chambers: the right and left atria and the right and left ventricles. Deoxygenated blood enters the right atrium from the body. Blood then flows to the right ventricle where it is pumped to the lungs. Here the blood releases carbon dioxide and collects oxygen. The blood then re-enters the heart at the left atrium. From there it passes to the

left ventricle. It is from there that the blood is pumped throughout the body (Tortora and Grabowski 1993: 592-597).

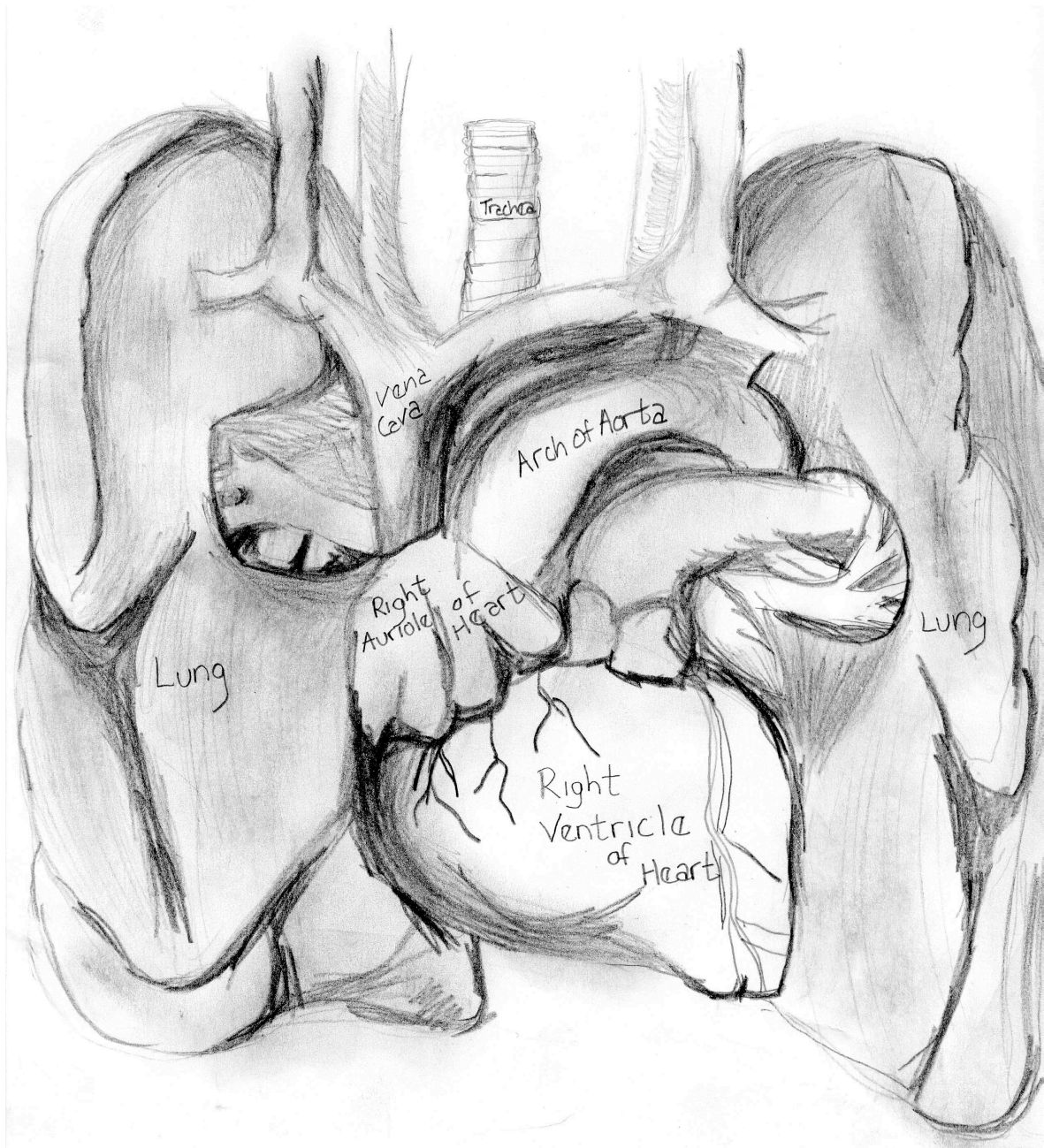


Figure 10. The location of the heart in the body and its morphology.

At this juncture, I must note that Maffi (1994) is wary of glossing *o'tanil* as heart and would rather gloss it as chest or air passages (*ibid.*: 194). My interview data show a distinct bias to the 'heart' gloss for *o'tanil*, though a 'chest' usage is also evident. Therefore, it is clear that the term is polysemous and refers to both. This topic will be taken up in chapter 10 where it is more appropriate.

Table 3. Selected transcribed quotations on the appearance of the heart.

<i>bi yilel ko'tantik, ja' nax te ala bik'it nax te jko'tantik jich nax yala muk'ul, komo ay smarka sluchiw, ja'nix jich bit'il chambalam eke, jich ko'antik ek</i> What does the heart look like? Its small and its like it has horns. Its sort of oval. Our heart is like the one of the animals.
<i>bi la yilel te ko'tantike</i> What does the heart look like? <i>ala telel</i> Its oval.
<i>bi la yilel te ko'tantike</i> What does the heart look like? <i>wolol i ma</i> Its round.
<i>bi la yilel te ko'tantike</i> What does the heart look like? <i>wolol niwan telel niwan</i> Spherical, perhaps.

To the Tzeltal, the heart is a small, round or oval structure located below the ribcage (Table 3). Elois Ann Berlin believes that this placement may be suggested by the beating of the abdominal aorta (personal communication). It is the organ of primary importance to the Tzeltal

Table 4. Selected transcribed quotations highlighting the heart's primary role of "allowing us to live."

<i>ja'me jicha sk'an, meel la sna'ix stojol binti kuxulotik, tek'elotikix, komo ya jna'tik stojol ts'i'</i> <i>ja'nanix kuxulotik a te la choltikix, te jko'tantike ja kuxulotik yu'un, te jputstike ja'te jkich'tik</i> <i>ik'e ya sbentes te jch'ich'eltike</i> That's it, we know how we live. We are standing and we know how we have life; our hearts give us life. Our lungs breathe and make the blood circulate.
<i>kuxulotik yu'un te jko'tanik la jkaltikix, ja' nax la bal jich ya'tel a te ye o ay to la bal ya'tel xan</i> <i>yan</i> You have said that the heart gives us life. Is that its only work or does it do something else? <i>ay nax, ja'te bit'il ayotikix a</i> Yes, it is our sense of being.
<i>bi a'tel te o'tanil</i> What is the heart's work? <i>ja' tey kuxulotik a</i> From it we live.

Table 5. Selected transcribed quotations showing the relation of the heart to the lungs

<i>bi la ut'il este k'alal ya jkich'tik ik'e ja' ya stij sba ts'i</i> How is it that when we breathe it [the heart] moves? <i>ya stij sba ts'i pero casi majik sok ts'i sot'otike putstike</i> It moves together with the lungs.
<i>bi la ut'il x'a'tej ta maja ts'i te como ya jna'tik ya jkich'tik ik'y sok a ts'i jko'tantike y bi la yut</i> <i>sba</i> How does the breath [and the lungs] work with our hearts, how do they communicate? <i>bueno este pues yaniwan stilule sba, como ma jna'tik stojol</i> Well I think they move, I'm not sure.
<i>Se mueve entre los dos el corazon y el sot'otil para que asi tiene sangre.</i> They move together, the heart and the lung, so that we have blood.
<i>jala ts'i ko'tantike este ay la bal este cha' xajt' binti tey a te ko'tantik ch'i</i> Are there other parts of the heart? <i>sot'otik, putstik, ja' nax a bi</i> Just the lungs.

Maya. “Our heart is how we live,” or, “Our heart is our sense of being” are common themes when discussing the organ (Table 4). The role of the heart is captured by one informant in saying, “we are standing and we know how we have life; our heart gives us life.” Further, Maffi (1994) notes that “virtually all authors on the Highland Maya have reported that the ‘heart’ is considered to be the ultimate source of heat ... also seen as the source of strength and power in the body” (203).

Table 6. Selected transcribed quotations highlighting the heart’s role in breathing.

<i>kich'tik ochel ik' xbajt ta jko'tantik</i> When we breathe the air goes to our hearts.
<i>ja'nix laba sbabi ya xk'ot te ik' ta jko'tantike y patila bal ya xk'ot ta putstike</i> Does the air go to our hearts or the lung first?
<i>ja' sba te jko'tantike y xk'ot ta jputstik</i> First our hearts and then our lungs.
<i>ja'me jich a sk'an, meel la sna'ix stojol binti kuxulotik, tek'elotikix, como ya jna'tik stojol ts'i ja' na nix kuxulotik a te la choltikix, te jko'tantike ja kuxulotik yu'un, te jputstike ja'te jkich'tik ik'e ya sbentes te jch'ic'eltike</i> That's it, we know how we live. We are standing and we know how we have life; our hearts give us life. our lungs breathe and make the blood circulate.
<i>ko'tantik ya x'och tal li' ta jketik nix xbajt' ta jko'tantik</i> The heart. It [air] enters our mouth and goes to our hearts.
<i>ja'ts'i ko'tantike ta skolta te ya xk'ixtik ik'e</i> The air goes to the heart and it [blood] circulates.
<i>a'nix te ya kich' kiptik yu'un te ch'ich'eltik te ya xtal ta ko'tantike ja'tey yich'otal ik' a te ko'tantike te ch'ich'eltike</i> We breathe life force with air into the heart and the heart makes it circulate with the blood.
<i>ay la ba este yantik xan a te ko'tantik</i> Are there various parts of the heart?
<i>ja' ts'i ya kich'tik ik'e kich'otik ik' sok te jch'ich'eltike</i> There we breathe in the air with our blood.

The lung is seen as a part or lobe of the heart (Table 5). Likewise, Holland (1962: 156-157) glosses the organ *ko'onton* – a Tzotzil dialectical variation of *o'tanil* – as ‘heart, lung.’ Though Maffi (1994) claims there is no indication that the Tzeltal believe that there is communication between the conduits of air and the heart, my informants make it clear that when we breathe the movement of the lung draws air into the heart (Table 6). When the air reaches the uheart it gives us the sensation of life and if air fails to enter the heart we will die. As, “They move together, the heart and the lung, so that we have blood,” it is the pressure of air in the heart that impels the blood to circulate (Table 7). This supports Maffi (1994) who reports that “some people specify that the function of breathing is to help the heart pump the blood around the body” (194).

Table 7. Selected transcribed quotations highlighting the heart’s role in the circulation of the blood.

ja' me jich a sk'an, melet la sna'ix stojol binti kuxulotik, tek'elotikix, como ya jna'tik stojol ts'i ja' na nix kuxulotik a te la choltikix, te jko'tantike ja kuxulotik yu'un, te jputstike ja'te jkich'tik ik'e ya sbentes te jch'ic'eltike

That's it, we know how we live. We are standing and we know how we have life; our hearts give us life. our lungs breathe and make the blood circulate.

ja'nix te ch'ich'eltike yich'oj yip te bi ya pastike, ja' ya x'a'tej te ch'ich'eltike ya yich' tal yip ta ko'tantik

The blood gets life force in the heart and then begins to circulate.

bi la ut'il ya stak' ya xjul ta ko'tantik te yip te ch'ich'eltike

How does the life force in the heart make the blood circulate?

ja'te ya kich'tik ik'etike

Its when we breathe.

The heart is the primary source of *ip* – henceforth glossed as life force – which it extracts from air and delivers throughout the body via blood (Table 8). When the life force of the heart is diminished so is that of the blood and, by extension, the rest of the body.

Table 8. Selected transcribed quotations highlighting the heart’s role in providing life force

<i>ay nax yat'el te jko'tantike lek a te bit'il kich'oj kiptik a te bit'il xulotik xkaltik, x'a'tej te jko'tantike</i> With our heart we have life force and that's how we live and work.
<i>ja'nix te jko'tantik te ya spas tulane swenta yich'yip te jbak'etaltike, ja'nix sok te jch'ich'eltike yich'o yip ta tulane</i> It is only our hearts that give life force to our bodies. It is through our blood that it gets life force.
<i>li'nix ay kiptik ta kok k'abtik ta chialtik ja'nix te ta ko'tantike</i> They [the veins] get the life force from the heart.
<i>bi la ut'il te ch'ich'eltike ja'yip ek pero banti xtal xan ek ts'i yip ek e, ba ay la xlok'tel ek ts'i yip ek e</i> How does blood get life force, where does life force come from? <i>pues ja'na nix te jko'tantike, ta jko'tantik na nix</i> It comes from our hearts, from our hearts.
<i>bueno ta me laj yip te ch'ich'e yu'na nix laj yip ek a te jko'tanike, yu'un ma ek binti jpoxtatikix a, mabi stak' kabetikix a</i> Well, if the life force finishes in the blood its because it finishes in our hearts. Its because we can't find medicine for it.
<i>yip a ts'i te setel niwan ek'a, ta yutil te ko'tantike yak nax i, ya stijba im a meel ja'yun yakal bel ya wa'its'i</i> It [blood] gets life force there in the heart and from there it begins to circulate.
<i>bueno ja'nix yak'oj yip ts'i jko'tantik bit'il x'at'ejotike como bats'i chuybil ja'te jko'tantike ja'yak'yip, ya xch'unbetik smantal bi jpastik, ja'nax stukul te jko'tantike</i> It is always our hearts that give us life force when we work, it's the only one we can obey to do something.
<i>bueno ok te kok k'abtik ts'ine, kakantik, xu'te bae xbotike y ay yip te jkok k'abtike, me ma eke ma xu, ma x'at'ej, te me ay yipe ya xu'xbajt' ta a'tel bi jpastik como nopoxtikix ta ko'tantik sok joltik bae k'alal ya xbatik</i> Well, its always that we are able to go where we do with the hands and feet because there is life force. Without life force you can't work, but when there is life force you can do what you have thought to do in the heart and head.

Table 9. Selected transcribed quotations highlighting the heart's role in sensing hunger.

<i>ja' niwan jich ya sk'an xwe', kapal te jko'tantik ta me la sta yorail te bit'il ya xwe'otike, xpich'et te jko'tantike komo yu'un ya sk'an swe'el, jich ta jbak'etaltik komo pareja ya sk'an swe'el te jbak'etaltike</i> Our hearts want food when there is hunger, they begin to hurt. It's the same throughout our bodies.
<i>bi la yu'un te ma kak'xtakej te jwe'eltike</i> How come it is important that our food is not too dry? <i>como ja' ya sk'an te jko'tantik</i> That's how our hearts want it.
<i>li' ta jko'tantike xpich'et, ma eki xbajt te jch'ujtike xwi'najotikix a, ma ekix yip a te k'inal, me jweotike ya yak'yip te k'inal te me noj te jch'ujtik</i> Here in our hearts it begins to grumble and it drops into our bellies when there is hunger. We feel weak. And when our bellies are full again our hearts become content.

Table 10. Selected transcribed quotations highlighting the heart's role in processing consumed water.

<i>melel ja' ya sk'an te jko'tantike, ta me ay ba yakotik ta bel siempre ya sk'an te tol ja', ya xkux te jko'tantik ta me jkuch'tik tolja'e, ma e ya xljajotik</i> Our hearts ask for it, when we walk they always ask for water. Our hearts are refreshed when we drink water. Without it we die.
<i>bi la ut'il ya ka'ytik te xljajotik ta takin ti'il</i> How do we come to feel thirst? <i>yu'un ya xtakej ko'tantik, ta jko'tantik ya sk'an, ja' ya xljaj yip te jch'ich'eltik, ya xtakej yael te jbak'etaltike</i> Our hearts dry and the life force in our blood finishes. Our bodies feel like they dry out.
<i>bi la ut'il ya xk'o ta ko'tantik te ja'e, ya ba xpamaj te a</i> And how does liquid reach the heart? <i>ma ba xpamaj, ta jtsukumtik ya xk'ot</i> It doesn't, it goes to our stomachs.

Additional life force is extracted from food in the stomach and added to the blood's supply. Hunger, though related to emptiness in the stomach, is felt in the heart (Table 9); "Here

in our hearts it begins to grumble and it drops into our bellies when there is hunger. We feel weak. And when our bellies are full again our hearts become content.” Thus the heart maintains the blood by ensuring a supply of life force.

Likewise, water travels directly to the heart when it is consumed (Table 10). From there it is mixed with the blood. Like hunger, thirst is felt in the heart. The blood then delivers the water to the rest of the body to irrigate it.

Once the body has been given potential with life force and irrigated with water, the last spark required for life is thought. The heart provides this spark (Table 11); “it [heart] only makes us think and remember where we should direct ourselves, what to think about or whether to work. Our hearts talk.” and, “only our hearts know when we work. If we look for firewood, if we work, there is no other, only and always our hearts. Whatever we look for be it firewood or work, we are like a person our hearts send.” In fact thought is one important function of life force, “the heart has life force because it is there that we want to work. That's where the thoughts come from.”

Table 11. Selected transcribed quotations highlighting the heart's role in thought.

<i>ja' ya'tel te bi ya snop te ko'tantike</i> It's work is that we think in the heart.
<i>Te ya xwet' a i ma melei ja'yu'un te ya xwet' a wayats'i bi ya jnoptik</i> Thoughts just come out of it [the heart] because it is the only one that thinks.
<i>ja yip ts'i ya jnop ko'tantik ya x'a'tejotike ma, ja'jich teye</i> There in the heart we think whether we will work.
<i>ja' nax ya sna' te banti ya xbaotik, binti xi' bi ya spastik, ya x'a'tejotik, ya x'a'yan te jko'tantik</i> It [heart] only makes us think and remember where we should direct ourselves, what to think about or whether to work. Our hearts talk.

Table 11. (Continued)

<i>ju'uk ts'i ja nix ko'tantike ma yu'un a nix ay yip a te ko'tantike meel yu me ya jk'antik ya x'a'tejotik xtunotik ya a'wa'i</i> the heart has life force because it is there that we want to work. That's where our thoughts come from
<i>ya yik'otik ta at'el yael, ya nax xch'untik bit'il yik'otik, li' nix ta jko'tantik te ya jch'untik te ya yik'otik ta at'ele, pero li' ta jko'tantik te ya yik'otik ta at'el te jtatike, ta jko'tantik ya xk'pojtal</i> If it calls us to work we obey, and it is in our hearts that we obey to do the work. Its like our father that takes us to work, but the advice is from our hearts.
<i>meel ts'i ya x'a'tejotike', chikan, ja nax a te jko'tantike, ya ba p'ojtik si', ya bal x'a'tejotik ta a'tel, ma'yuk yan ja' nax te jko'tantik, bi ya jletik bel ya'tik, jabal te si', jabal te a'tel, tulnanix yael te winik te mach'a ya spasbetik yael te jko'tantike</i> Only our hearts know when we work. If we look for firewood, if we work, there is no other, only and always our hearts. Whatever we look for be it firewood or work, we are like a person our hearts send.
<i>bi la ut'il ya xtal nix lek ya'el a te snopojibale</i> How do we come to do what we think about doing? <i>ja'nix te ja' ya x'ayantal te ko'tantike</i> The heart speaks.
<i>bueno sok ta joltik, xchebal niwan ya snop joltik sok ko'tantik</i> Well, [we think] with the head. Perhaps in the heart and then in the head.
<i>bi la ut'il ya xtal te snopibal jko'tantike</i> How does thought come to the heart? <i>como ik' ya snop li' ta jko'tantik sok joltik</i> It's the air that thinks in our hearts and in the head. <i>Y primero sale del corazon y luego en la cabeza?</i> And it comes out first from the heart and then the head? <i>Yak</i> Yes
<i>ja' la ts'i te me la noptikix a ts'ine bi la ut'il ya spas ta ts'in jatoj la bal</i> When we think to do something, how does the thought become the movement? <i>spisil sok joltik ts'i ko'tantik spisil i ma</i> Its [thought] the same between the head and the heart.
<i>ma la bal snopojibal sok ts'ij ko'tantike o k'ejel la bal bi ya snop a te joltike</i> Are the thoughts of the heart and the head the different? <i>ma'yuk ja nax pajal ya yay ts'i ko'tantike</i> No, they are the same as in the heart.

Related to thought is emotion, and it too originates in the heart. In fact a majority of terms for emotions can actually be translated as '[something] heart'. For example sadness translates as either revolving heart (Maffi 1994) or as layered heart. Brian Stross has claimed to have collected over 100 of these terms and should be referred to for further examples (Stross 1976).

The heart is also believed to be the seat of the soul (Table 12). It is this aspect of the heart that most easily explains the heart's role of combining the source of life force with the seat of consciousness.

Table 12. Transcribed quotation describing the heart as the locus of the soul.

melel te la jkaltike ja kuxulotik a, me ay binti yan ya'tel ts'ine
 Besides breath and life is there other work [of the heart]?

jch'ueltike
 our souls.

***Ch'ich'el* and *Chialtik*: Blood and its Threads**

As is known to the western medical system, blood transports oxygen and nutrients to the cells of the body and carries carbon dioxide and waste away from cells. It regulates body pH and heat and cellular water content. Finally, it protects the body from blood loss through clotting and from disease with antibodies and white blood cells (Tortora and Grabowski 1993: 567).

The Tzeltal do not differ much from the views of biomedicine with regards to blood. Blood, as it works directly with the heart, is of primary importance to the maintenance of life. Not only does it work with the heart, but it also works with all of the body. As one informant put

it, “its in our blood that we live.” First and foremost, the blood carries life force, or more strongly worded, “our blood is our life force” (Table 13). This life force is then distributed throughout the body so that we can work or move. It is the life force that energizes our body and makes it potent. Without life force we cannot live.

Table 13. Selected transcribed quotations highlighting the blood’ role of providing life force.

<i>ch’ich’ja’ fuersatik</i> The blood is our life force.
<i>yip a ts’i te setel niwan ek a, ta yutil te ko’tantike yak nax i, ya stijba i ma meel ja’yu’un yakal bel a’wa’i ts’i</i> It [blood] gets life force there in the heart and from there it begins to circulate.
<i>binti la ya’tel ek te jch’ich’eltik, bi la ya’tel te jch’ich’eltike</i> What is the work of our blood?
<i>ja’jich kuxulotik a ek a i ma</i> Its where we live.
<i>yip a ts’i te setel niwan ek’a, ta yutil te ko’tantike yaknax i, ya stijba i ma meel ja’yu’un yakal bel ya wa’its’i</i> It [blood] gets life force there in the heart and from there it begins to circulate.
<i>ja’nix kiptik sok te ch’ich’eltik sok te bak’etaltik te ya x’a’tejotike ja’ kiptik, binti nix ut’ul ya x’a’tejotik te me ma’yuk kiptike</i> The blood in the body gives life force so we can work, we can’t work without life force.
<i>ja’ kuxulotik yu’un te ch’ich’eltike</i> Its in the blood that we live.
<i>ja’ ya x’atejotik yu’un te ch’ich’eltike te bit’il kuxulotik yu’un te ch’ich’eltike</i> Its because we have blood that we live and go to work.
<i>ja’nix sok te jch’ich’eltike yich’oj yip ta tulane</i> It is through our blood that it [the body] gets life force.
<i>bueno ta me laj yip te ch’ich’e yu’un nanix laj yipek a te jko’tanike, yu’un ma ek binti jpoxtatikix a, ma bi stak’ kabetikix a</i> Well, if the life force finishes in the blood its because it finishes in our hearts. Its because we can’t find medicine for it.

Table 13. (Continued)

<i>bi la ut'il te ch'ich'eltike ja' yip ek pero banti xtal xan ek ts'i yip eke, ba ay la xlok'tal ek ts'i yipeke</i>
How does blood get life force, where does life force come from?
<i>pues ja' nanix te jko'tantike, ta jko'tantik nanix</i>
It comes from our hearts, from our hearts.
<i>ja' ay spuensa sok te ch'ich'e</i>
There is life force with the blood.
<i>kuxulotik sok ch'ich' porque ja tey yich'oj yip a te ch'ich'e</i>
We live with blood because there is life force in the blood
<i>bi la ut'il ya stak' este ya tijbatik ya xbenotike</i>
How does it [blood] let us move or walk?
<i>ja' ya kich' kiptik yu'un te ch'ich'eltike chialtike</i>
The blood and the veins deliver life force.
<i>ja' ya xben te ch'ich'eltike ja' ya xben te kiptik, kiptik me ta a'tel ya'wa'i te ya x'a'tejotike xtunotike</i>
Where blood goes, there goes life force, if we didn't have life force we couldn't work.
<i>ja'nix yak'o yip te ch'ich'eltike ja' kuxulotik yu'un te ch'ich'eltike</i>
We live in the blood because it gives us life force.
<i>bueno te yip te jch'ich'eltike ja'nanix a te bit'il aye, ma ek ba taiktel yan, ma ek ba xtal yan, ja'nanix a te bit'il ay yip te jch'ich'eltike</i>
Well, the life force of our blood is natural, it doesn't come from anywhere else.
<i>Las venas se conectan con el estomago. Fuerza sale en el sangre como café sale en agua que hierve.</i>
Veins are connected to the stomach. Life force comes out [of the food] in the blood like coffee comes out in boiling water

Life force is thought to come to the blood from food that is processed in the stomach but more so from the heart. Common statements include, “It [blood] gets life force there in our heart and from there it begins to circulate.” and, “if life force finishes in our blood its because it finishes in our heart” The source of life force in the heart ranges from an autochthonous entity – “well, the life force of our blood is natural, it doesn't come from anywhere else.” – to being extracted from air – as suggested in multiple untaped interviews.

A secondary role of the blood is to carry water to irrigate the body (Table 14). Water goes to the heart from the mouth and is then transferred to the rest of the body by the blood. However, “very little goes in our blood because if too much enters, our blood breaks down because water is different.” The water that does not enter the blood may become urine straight from the heart or may circumvent the heart altogether and be diverted to the stomach.

Table 14. Selected transcribed quotations highlighting the blood’s role of processing and delivering water and food.

<i>te ja' kuch'tik ya xbajt' ta jch'ich'eltik, ay xlok' ta chuxtayel</i> The water that we drink goes to our blood and comes out as urine.
<i>jteb nax ya xk'ot ta jch'ich'eltik, te yakuk xla j bajt' spisile ya sok te ch'ich'e meel k'ejel a tol ja'e, yan mene ja' nax niwan te ya sk'an te bit'il xbajt' jtebuk yaele, jteb nax te ya xk'ot ta jbak'etaltike, como ta jchuxtik ya xbajt'</i> Very little goes in our blood because if too much enters, the blood breaks down because water is different. our bodies ask for a little bit to go in our blood because the rest comes out as urine.
<i>ja' ya st'un bel te ala chietike</i> Water circulates in the veins.
<i>bi la ut'il xbenxan bel ek ts'i chialtike,</i> And how does it get to the veins?
<i>pues ja' tey ya skapixba bel sok te ch'ich'e, xpaxajixbel sok te jch'ich'etike</i> Because it joins our blood.
<i>bi la ya spas xan ek a ts'i te ja' ta jch'ich'eltike, bi la ya spas xan ek a te jch'ich'eltike</i> What does water do in our blood?
<i>ya xbe i ma</i> It circulates.
<i>ja' la ts'in ta me la kuch'til xan tolja' bi la ya spas te me la kuch'tik tolja'e</i> When we drink, where does the liquid go?
<i>ya xbat ta ch'ich'eltik te ja'e</i> The water enters the blood.
<i>ja' la jich bit'il ya xwe'otik pero bi la ut'il ya stunix la xan ek'a te alale xi ya'wa'i</i> When we eat, how does the food get to the fetus?
<i>ch'ich' ya stun stukel</i> It gets there in the blood.

Table 15. Selected transcribed quotations highlighting the blood's role in thought.

<i>No pienza pero manda el corazón se jira el sangre. llega los pensamiento primero el pienza en el corazón y ya el corazón esta jirando el sangre, no pienza ese sangre pero alli va.</i> It [blood] doesn't think, but the heart commands the blood to circulate. Thoughts arrive first in the heart and it makes the blood circulate. The blood doesn't think, but there the thought goes.
<i>bi la ut'il ya xtal snopibal yu'un ek te ch'ich'e</i> How does thought arrive in the blood?
<i>como ja' tey jkich'o jkiptik a, ja' ya x'at'ejotik sok, me ma x'atej te jch'ich'eltike ya xla jotik</i> From there comes our life force. With it we work. If our blood doesn't work we die.
<i>bueno ja' la ts'in ta me k'alal este ya majtik o sea ya tijbatik ya la stij sbats'il k'abtike bi la ut'il ya stij sbaj</i> If we think to move something how does it come to move?
<i>ja' ya xtijot ek ts'i ch'ich'eltik ema</i> We move it because we have blood.

However, the Maya verge from biomedicine in believing that blood carries thoughts from the heart throughout the body (Table 15). “It [blood] doesn't think, but our heart commands our blood to circulate. Thoughts arrive first in our heart and it makes our blood circulate. Our blood doesn't think, but there the thought goes.” Likewise, the untaped interviews suggest that sensations of touch and pain reach the heart where we become aware of them via the blood.

Veins gather blood and its constituents of life force and water in the heart and provide a passage for the blood to circulate throughout the body (Table 16). By way of veins, the blood irrigates the body with water and provides life force to allow one to live.

Table 16. Selected transcribed quotations highlighting the blood's circulation

<i>ya xbeen te me tulan k'inale, k'alal te me tulan te ko'tantike como yich'oj yip te ch'ich'eltik te bit'il xbenotik, k'alal te me k'unej te jch'ich'eltike bit'il stsakotik te chamel, tey ya xkom kiptik xan yu'un ek, ja' ya yich' yip te jch'ich'eltike, ma ek te ch'ich'e ya xkom k'inal</i> It [blood] circulates when we feel good, when our heart is strong. Also, the blood has life force when we walk, but when the pressure drops from illness, so does the life force. Without blood we can't live.
<i>spisil bak'etaltik ya xben ta jkot'oltik, ay yip te jch'ich'eltik, me tub ch'ich' ya xla jotik, jich xanix ayat, ya sayts'ujotik</i> It circulates throughout the body. There is life force in our blood. Without blood we die, we feel weak.
<i>pero ja' la bi la ut'il ts'i k'alal sben ts'i jch'ich'eltike bi la yu'un ts'i</i> But why is it necessary for our blood to circulate? <i>ma jna'tik xa ts'i, ya stij sba, pues ja' jich ja' kuxulotik a, como ay jch'ich'eltik, ya xben ch'ich'eltike kuxulotik</i> I don't know, it just moves and that's how we live. If our blood circulates we live.
<i>ja' la bi la yu'unek ts'in te ya to la xben ek ts'i jch'ich'eltike,</i> Why does our blood circulate? <i>ya xben porque ya x'a'tej sok ts'i te jko'tantike, porque jich kuxulotik a</i> It circulates because it works with our hearts, because that's how we live.
<i>ja'me jicha sk'an, me lel la sna'ix stojol binti kuxulotik, tek'elotikix, komo ya jna'tik stojol ts'i' ja'nanix kuxulotik a te la choltikix, te jko'tantike ja kuxulotik yu'un, te jputstike ja'te jkich'tik ik'e ya sbentes te jch'ich'eltike</i> That's it, we know how we live. We are standing and we know how we have life; our hearts give us life. Our lungs breathe and make the blood circulate.
<i>ja'nix te ch'ich'eltike yich'o yip te bi ya pastike, ja' ya x'a'te te ch'ich'eltike ya yich'tal yip ta ko'tantik</i> The blood gets life force in the heart and then begins to circulate. <i>bi la ut'il ya stak' ya xjul ta ko'tantik te yip te ch'ich'eltike</i> How does the life force in the heart make the blood circulate? <i>ja'te ya kich'tik ik'etike</i> Its when we breathe.
<i>yanix xben a yabal xkuxlotik ta me ma xben ch'ich'eltike te bit'il ma x'a'tejotike</i> When the blood circulates we feel alive, if it doesn't circulate we can't work.
<i>bueno ya nanix stij sba a, jich ya xpaxaj ta ch'ich'etik, ya xpaxaj ta jchialtik, jich ya xla j been</i> Well, it is natural that it moves by itself, that's how the blood circulates in our veins.
<i>ya ben te jch'ich'eltike como tey nax xjoybe ek a, tey nax xla j tey nax xla jt'ix</i> Our blood circulates and just goes around, that's all.

Chinamil: The Heart's Partner in Thought

Tortora and Grabowski (1993) describe the brain as:

the center for registering sensations, correlating them with one another and with stored information, making decisions, and taking action. It is also the center for intellect, emotions, behavior, and memory. But the brain encompasses yet a larger domain: it directs our behavior toward others ... We are still at the frontier of being able to describe many brain functions (405).

The brain, more commonly referred to as the head, was only mentioned by four informants, however the reports were quite uniform (Table 17). It is an organ that is unanimously associated with thought: three informants claiming a role in thought to the brain and one claiming that there is no communication between the heart and brain (thus denying the role of thought to the brain). Two of the informants who accept the role of the brain in thought believe that the heart thinks first and then the thought moves to the brain for further refinement. The third says that the heart and brain think together at the same time. The thoughts are felt to be identical between the brain and heart with the possible exception that the brain may imagine what we will do. This would imply a separation of forethought to the brain with all other thoughts and emotions residing in the heart.

It is because we breathe that the heart works with the brain. Thoughts rise to the brain from the heart by means of the air that we inhale. The thoughts are then transformed into action by of life force.

That the brain is not an organ mentioned by most informants may have two explanations: the brain is not felt to have special significance in Maya physiology and is an artifact of western education, or informants assumed that I specifically wanted to focus on the trunk of the body

Table 17. Selected transcribed quotations highlighting the brain's function.

<i>spisil sok joltik ts'i ko'tantik spisil i ma</i> Its [thought] the same between the head and the heart.
<i>bi la ut'il xbajt te bit'il ya snop te jko'tantik sok joltike</i> How do our hearts think with the head?
<i>ja' chikan bit'il ay te jko'tantik te snop sok te joltike, ya jch'untik te bi xi' yael te snop te joltik sok te jko'tantik banti ya xbatik</i> Our hearts think with the head. We always think with the head and our hearts.
<i>Y primero sale en el corazon y luego en la cabeza?</i> And it [thought] first comes out of the heart and then the head?
<i>Si.</i> Yes.
<i>bueno sok ta joltik, xchebal niwan ya snop joltik sok ko'tantik</i> Well, [we think] with the head. Perhaps in the heart and then in the head.
<i>bueno, ay niwan ts'i ma, ja'nix te bi sna' snop te joltike, bi xi, bi ya jpastik, meltsantik, ta joltik sna'</i> Well, the head imagines what we will do.
<i>Komo ik' ya snop li' ta jko'tantik sok joltik</i> It's the air that thinks in our hearts and in the head.
<i>ala a'tel, bueno, te jchinamtike pero ja' la este ay lawanix ya'tel te a teye</i> Tell us, do our brains have any work?
<i>ma'yuk</i> No.

instead of the whole organism. It is my belief that the first is the case due to the fact that while discussing thought the brain would naturally be volunteered if believed to have a role. Thought was discussed with all informants and the majority felt that it was purely a function of the heart.

Puts'il: The Heart's Pump

The lungs are a paired set of organs located in the chest and separated by the heart. Air is drawn in through continuously branching air passages terminating in a series of tiny alveoli (Figure 11). The lungs take in air by the lowering of the diaphragm and extension of the chest

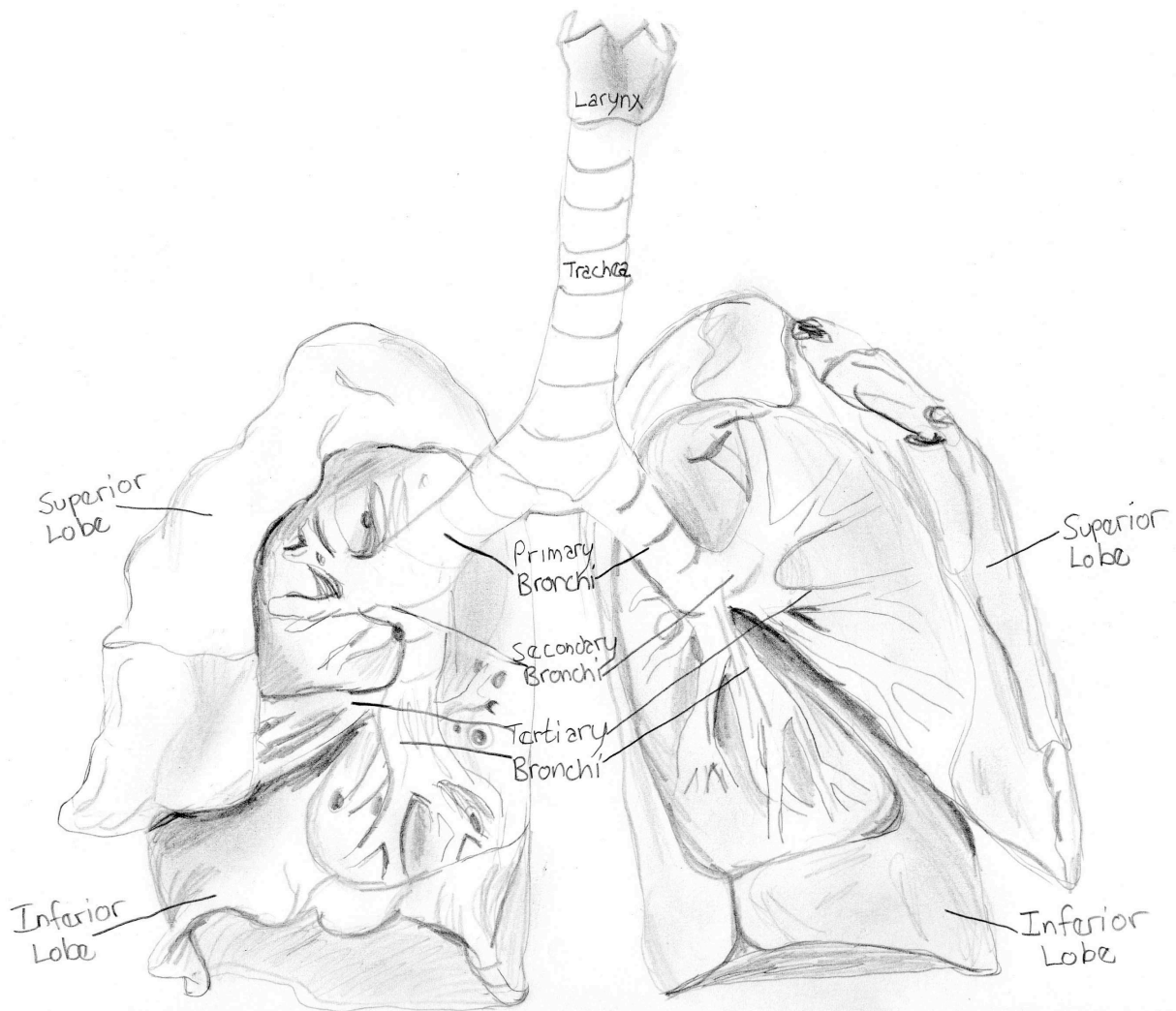


Figure 11. The morphology of the lung.

muscles. This lowers the air pressure in the lungs relative to the environment and air enters to equalize the pressure. The air is absorbed by blood which also releases carbon dioxide into the lungs as waste. When the muscles relax, the pressure is raised and the carbon dioxide is released into the atmosphere. The air is delivered to the cells of the body by the blood (Tortora and Grabowski 1993: 721-738).

The lungs, or rather lung as most informants feel that there is just one, is associated with the heart (Table 18). The lung is known by two names, *puts 'il* and *sot 'ot 'il*. However, both of these refer to the same organ (Table 19). This may be an artifact of an old distinction between human and animal lungs (Elois Ann Berlin, personal communication).

Table 18. Selected transcribed quotations highlighting the believed number of lungs.

<i>ay lawan cheb ts 'i</i> Are there two [lungs]?
<i>junax ay</i> There is one.
<i>Y hay varias partes el sot 'otik o putstik o son una cosa entera?</i> And are there multiple parts of the lung or is it one thing?
<i>casi junax</i> Just one.
<i>ja' nax la bal jun ay la bal cheb oxeb</i> Is there one or are there two lungs?
<i>ju 'uk junax</i> No, just one.
<i>ay lawan cheb oxeb putstik ay lawan cheb oxeb k'intik</i> Are there multiple lungs, are there multiple kidneys?
<i>ma 'yuk</i> No.

Table 19. Selected transcribed quotations regarding the two terms for ‘lung.’

<i>bi yat'el tej sot'otik?</i> What is the work of our lungs?
<i>ja' tey kuxolotik a, kich'tik ik'</i> From it we live because it breathes.
<i>te jputstik bi ya'tel</i> What does the lung do?
<i>la misma nada mas que tiene dos nombres</i> The same it just has two names.

Otherwise the lung of the Maya is quite similar to the lung of western medicine. Though somewhat autonomous, the lung is widely considered to be a facet or lobe of the heart with a particular task, rather than as a separate organ. It is located in the chest on the above of the heart and to the side of the liver (Table 20). It is sort of flat, very soft and appears similar to sponge or cork (Table 21).

Breathing is fundamental to the maintenance of life. Breathing draws air into the heart by the action of the lung (Table 22). If air were not to reach the heart we would die as it provides essential life force to the body. Life force is extracted from air in the heart and transferred to the blood. It is felt that while we breathe the lungs move and in turn the heart moves and circulates the blood, which distributes life force to all the various parts of the body (Table 23). To sum up, one informant stated, “that’s it, we know how we live. We are standing and we know how we have life; our heart gives us life. our lungs breathe and make our blood circulate.”

Table 20. Selected transcribed quotations highlighting the location of the lung.

<i>Ma la bal ay sok te jko'tantik , putstik, bi la ut'il yak'oj sba</i> How are our hearts and lungs arranged?
<i>tsobolaj sba te oxotene ko'tantik, jputstik jsejkubtik, ja' nax me wol ayik</i> They are there together with the heart; on this side our lung and on the other our liver.
<i>li ta o'tanil, banti ay te jputstik</i> Where is the lung there in the heart?
<i>te ay ek a, como jich ay jsejkubtike jich kajal, a los lados</i> Its found there with our liver, on the sides.
<i>ta bak'etal te puts jipil ta jko'tantik</i> In the body, the lung is hung with our heart.
<i>tey nax ay a, pajal ay sok jsejkubtik</i> It [the lung] is there with our liver, they are together.
<i>li'i te jko'tantik, banti ay te jsot'otik te jputstik</i> Here is the heart, where are our lungs?
<i>ta xujk', ta fuera</i> To the side, on the outside.
<i>bueno, ja' la ts'i ko'tantike este ay la bal este cha' xajt' binti tey a te ko'tantik ch'i</i> Well, does our heart have multiple parts?
<i>jsot'otik, jputstik, ja' nax a bi, tey sjunej sbaa sok jko'tantik</i> Just our lungs, they are together with our heart.
<i>banti ay te jputstik ta bak'etal</i> Where are our lungs in the body?
<i>ay ta ko'tantik, ja' ak'ol ay te ko'tantike</i> In the heart, above the heart.
<i>y banti ay te putstik ta bak'etal</i> Where in the body are the lungs?
<i>ja' sjune sba sok te sejk'ubtike</i> There to the side of the liver.
<i>banti ay te jputstik</i> Where is our lung?
<i>ja' te a banti ay jsejk'ubtik ema</i> There with our liver.

Table 21. Selected transcribed quotations highlighting the appearance of the lung.

<i>bi la yilel te jputstike</i> What does the lung look like?
<i>ja' tsin te ala lechele</i> It is flat.
<i>bi la yilel ek ts'i jputstik</i> What do our lungs look like?
<i>telel niwan te jputstike</i> Our lung is little bit flat.
<i>ma jna'tik bi yilel jputstik komo que ja jichuk te bit'il sot'ot' esponja</i> I don't know what our lung looks like, maybe it looks like a sponge.
<i>bi la yilel te jputstike</i> What does our lung look like?
<i>komo sot'ol stukel</i> It just looks like itself.
<i>bi la yilel ts'in te jputstike tulanbal</i> Does our lung look hard?
<i>ju'uk i ma k'un i ma</i> No, very soft.
<i>bi la yilel ek te putstik tulanbal</i> Does our lung look hard?
<i>k'un</i> Soft.

Table 22. Selected transcribed quotations highlighting the lung's role in breathing.

<i>ko'tantik ya x'och tal li' ta jketik nix xbajt' ta jko'tantik</i> The heart. It [air] enters our mouth and goes to our heart.
<i>kich'tik ochel ik' xbajt ta jko'tantik, x'och ta jni'tik, ya xk'ot ta jputstik</i> The air goes in and goes to our heart. It goes in our nose and then to our lung.
<i>Tey nax la bal laj a bi</i> It just ends there?
<i>te ya sujtal lok'el bit'il kich'uletik ik'</i> What we breathe comes back out.
<i>ja' ts'in te jich kuxulotike, in te me ma ek x'och te ik' ta jko'tantike xlajotik</i> Its how we live, if air does not reach our heart we die.

Table 23. Selected transcribed quotations highlighting function of the lung.

<i>ma jna'tik bi ya'tel o ay ba bi yat'el o ja' banti kich'tik ik'e</i> We don't know what its [the lung] work is, maybe it is where we breathe.
<i>binti la ya'tel ek ts'i jputstik</i> What does our lung do?
<i>ma'yuk</i> Nothing.
<i>ma xkil binti me te ya'tele, ja'yich'oj yip te a te ya'tel xkaltik eke</i> I don't know what its [the lung] work is, maybe we get life force because we breathe
<i>ma xkil bi ya'tel ja'niwan te ya xjuch'jwe'eltike bit'il ay, ma na' stojol te bi ya'teleke</i> I don't know what its [the lung] work is. Perhaps it grinds up our food, I don't know.
<i>bi la ut'il te k'alal ya jkich'tik ik'e ja' ya stij sba ts'i</i> How is it that when we breathe it [the heart] moves?
<i>ya stij sba ts'i pero casi majik sok ts'i jsot'otike jputstike</i> It moves together with the lungs.
<i>bi la ut'il x'a'tej ta ma ja ts'i te komo ya jna'tik ya jkich'tik ik'y sok a ts'i jko'tantike y bi la yut sba</i> How do they work together, how do they [lungs] communicate with our heart?
<i>bueno este pues yaniwan stilule sba, como ma jna'tik stojol</i> Well, perhaps they move, I don't really know.
<i>bi la yu'un te jkich'tik ik'e</i> Why do we breathe?
<i>ya jkich'ulantik ik' ts'in ma, ya stijulan sba</i> Because when we breathe it moves.
<i>ja'me jicha sk'an, me lel la sna'ix stojol binti kuxulotik, tek'elotikix, komo ya jna'tik stojol ts'i' ja'nanix kuxulotik a te la choltikix, te jko'tantike ja kuxulotik yu'un, te jputstike ja'te jkich'tik ik'e ya sbentes te jch'ich'eltike</i> That's it, we know how we live. We are standing and we know how we have life; our hearts give us life. Our lungs breathe and make the blood circulate.

Sekubil and Ch'ajil: The Mysterious Liver and Gallbladder, Source of Stomach Woes

The liver (Figure 12) extracts oxygen, nutrients and poisons from the blood, stores nutrients, detoxifies or stores poisons and secretes nutrients into the blood when needed. Further, it aids in carbohydrate, lipid and protein metabolism, removes drugs and hormones from the

blood and activates vitamin D. Finally, the liver excretes bile (Tortora and Grabowski 1993: 790-795).

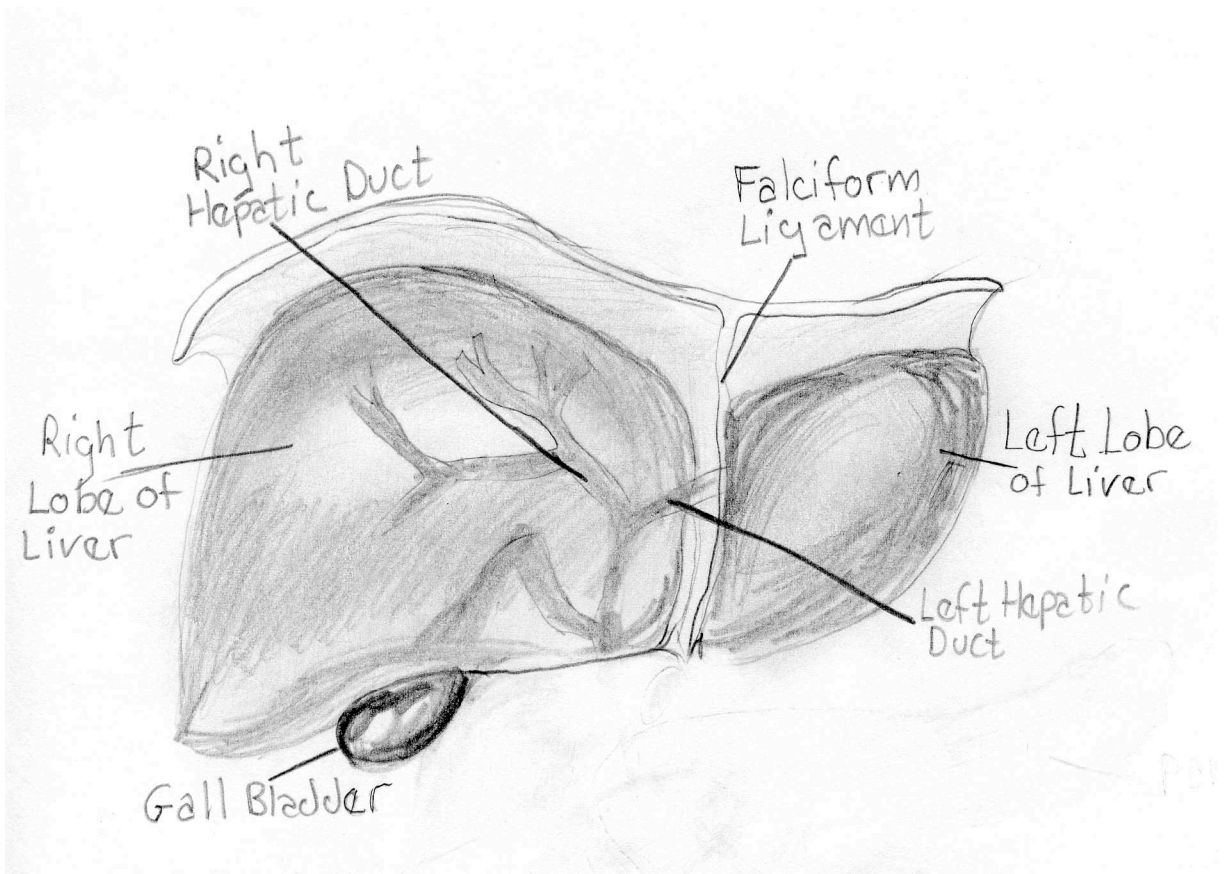


Figure 12. The morphology of the liver and location of the gallbladder.

The liver is thought, by the Maya, to be found to the right of the heart and somewhat lower, towards the belly, and close to the stomach. It is also near the lung, which is found on the other side of the heart (Table 24). It is large red organ that is somewhat flat (Table 25).

Table 24. Selected transcribed quotations highlighting the location of the liver.

<i>ay ta jch'ujtik</i> Its [the liver] in the belly.
<i>banti la ta ch'ujtiltik ay te sek'ubtike</i> Where in the belly is the liver?
<i>ta sts'el jtsukumtik</i> Near our stomach.
<i>bi la ut'il ay ja'la bal ak'ol ay te ko'tantike ja'la bal alan ay te sejk'ubtike</i> Is the heart higher or lower than the liver?
<i>ja' ak'ol ay te ko'tantike</i> The heart is higher.
<i>ta alan la bal, ta xujk' la bal</i> Is it [liver] below [the heart], is it to the side?
<i>ta alan</i> It is to the side.
<i>banti ay te sejkubtik ta bak'etal?</i> Where in the body is the liver?
<i>li ay ta jko'tantiki</i> There, in the heart.
<i>te jsejkubtik, jich ay jsejkubtik to jich ay ko'tantik to</i> Our liver is next to the heart.
<i>binti tijil yiloj sba sok</i> What is it [the liver] near?
<i>ja' te jputstike</i> Our lungs.
<i>tey nax ay a, pajal ay sok sejkubtik</i> Its [lung] there with the liver, they are together.
<i>y banti ay te putstik ta bak'etal</i> Where in the body are the lungs?
<i>ja' sjune sba sok te sejk'ubtike</i> There to the side of the liver.
<i>tsobolaj sba te oxoxtene ko'tantik, putstik sejkubtik, ja' nax me wol ayik</i> They are there together with the heart; on this side the lung and on the other the liver.

Table 25. Selected transcribed quotations highlighting the appearance of the liver.

<i>bi la yilel te sejk'ubtike</i> What does the liver look like?
<i>ala lejchel</i> Kind of flat.
<i>bi la yilel te sek'ubtike</i> What does the liver look like?
<i>lechel</i> Flat.
<i>bi la yilel te sejk'ubtik</i> What does the liver look like?
<i>pechel niwan</i> Perhaps its flat.
<i>bi la yilel</i> What does it [liver] look like?
<i>este tsaj</i> Its red.
<i>wolol la bal, pechel la bal, tasal la bal</i> Is it round, flat or oval?
<i>ala lechel</i> Its flat.

There is a vague sense that the liver is associated with the heart or the stomach but its role is not understood (Table 26). However, one untaped informant suggested that when we breathe smoke it might go to the liver. The general sentiment is that it has no function. Alternatively, is thought to have an unknown function or that, “it is the work of God, it’s the same, the animals have a liver too.”

Table 26. Selected transcribed quotations highlighting the function of the liver.

<i>bi ya spas ja' nax te tey nap'al ek a</i> What does it [the liver] do? Its just stuck there.
<i>binti la ya 'tel te sejk'ubtike, bi la ya 'tel ay wan bi la snop ay wan bi ya x'a'tej ay ya xtal snopojibal te'a</i> Do you know what the work of the liver is? <i>ma'yuk</i> No.
<i>ju'uk, ma x'a'tej stukel, jtul nax te ya x'a'tej te jko'tantike, ja' nax jun, yan teye ma'niwan x'atej stukel</i> No it [the liver] does not work. Only one works and it is our heart. Only with our heart do we think where we want to go.
<i>ma'yuk ya'tel te sejkubtike, jichnax ay stukel, ma ba ya xk'opoj stukel, ma ba jich te bi'til ko'tantik te xk'opoj stukele, ma be xk'opoj jichnax ay</i> There is no work of the liver, its just there because it doesn't talk. It's not the same as the heart that talks.
<i>melel jich stalel spasojetik te Dios bit'il ay te sejkubtike, como spisil jich chambalmetik, ay sejkub, ay bi ay yu'un te chambalmetik, spisiltik jicha, ay wakax binti ay, ma jpasbilotik yu'un te Dios</i> It is the work of God, it's the same, the animals have a liver too. It's the way God made it, that animals have one, as do cows.
<i>ma jna' te binti ya'tele ja' nax te jich ay ta jch'ujtike</i> I don't know what it [the liver] does, its just found there in our belly.
<i>yalaw x'a'te sok tsukumtik o ju'uk</i> Does it [liver] work with the stomach or not? <i>yak</i> Yes.
<i>bi la ts'inte a'tel ay sok ts'in te tsukum</i> What is it's work with the stomach <i>ma jna'</i> I don't know.
<i>ay nax ya'tel pero ja'ts'in te ma jna' stojol te bi ya'tele</i> Maybe it [the liver] has work, but I don't know what its work is.

The gallbladder is a small sack connected to and under the liver (Figure 27). Bile produced by the liver is stored in the gallbladder. There it is concentrated and secreted in the small intestine to emulsify fat, aiding its absorption (Tortora and Grabowski 1993: 795).

Table 27. Selected transcribed quotations highlighting the appearance of the gallbladder.

bi la yilel ek ts'i jch'ajtik

What does our gallbladder look like?

ja'nix jich jch'ajtik te bit'il wakax, ijk' i ma

It looks like a cow's gallbladder, its black.

bi la yilel te ch'ajtik

What does the gallbladder look like?

ala telel, yax i ma, ala yax nax

Enlongated and blue-green.

bi la yilel te jch'atike

What does our gallbladder look like?

ala tasal, tey nap'ala, bueno este como ma jna'tik, yax o ijk', ma jna'tik

A little long and its connected there [to the liver]. I don't know if it is blue-green or black.

bi la yilel te jch'ajtike

What does our gallbladder look like?

te jch'ajtike ijk', pejchajtik tej ch'ajtik, k'an ta tinta

The gallbladder is black, it is flat and is sort of like ink.

bi la yilel te ch'ajtike

What does the gallbladder look like?

jich yala kilil ini

Its enlongated.

To the Tzeltal the gallbladder is a long greenish blue or black sack-like organ (Table 27) connected to the top, middle edge of the liver (Table 28) and is full of bitter ink or fluid. The

bitterness of the gallbladder is such that it is the only organ that has a literal translation; *ch'aj* literally translates as 'it is bitter'. Like the liver, the gallbladder is not generally thought to have any function (Table 29). On the other hand, some informants mentioned that it drips a fluid into the belly when we eat, but it is not known what this fluid does in a healthy person.

Table 28. Selected transcribed quotations highlighting the location of the gallbladder.

y banti ay te jch'ajtik ta bak'etal
And where in the body is our gallbladder?

jipil tey ta sejkubtik, tey lak'al a
Its hung on the liver, its right there.

el jch'ajtik banti ay te jch'ajtik
Our gallbladder, where is our gallbladder?

ay ta sejk'ubtik
Its in the liver.

y banti ay te jch'ajtik
Where is our gallbladder?

ja' sjune in te sejk'ubtike
Its there with the liver.

y el ch'ajtik banti ay
And where is the gallbladder?

el jch'ajtik tey nap'al a, tey nap'al sok a ta sejkubtik jich ay ta olil ini
our gallbladder is stuck in the middle of the liver.

el ch'ajtik, banti ay te jch'ajtik
The gallbladder, where is our gallbladder?

te jch'ajtike, ja' jich ay jsejkubtik ek to ja' jich lats'al te ak ini
Our gallbladder is laid on our liver.

Table 29. Selected transcribed quotations highlighting the function of the gallbladder.

bi la ya 'tel te jch 'ajtike

What is the work of our gallbladder?

ma 'yuk ya 'tel, jich nax jich ay

It does not have any work, its just there

ma xkil bi ya 'tel ek te jch 'ajtike

I don't know what our gallbladder does.

bi la ya 'tel te jch 'ajtik

And what is our gallbladder's work?

ma 'yuk ya 'tel

It doesn't have any work.

bi la ya spas ek te jch 'ajtike, como ay ya 'lel ts 'i bi la ya spas

What does the liquid in our gallbladder do?

te jch 'ajtike ya xlok' jtebuk bit 'il k 'ala ya xwe 'otik

Our gallbladder lets a little out when we eat.

ja ' nax jich tey a, te x 'a 'tejej ma bi ya spas, ma ba jich te bi 'til ko 'tantik

It [gallbladder] doesn't do anything, its not like the heart.

Unlike any of the other organs, excluding the *me' winik* discussed below, the gallbladder is believed to be the source of illness (Table 30). It is thought that if too much of the liquid held in the gallbladder enters the belly it causes colic – *kóliko* in Tzeltal, a Spanish loan – an illness causing severe pain in the belly. The liquid is thought to be exuded in excess when one becomes angry while eating. In severe cases the gallbladder is thought to burst. However, I would like to note that this clearly parallels humoral concepts held by the Spanish at the time of conquest (Foster 1994). Therefore the physiology of the gallbladder may be a Spanish loan.

Table 30. Selected transcribed quotations highlighting the gallbladder's role in producing colic.

ay chamel ta jch'ajtik

Is there an illness in our gallbladder?

ay niwam xchamel ts'i

I think there is an illness.

bi la yael ya xti'wan ek te xchamel te jch'ajtike

How does this illness of our gallbladder affect us?

ja' nax a te xti'wanej o ja' niwan a te xti'wanej mehel chajp a, xpich'ich'et ta yael yael te jch'ujtike

It just causes pain but we don't know why. It feels like it squeezes us.

ay la bal este chamel te a te ta jch'ajtike

Is there illness of our gallbladder?

ay jchameltik te'ek'a

Yes, there is illness there.

bi la ya'el ya ka'ytik ya staotik te chamele

How does that illness affect us?

ya xti'wan ta jch'ujtike

It hurts [literally 'bites'] in the belly.

ay lawan chamel ta jch'ajtik

Is there an illness in our gallbladder?

ay ts'i ta me lijk, ja' ay bi la spas ts'in te jch'atike ma ay ma ti t'uts ay bi t'il st'usaway ts'i jch'atike ma ja' te ya xlijk ta a te chameltike

Yes, there is an illness. Sometimes it bursts and we could die.

bi la ut'il ya stak' a ts'i ya xt'om

How does it come to burst?

ja' ts'i ya xlijk k'ajk'altik ts'i ay ja'k'al ay ba'ay bi ya jtutik a

If we become angry while we eat something it starts.

bueno ta me ts'uj te ch'ajtike, ya xlijk' ti'wanuk ta jch'ujtik, mero k'ux ts'i ma xuix a

Well, the gallbladder leaks, it begins to cause pain and we become debilitated.

K'inil: One Lump or Two

As known by biomedically trained doctors, the kidneys are a pair of organs found in the lower back (Figure 13). The right kidney is slightly lower because of the liver's presence.

Kidneys remove waste from blood, regulate the blood's fluid and electrolyte content. This is done by excreting wastes and excess water and electrolytes. Finally the kidneys activate vitamin D (Tortora and Grabowski 1993: 864-874).

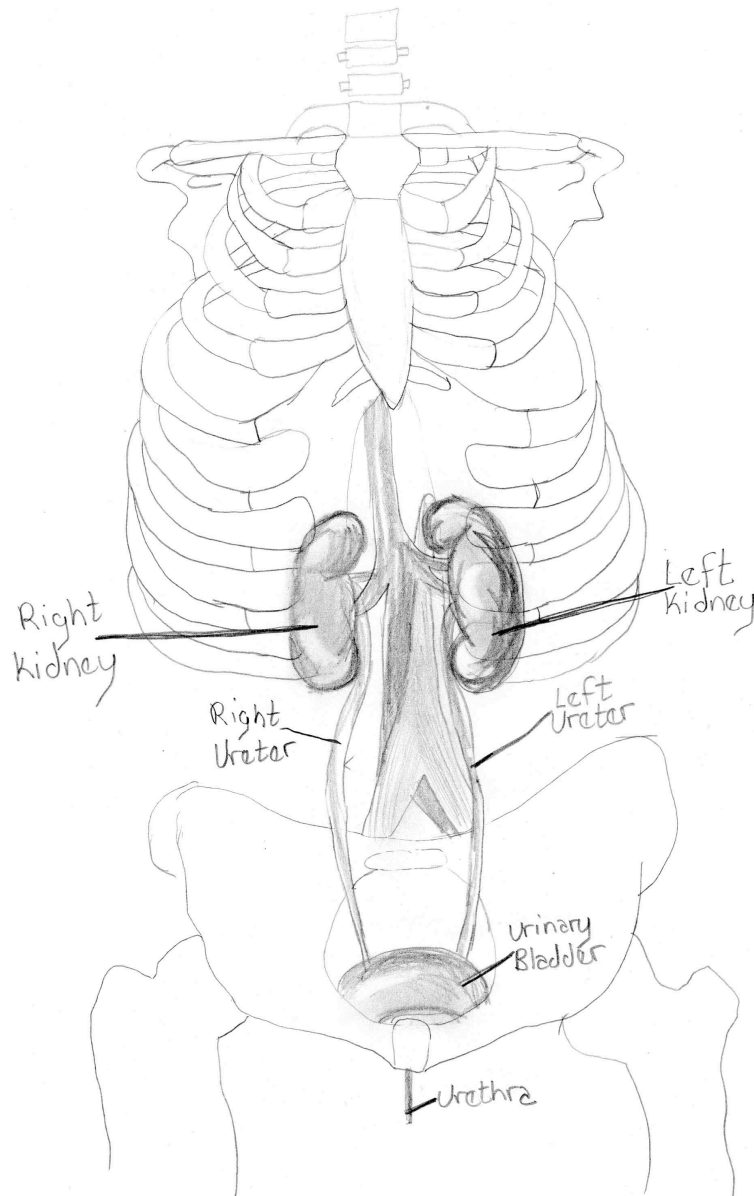


Figure 13. The location of the kidneys in the body and their morphology.

Table 31. Selected transcribed quotations highlighting appearance of the kidney.

<i>pechel te jk'intik</i> our kidney is flat.
<i>te jk'intik ala ijk'ik ek i ma</i> Our kidney is purplish black
<i>bi la yilel ek ts'i jk'intike</i> What does our kidney look like?
<i>ala telel nax i ma</i> Kind of longish.
<i>bi la yilel te jk'intik</i> What does our kidney look like?
<i>ala telajtik</i> It is oval.
<i>te jk'intik, bi la yilel ek</i> What does our kidney look like?
<i>ala pechajtik</i> They are flat.

For the Tzeltal, the kidneys are purple or black, flat, elongated ovals (Table 31). Yet, the kidney is variously mentioned in the singular or the plural with about equal frequency (Table 32). Related to the debated plurality of the organ, its location varies by informant (Table 33). Interview data from the sessions not recorded on tape show a strong bias to a single kidney located in the chest to the right of the heart and somewhat to the back or the center of the body cavity. For those who conceive of the kidneys as plural place the pair hung on the spine or ribs on either side of the body and under the heart.

Table 32. Selected transcribed quotations highlighting perceived number of kidneys.

<i>cheb te jk'intike</i> We have two kidneys.
<i>ay lawan cheboxeb putstik aylawan cheboxeb jk'intik</i> Are there two or three lungs or two or three kidneys?
<i>ma'yuk</i> No.
<i>banti la ay te jk'intik, ta elaw ala ba ay o ta spat,</i> Where is our kidney, more to the front or more to the back?
<i>ju'uk, jp'ej jich ayi como cheb</i> On either side because there are two.

Table 33. Selected transcribed quotations highlighting the location of the kidneys.

<i>banti ay te jk'intik ta bak'etal</i> Where in the body is our kidney?
<i>ta ko'tantik</i> In the heart.
<i>k'intik la yu'wan sjune sbas ok ko'tantik te k'intik k'ejel ay ek' a</i> Is the kidney part of the heart or separate from it?
<i>si abajo</i> It is below.
<i>jk'intik nap'al ta, ma jna' binti sjune sba soke, ma bal ta li ta te ta jch'ujtik, ta jbak'eltik, ta jmochtik</i> The kidney is stuck there, but I don't know what it is with. Its there in the belly, on the bones, the ribs.
<i>banti la ay te k'intik, ta elaw ala ba ay o ta spat,</i> Where is the kidney, more to the front or more to the back?
<i>ju'uk, jp'ej jich ayi como cheb</i> On either side because there are two.
<i>banti ay te jk'intik ta bak'etal</i> Where in the body is our kidney?
<i>li ta ste'el jpatike</i> On the spine.

The vast majority of informants claimed that the kidney had no function and that it was just there at the will of God (Table 34). However, one source held the ambivalent view of, “maybe the kidney has work because it is in the body.” It was mentioned by a few informants that the kidney is associated with the heart due to its proximity, but no specific function was given.

Table 34. Selected transcribed quotations highlighting the function of the kidney.

<i>ja' ts'i ay ya'tel te bi xi ya x'a'te ta bak'etaltik te jk'intike</i> Maybe our kidney has work because it is in the body.
<i>bi la ya'tel xan ek te k'intik</i> What is the work of the kidney?
<i>ma'yuk ja' nax te, te sjune sba ae</i> I don't know.
<i>bi la ya'tel ek ts'i jk'intike</i> Does our kidney have work?
<i>ma'yuk</i> No.
<i>Bi ya spas te jk'intik</i> What does our kidney do?
<i>jich nap'al</i> Its just stuck there.
<i>y bi ya spas te jki'intik?</i> What does our kidney do?
<i>ma bi ya spas te jk'intike, ma'yuk</i> Our kidney doesn't do anything.
<i>bi la yat'el te jk'intike</i> What is our kidney's work?
<i>ma xkil ta me ay ya'tele</i> I don't know what it's work is.

Muk'ul Tsukum and Ch'in Tsukum: The Two Stomachs

When we eat, food passes down the esophagus to the stomach (Figure 14). The stomach

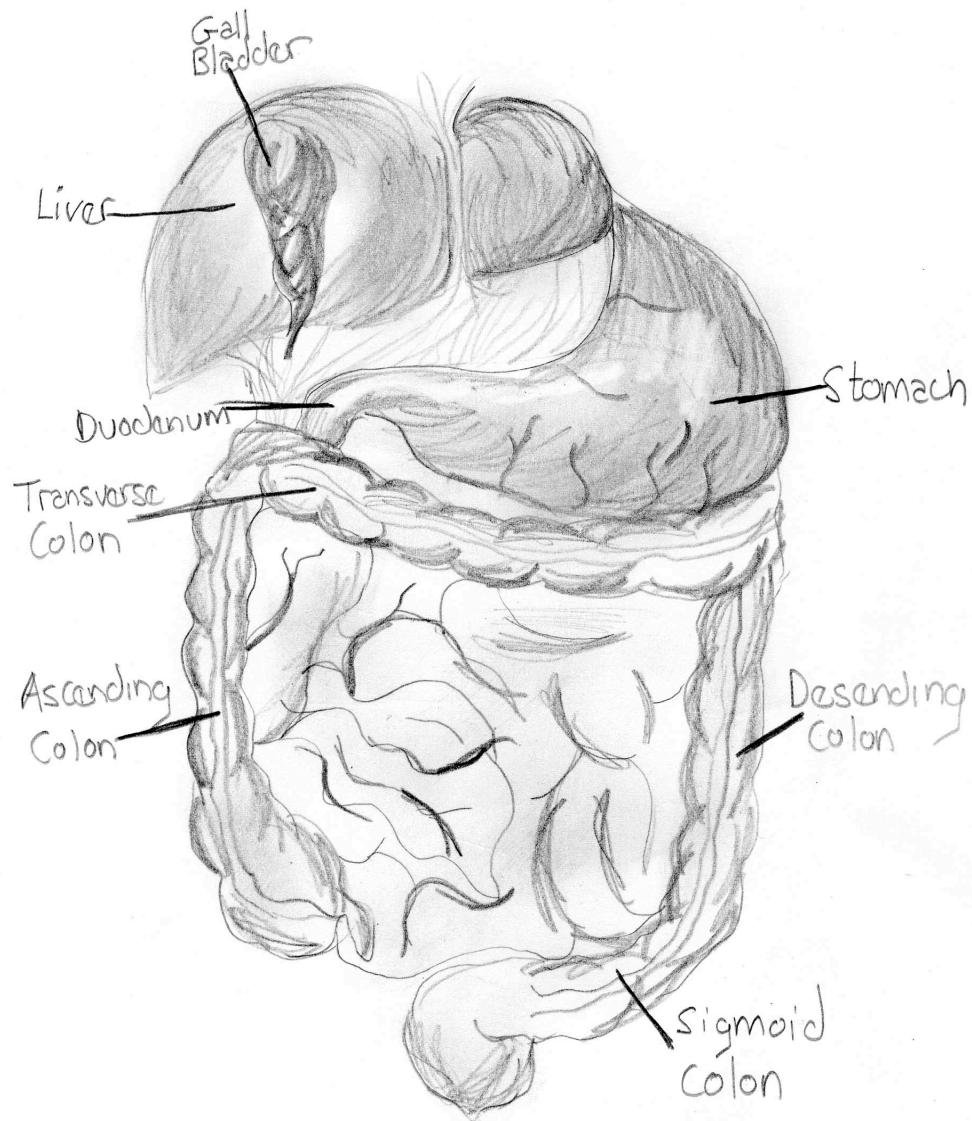


Figure 14. The location of the stomach and intestines. The liver and gallbladder have been “lifted” for a clearer view of the stomach.

then breaks down the food by chemical and mechanical means to prepare it for digestion. The action of the stomach renders the food into a mostly liquid state called chime which is then passed through a narrow sphincter into the small intestine (Tortora and Grabowski 1993: 780-787).

Table 35. Selected transcribed quotations highlighting the perceived number of stomachs.

<i>junax stukel te jtsukumtike</i> There is only one stomach.
<i>ma'yuk cheb, ja' nax jun</i> There are not two [stomachs], just one.
<i>ja' nax ay jun jtsukum</i> Is there only one stomach?
<i>ja' nax</i> Only.
<i>ma'yuk ch'in tsukum, muk'ul tsukum,</i> There is not a small stomach and a large stomach?
<i>eso si como ma jna'tik, la verdad no sé</i> I don't know, the truth is that I don't know.
<i>ma'yuk stukel te cheb te jtsukumtike, ja' nax a te jtsukumtik te ala june, te bikiltike ja' nax niwan jun ek, muk'ul jbkiltik jich bit'il wakax, ay niwan ch'in niwan bit'il wakax ay smuk'ul tsukum, smuk'ul bikil, ay ch'in, jichotik niwan ek</i> We don't have two stomachs because there is only one. The same with the intestines; there is only one and it is the large like the cow has. Maybe we have a small one like the cow, too.
<i>ay ja' nax muk'ul tsukum o ay xchebal tsukum</i> Is there only a large stomach or are there two stomachs?
<i>ja' ts'i ch'in tsukume</i> There is a small stomach.
<i>hay jun tsukumtik o hay cheb tsukumtik</i> Are there one or two stomachs?
<i>ay ch'in jtsukumtik</i> There is a small stomach.

Table 36. Selected transcribed quotations highlighting the location of the stomachs.

<i>ja' nax ts'i we'eltike bit'il ya x'ko ek ts'i we'eltike ja'me ya sjok' ochan tey e</i> How does food reach the stomach? <i>li ya xkojta ko'tantik</i> It passes there in the heart.
<i>ta jbkiltik ya xkoj te we'eltike ya xk'ot ta tsukumtike</i> Food goes down our intestine and down into the stomach.
<i>ya xkobel ta jbkiltik xk'ot te ta tsukum</i> It [food] goes down the intestines and into the stomach.
<i>bi la ut'il ya xk'ot te jwe'eltik tey ta jtsukumtik, ya xk'o bel</i> How does food reach our stomach? <i>li ya xk'o ta sbe kik'tik</i> It goes down the trachea.
<i>ya x'ko li' ta jtutubtik, x'ko ta jtsukumtik y ya xbajt' ta jbkiltik</i> It [food] goes down our throat and enters our stomach, then it goes to our intestines.
<i>bi la ut'il ya xk'ot te jwe'eltik ta jmuk'ul jbkiltike</i> How does food get to the large intestine? <i>ya xk'ax ta tsukum</i> It passes through the stomach
<i>tey ya xk'ot ta jtsukumtik ora ya xijtile sba ta jbkiltik</i> First it [food] goes to our stomach and then to our intestines.
<i>k'alal ma to xk'ot ta este muk'ul bikiltik banti la ya xk'ot</i> Where does it [food] go before it reaches the large intestine? <i>ta muk'ul jtsukumtik</i> To our large stomach.
<i>ja' la ts'i ta me k'ots'i we'eltike banti la ya xk'ot ta muk'ul tsukumtik la bal ta jch'in tsukumtik la bal</i> Does the food pass to the large stomach or the small stomach first? <i>ja' ts'i ta muk'ul tsukumtik ema</i> To the large stomach.
<i>Banti la ya sk'ot sbabial ta muk'ul tsukum la bal o ta ch'in tsukum</i> Where does it [food] go first, the large stomach or the small stomach? <i>ta jmuk'ul tsukumtik</i> Our large stomach.

Table 37. Selected transcribed quotations highlighting the function of the stomachs.

<i>ja' tey xk'ot a ek ts'i jwe'eltik</i> The food that we eat goes there [stomach].
<i>ja' ya'tel ek i we'eltik ema</i> Food gathers there [in the stomach].
<i>ma bi spas ja' nax te a stsob sba kaltik a</i> It [stomach] does nothing, it [food] just goes there.
<i>tey nax, me och selo ts'ine ya xjelaw ta muk'ul bikiltik</i> There, if it [food] enters there [in the stomach], it stays in the large intestine.
<i>ya x'a'tej komo ya xijulabe sba ta jbikiletik ta me yu'un bit'il aye</i> It [food] works [in the stomach] and then is passed to our intestine as it always is.
<i>bi ya spas ts'i jtsukumtik sok ts'i jwe'eltike</i> What does our stomach do with our food?
<i>pues tey ya xtak'ajix a</i> Well, it ferments there.
<i>ja la ts'i te we'eltik bi la spas te ats'i ta muk'ul tsukumtik</i> What happens to food in the large stomach?
<i>bi ya spas i ya xtub te a i ma</i> What happens? It begins to stink in there.
<i>ja' la ek ts'i ch'in jtsukumtike binti la xan ya'tel te ek a ts'in</i> What is the work of our small stomach?
<i>ja' na nix ya'tel xan ek a ts'i</i> It's the same [food gathers there].
<i>bi la ya spas xan ts'i me jelaw ta chin tsukum</i> What happens when it comes to the small stomach?
<i>ja' na nix jich i ma</i> The same [begins to stink].
<i>ay la wan este xyal xmots'i ya'teljik sok te ch'in tsukum sok muk'ul tsukumtiik</i> Are there differences between the work of the large stomach and the small stomach?
<i>ma'yuk ma</i> No.
<i>ay la wan este xyal xmo ts'i bit'il ya x'a'te ek ts'i tsukumtike o jma ya x'a'te</i> Is the work of the two stomachs the same or different?
<i>los dos es lo mismo</i> The two are the same.

However, informants variously refer to one stomach or two stomachs (large and small), with a slight favor towards the plural (Table 35). The stomach or stomachs are located in mid-gut, underneath the heart (Table 36). The large stomach is located above the small stomach, when thought to be present.

The stomach(s) are involved with the passage and processing of food (Table 37). Though one informant claimed that the large stomach stores food and the small processes it, most informants believe that the work of the two is the same. Food arrives in the (large) stomach by passing from the mouth through the esophagus (*tutubil*), the trachea (*kik'il*) or, more often, the intestine. The processing of food is variously described as working, mixing, rotting, decomposing or fermenting in the stomach. In all cases, life force is extracted from food at this stage.

Table 38. Selected transcribed quotations highlighting the stomachs' role in producing feces.

banti la ya skap sba te jwe'eltik ya xbat ta tsa'
Where does our food change into shit?

ja' ts'i ya ka'yitik tsa'nele ta jbkiltik ja' ts'i ta jbkiltik ema
The shit passes through our intestine and then it comes out.

bantila ya skapba sok te tsa'tike, bantila ya skapbel sba ya'el te we'eltike
Where does food convert into shit?

ta muk'ul tsukum i ma
In the large stomach.

binti la spas ts'i jwe'eltik ta tsukum
What does our food do in the stomach?

ya skap sba te a, entonces k'ot xan yan ts'in sten sbaik jich xlok' ta tsa'tael
It mixes there and when more food comes it comes out as shit.

It is debated whether the food is converted into feces in the stomach or the intestine, with both ideas sometimes held by the same informant (Table 38). If waste is formed in the stomach it is either that the food is simply converted to waste or that the waste is separated from the life force provided by the food. While food is processed, gas is formed in the stomach(s) as a byproduct of food mixed with a small amount of air breathed into the stomach (Table 39).

Table 39. Selected transcribed quotations highlighting the stomachs' role in producing gas.

<i>ba xa'a'wil ja' te yik'alel te jwe'eltike, kich'ulatik te ik'e ja tey spul sba, jichun ya xnoj jich ya xlok' ta tsistael</i>
I think that they are gasses generated from the food we eat, and as we breathe, air is introduced there and then it comes out as a fart.
<i>bi la yu'un te ma ba lekix a te yik'e</i>
Why does the air [of farts] stink?
<i>bueno ja' ts'i ya soke, ja sts'i yik'alel te jwe'eltike, ta jch'ujtik, ya xyanaj yik'</i>
Well, the smell ferments in the belly.
<i>ya spas sba ta jch'utik</i>
They [farts] are made in the belly.
<i>banti la ya xlijk'tal</i>
Where does it [fart] form?
<i>ta jch'ujtik,</i>
In our belly
<i>ay la bal k'ejel ya xlijk'tal,</i>
Is there a specific place?
<i>ma'yuk</i>
No.

A small amount of liquid also passes through the stomach (Table 40). However it is debated over what liquid does so. For some, water enters the blood through the heart but other

liquids go to the stomach, for others the water is separated with some going to the heart and some to the stomach. Further, food contains water that also goes to the stomach.

Table 40. Selected transcribed quotations highlighting the stomachs' role in processing water.

<i>bi la ut'il ya xk'o ta jko'tantik te ja'e, ya ba xpamaj tea</i> How does water reach our heart?
<i>ma ba xpamaj, ta jtsukumtik ya xk'ot</i> It doesn't, it goes to our stomach
<i>bi la ut'il ya xk'ot ta jtsukumtik te ja'e</i> How does water reach our stomach?
<i>ya xk'ot, tey ya xk'o spaj sba sok a te jwe'eltike</i> Its found in the food we eat.
<i>ya kuch'tik ya xkobel ta jch'utik ya xkobel ta bikiltik sok ta tsukumtik</i> What we drink passes through the belly, it passes through the intestines and the stomach.
<i>ja' la ts'in ta me la kuch'tik xan tolja' bi la ya spas te me la kuch'tik tolja'e</i> When we drink, what happens to the water?
<i>ya xbat ta ch'ich'eltik te ja'e</i> The water goes to the blood
<i>spisil</i> All of it?
<i>ju'uk i ma ya xk'oj ta jbikiltik in i ma</i> No, some goes to our intestine.
<i>te toj bel ta bikil</i> Directly to the intestine?
<i>toj nax ts'i, te ya xk'ot ek a ta jtsukumtike</i> It also goes through our stomach.

Muk'ul Bikil and Ch'in Bikil: The Paths of Food

After the stomach, the food, now mostly liquid, passes into the small intestine where absorption of nutrients begins (Figure 14). Liquid along with nutrients is absorbed by the blood

through the intestinal wall. The chime then passes into the large intestine where the final absorption of liquid solidifies the undigestible portions of food and forms feces. The feces are then defecated (Tortora and Grabowski 1993: 797-811).

Table 41. Selected transcribed quotations highlighting the perceived number of intestines.

<i>ja te j̥bikiltike, cheb niwan</i> The intestines, there are two, perhaps.
<i>ay bal che oxe b te j̥biikiltike</i> Are there two or three intestines?
<i>ma 'yuk, pura junax te bikil, pero puede ser ay niwan ch'in bikil</i> No, just one, but there could be a small intestine.
<i>ay nax ay j̥muk 'ul j̥bikiltik ay jch'in j̥bikiltik</i> There is our large intestine and our small intestine.
<i>ay la bal cha 'ox ten te j̥bikiltik</i> Do we two or three intestines?
<i>ma 'yuk</i> No.
<i>ma 'yuk stukel te cheb te tsukumtike, ja' nax a te tsukumtik te ala june, te j̥bikiltike ja' nax niwan jun ek, muk 'ul bikiltik jich bit'il wakax, ay niwan ch'in niwan bit'il wakax ay smuk 'ul tsukum, smuk 'ul bikil, ay ch'in, jichotik niwan ek</i> There are not two stomachs because there is only one. The same with the intestines; there is only one and it is the large like the cow has. Maybe we have a small like the cow, too.

The Tzeltal generally believe that there are both a large and small intestine (Table 41). However there is some confusion as exemplified by one informant as, “There are not two stomachs because there is only one. The same with the intestines; there is only one and it is the large like the cow has. Maybe we have a small like the cow, too.”

Table 42. Selected transcribed quotations highlighting the location of the intestines.

<i>y banti ay te muk'ul jbikiltik</i> Where is our large intestine? <i>li' na nix ta jch'ujtik</i> Here, also, in our belly.
<i>banti ay te ch'in bikil ta bak'etal</i> Where in the body is the small intestine? <i>li' ta jch'ujtike</i> Here in our belly.
<i>sjunej sbaik sok nanix li ta jch'ujtiki, tey nax snitoj sba niwan a</i> They [large and small intestine] are found together in the belly. They are connected.
<i>te jbikiltik banti ay ta bak'etal</i> Where in the body are our intestines found? <i>te jbikiltike ja' nax tey ta sael ko'tantik</i> Our intestines are found to the right of our heart.
<i>tey nax, me och selo ts'ine ya xjelaw ta muk'ul bikiltik</i> There, if it [food] enters there [in the stomach], it stays in the large intestine.
<i>bi la ut'il ya xk'ot te jwe'eltik ta jmuk'ul bikiltike, toj la bal ta muk'ul bikiltik o ju'uk</i> How does food get to the large intestine? <i>ya xk'ax ta tsukum</i> It passes through the stomach?
<i>tey ya xk'ot ta jtsukumtik ora ya xijtile sba ta jbikiltik</i> First it [food] goes to the stomach and then to the intestines.
<i>ja' la xan ek bi la ut'il ya xk'ot xan ek ts'i we'eltik ts'i ta tsukumtik pero bi la ut'il ya xk'ot xan te ek a ta jtskumtike</i> How does food reach our stomach? <i>ta jbikiltik ya xk'ot te we'eltike ya xk'ot ta jtsukumtike</i> It goes down our intestine and down into our stomach.
<i>bi la ut'il ya xbajt ts'i jwe'eltik ts'i k'alal ya xk'ot ta jtsukumtik</i> How does our food arrive in our stomach? <i>ya xkobel ta jbikiltik xkot te ta tsukum</i> It goes down our intestines and into our stomach.
<i>bi la ut'il ya xk'ot te jwe'eltik ta jtsukumtike</i> How does our food reach our stomach? <i>ya x'ko li' ta jtutubtik, x'ko ta jtsukumtik y ya xbajt' ta jbikiltik</i> It goes down our throat and enters our stomach, then it goes to our intestines.

Table 43. Selected transcribed quotations highlighting the order of the large and small intestines.

<i>banti la ya xk'ot sbabial,</i> Where does it [food] pass first [large or small intestine]?
<i>ta muk'ul bikil,</i> The large intestine.

<i>sbab i la bal ya xjelaw ta muk'ul jbikiltik</i> Does it [food] pass first or second through our large intestine?
<i>ja'sbabial ya xjelaw ta muk'ul jbikiltike</i> First through our large intestine.

<i>bueno ja'la ts'i ta me k'otix a, ja' la ts'i me k'ot a jtsukumtike banti la toj bel ta jmuk'ul jbikiltik</i> <i>la bal ta jch'in bikiltik la bal</i> OK, after it [food] goes to our stomach does it go to our large intestine or to our small intestine?
<i>ja' ts'i muk'ul bikiltik ema i ta patil ch'in</i> To the large intestine and then to the small.

For approximately half of the informants, the intestines are located to the right of the heart or in the chest and deliver food to the stomach (Table 42). However, it is generally thought, even by most of those holding the previous belief, that the intestines are in the lower belly, under the stomach(s) with the large above the small with food passing first through the large (Table 43). In all cases the intestines are associated with the stomach(s) and are involved with the passage of food and/or food wastes through the body.

Food is thought to be forced into the intestines by the consumption of additional food which arrives in the stomach (Table 44). The food is then pushed along the intestines as more food is consumed. According to some of the untaped interviews, the intestines are thought to continue the process of extracting life force from the food.

Much like the stomachs, the two different intestines are not thought to differ in function (Table 45). Food passes from the large intestine to the small as the food gives up increasing

amounts of its life force. The journey from the mouth to the small intestine takes from one to two days.

Table 44. Selected transcribed quotations highlighting the function of the intestines.

<i>ja' tey x'ain a te sbaal jch'ujtik, bitil xwe'otik</i> Food travels through the belly in it [intestine].
<i>te muk'ul jbkiltike ja' na nix we'eltik x'a i ma</i> Food also passes through our large intestine.
<i>binti la ya spas te muk'ul jbkiltike</i> What does our large intestine do?
<i>te ya xk'o a te jwe'eltike</i> Our food goes through there.
<i>binti la ya'tel te ch'in jbkiltike</i> What is the work of our small intestine?
<i>ja' ts'in ya xwe'otik eke</i> Food passes there.
<i>bi la ut'il ya xk'ot te jwe'eltik ta ch'in jbkiltike</i> How does food arrive in our small intestine?
<i>tey x'ain a, xjala jun chebuk k'al</i> It gets there after one or two days.

If liquids are thought to be in the foods and to pass through the stomach they are likewise thought to pass through the intestines (Table 46). However, for some informants, water that enters the blood in the heart may then pass to the intestines, circumventing the stomach. The liquid or water is then thought to pass from the intestine into the belly.

Table 45. Selected transcribed quotations highlighting the similarity of function between the large and small intestines.

<i>ay la wan xyal mots'i ya'tel sok ts'i muk'ul bikiltik ch'in bikiltik ch'e</i> Is there a difference between the work of our large and small intestines?
<i>ma'yuk</i> No.
<i>te cheb bikil pajal sok</i> Are the two intestines the same?
<i>pajal sok</i> They are the same
<i>ay la bal este sjeloba ek te ya'telil te bit'il ya xben yael a te jwe'eltike komo ja' ya'tel jich ya xben a te jwe'eltik te'a, ay la bal mach'a muk' te ya'tele ay la bal mach'a ch'in te ya'tele</i> The work [of the intestines] is that food passes there, is the work of the large different from the work of the small?
<i>ma'yuk ma, ma nax i ma</i> No, they are the same.

Table 46. Selected transcribed quotations highlighting the intestines' role in processing water.

<i>ch'ich'eltik stukel te ja'e, yanix k'o ta jbikiltik,</i> The water enters the blood and goes down to our intestines.
<i>ya xbat ta ch'ich'eltik te ja'e</i> The water goes to the blood
<i>spisil</i> All of it?
<i>ju'uk i ma ya xk'ojt a jbikiltik ini ma</i> No, some goes to our intestine.
<i>ya kuch'tik ya xk'o bel ta jch'utik ya xk'o bel ta jbikiltik sok ta jtsukumtik</i> What we drink passes through our belly, it passes through our intestines and our stomach.
<i>ja' la xan ek ts'i me la kuch'tik ja' ba la ya xba xan ek, ba la tojk'oel ek a ts'i me la kuch'tik xan ja'e</i> Where does the water that we drink go?
<i>jch'ich'eltik ja' te ya xba ta jbikiltik ta jch'ujtik</i> To our blood but also to our intestines and to our belly.

Again, food is converted into feces in either the stomach or the intestines or both (Table 47). Likewise, gas is also variously thought to form in the stomach or the intestines (Table 48).

Once the food is converted into feces it then passes through the anus.

Table 47. Selected transcribed quotations highlighting the intestines' role in producing feces.

<i>bi la ya spas te jwe'eltik ta bikile,</i> What does our food do in the intestine?
<i>ja' te tey x'a i ma, sta te yorail te xlok'e,</i> It passes there until it comes out.
<i>bi la spas a te we'eltik ta me jelawix bel ta bikiltik a, bae xbajt xan a</i> What happens to food after it passes through the intestine?
<i>ya xbajtix ta tsa' xlok'ix ta tsa'</i> The shit goes there, the shit comes out.
<i>banti la ya xbajt xan ek a te jwe'eltik ta jbikiltike</i> Where does food in the our intestines go?
<i>ya xlok'ix ta tsa'tael a</i> It comes out as shit.

Table 48. Selected transcribed quotations highlighting the intestines' role in producing gas.

<i>bi la ut'il ya xba ek ts'i ta jbikiltik ek ts'i yik'al</i> How does it [fart] come out in our intestines?
<i>ja' ts'i yik'alel ek ts'i we'eltike ma</i> It is the air that is in food.
<i>banti la ya stsob sba banti la ya x'en</i> Where does it [fart] form?
<i>ta jbikiltik</i> In our intestines.

Me' winik: A Uniquely Tzeltal/Tzotzil Organ

Me' winik is either an organ or illness, the attribution is unclear and differs from individual to individual (Table 49). It is found between the intestines and stomach in the region of the umbilicus and is not an organ that correlates with any organ known to biological science. Berlin and Jara (1993) note that the *me' winik* may be related to the Yucatec Maya organ *tipte'* which is the physical and cosmological center of the body. However, the Tzeltal do not attribute as much to the organ.

Table 49. Selected transcribed quotations highlighting the debate whether the *me' winik* is an illness or an organ.

<i>ma'yuk ya'tel ts'i ma, ja' na nix me och xchamel xlijk' ta ti'aw</i> I don't think it [me' winik] has a function, its only when there is illness that it causes pain.
<i>sme' nanix winiktik a chameltik nanix a</i> There is a me' winik, but it is an illness.
<i>bi la ya'el ya xti'wan</i> How does it hurt [me' winik]?
<i>ya xti'wan ta jch'utik melel jchameltik nanix a</i> It hurts in our belly because it is an illness.
<i>bi la ya'el ya staotik ts'i me'winike</i> How do we get me' winik?
<i>jich nax ya staotik ya'el te me'winike ja'te ya xti'wane</i> It just starts by itself, because we have the illness it hurts.
<i>bi la ya spas ek te sme'winiktike ta yutil jch'utike</i> What does the me'winik do in the belly?
<i>ja' ts'i ya xti'wan te ay jchameltike</i> It hurts because it is an illness.
<i>bi la ya'el ya xti'wan ta bats'il lek te me'winike</i> What really hurts when we have me' winik.
<i>ja' ts'i ya xti'wan te xwilwunxil ta ko'tantike</i> It hurts and jumps in the heart.

Table 49. (Continued)

<i>binti la ya'tel te me'winike</i> What is the work of the me' winik?
<i>bueno, ma jna'tik jip a xti'wani</i> We don't know it just causes pain.
<i>bi la yu'un te me'winik sbile</i> Why is its name me' winik [mother of man]?
<i>ja'la te xnijke, ta me lijk' ta nijkel ts'ine ya xlijk' ti'wanuk ch'ujtik</i> Because it trembles, it begins to tremble when it causes pain in the belly.
<i>bueno ay la wan binti ya'tel ek</i> Yes, and what is its work [the me' winik]?
<i>ay nax ya'tel ja' yip ek a ts'i xlijk ta ti'aw te ya ka'ytik tsa'nele</i> It does have work, pain comes out of it and it causes diarrhea.
<i>ay nax ya'tel komo ya xti'wan yawaeye, melek te me ma kejhaje ya smilotik, yan ta me yu'un kejhaje ya xlamaj te binti ya stijs ba e, ya xlijk' ch'abuk</i> Yes it [me' winik] does have work because it causes pain, and if we don't take care of it, it kills us. But if the pain is relieved it stops moving and we recover.
<i>chamawae ma xnijk' stukel, ma ba ya xnijk' a te k'ala ma xti'wane, yan ta me k'ala ya xti'wane ma stak' xbenotik yu'un</i> We feel that it [me' winik] doesn't move when there is no pain. But when there is pain we can't walk.

Though some say that only women have a *me' winik*, most believe that everyone has the organ because everyone can get the abdominal pain related to it (Table 50). However, *me' winik* translates as 'mother of man', a term given the organ by the ancestors because it moves and causes pain much like a baby forming in the womb. Its jumping or trembling is what causes the illness and is often discovered in pregnancy. These symptoms do display a predominately feminine bias. It is not known what precipitates the disease. In terms of biomedicine, Berlin and Jara (1993) make a convincing argument that the pain is frequently associated with gallbladder disease.

Table 50. Selected transcribed quotations highlighting the debate whether the *me'* *winik* is present in everyone or just women.

<i>jalaek te kristiano ay la bal sme' swinik</i> Does everyone have a me' winik? <i>ja bal ts'in te antse</i> Just the women.
<i>pero ay ya yalik jtul cheb te mala ayuk me'winiktik ta jpisiltik, ja' nax la ants</i> But, there are some who say that we don't all have a me' winik, that only women have them.
<i>bueno, komo ma jna'tik stojol ek ts'i, komo ya yalik ma'yuk, ja' nax ay sme' swinik te antsetike</i> Well, that we don't know, they just say that we all don't have then and that only women have a me' winik.
<i>spisil la bal ay ku'untik te me'winike o ju'uk</i> Does everyone have a me' winik or not? <i>spisil</i> Everyone.
<i>spisiltik la wan ay ku'ntik te me'winike o ja' nax la bal jtul te mach'a ay sme'winike</i> Does everyone have the me' winik or not? <i>ju'uk spisiltik</i> Yes, everyone.
<i>ja' la te me' winike, spisiltik la ba ay ku'untik te kuxulotik ta balumilale o ay la ba mach'a ma'yuk yu'un</i> Does everyone in the world have a me' winik or are there some that don't? <i>bueno como ka'ey ya'ele ay</i> Well, everyone has it.
<i>ay nax te sme jwiniktike komo ya stij sba te ya xti'wan te jch'ujtike komo yu'un ya xnijk'</i> Yes we all have one because when it moves it causes pain.
<i>ja'la bi la ut'il te me'winik spisila bal krisiano ay yu'un o jtul nax la bal,</i> Does everyone have a me' winik, or just some people? <i>spisil, spisil krisiano ay</i> Everybody has one.

Summary

As was predicted by the paired comparison data, the heart, blood and lungs are the most well known of the items found in the body. The heart is thought to be involved with circulating

blood, thought and emotion and breathes with the lung. The blood acts as the hearts messenger and delivers life force to the body. The gastrointestinal system, comprised of the two stomachs and the two intestines is also well described. This is the path of food through the body. Also, this is where life force is extracted from food and feces are formed. Finally, the rest of the organs are thought to do nothing and are not extensively described. From these data, ethnophysiological concepts will now be described at length.

Chapter 9

Ethnophysiology

Cardio-Pulmonary Physiology

The first and foremost role of the heart is to breathe because from breath all of the other functions of the cardio-pulmonary system follow. The lung or lungs move to bring air containing life force into the heart. It is important to remember that when the lungs are mentioned it is as an element or part of the heart. This is much like when one considers the fingers; though somewhat autonomous, they are, incontestably, part of the hand, not separate from it. Therefore the movement of the lungs is the same as the heart beat. As the heart moves, it impels the blood to travel through a circuit of veins throughout the body. When the blood passes through the heart it acquires life force and delivers it to all of the organs and muscles. It is the life force that allows organs to function and the muscles to move.

Also, it is through breathing that one is able to think. The life force contained in the air provides the seed for and substance of thought. A strong position is that breath and thought are the same thing. Thus, if the air one breathes is clean and of high quality, they will have good and productive thoughts, while if the air is bad, the quality of thought is adversely affected. In addition to thoughts, the heart is believed to be the source of emotions, sensations and thought. The heart then sends these thoughts to the respective parts of the body, along with life force, via the blood to become action. As in the quality of air, if one is healthy, and thus so is the blood, the thoughts are good and productive but, if one is sick, the thoughts are corrupted and therefore bad. Further, the blood does not merely deliver thought to the body, but also returns sensations from

the remote locations to the heart. It is only when the blood returns to its point of origin in the heart that one feels tactile sensations or pain. Further, work depletes the blood of life force and as the blood renews its supply in the heart we feel exhaustion or weakness.

As mentioned earlier, in a few cases the brain is believed to play a role in thought. Even for those who hold this perspective, the role of the brain is somewhat unclear. The most likely scenario is that the brain provides a storage and refinement facility for thoughts before they are delivered throughout the body. For one Maya consultant, the brain plays a role in forethought or planning while the heart provides raw thought and emotion. Regardless of the role, thought is believed to reach the brain in air as opposed to traveling via the blood. In this sense, the brain is an adjunct to the heart, much like the lung, as thought has not yet entered blood; which can only occur in the heart. Thus, an implied return journey from the brain is never discussed. Following this logic, the one informant who suggests that the heart and brain work together, instead of serially, may be closer to the beliefs of the other two, who only under repeated questioning allowed for a strict order of events.

As noted above, the lungs and the heart work together. The heart sends deoxygenated blood to the lungs to exchange carbon dioxide for oxygen. The blood is then sent throughout the body to provide the oxygen needed for their metabolism. However, the lungs do not make the heart beat nor are the beat of the heart. Though these systems are closely related they are not the same. Further, the blood does absorb nutrients from food and deliver nutrients to the cells. Up until this point, the ethnophysiology of the Tzeltal is quite similar to that of biomedicine.

On the other hand some differences do present themselves. First, the strong belief in one lung as opposed to two. Of much more interest is the attribution of thought and emotion to the heart, and the delivery of thought to the blood. The Tzeltal consider the cardiovascular system as

an integrated cardiovascular and nervous system. There is some mention of the brain's role in thought, but it is a mere adjunct. Nobody considers it to be the lone organ of thought. Yet, there is no sense of a nervous system beyond the brain. The blood and veins take on this role. It is this nervous system function that distinguishes the Tzeltal cardiovascular system from that of biomedicine.

Physiology of Liquids: An Intermediary System

Another role of the heart is to process the water one consumes. Liquid travels first to the heart where a portion of the water is combined with the blood. Water enables the blood to circulate freely. Moreover, water is also needed to irrigate the organs and muscles, allowing them to work. According to untaped interview data, when one works or exercises, the body, and thus the blood, heats and water is pushed out through the skin as sweat. This dries the body. The dried blood returns to the heart producing the sensation of thirst.

However, not all of the liquid one drinks enters the blood. Non-water elements of liquid, as well as water in excess of what the body needs, are diverted to the stomach and intestines. Further, liquid contained in food travels through the gastrointestinal system. This liquid aids in the extraction of life force from the food, which is then transmitted to the blood and delivered throughout the body.

The Tzeltal concepts of water physiology are quite distinct from those of western medicine. Though water does enter and compose some of the blood, it does not do so via the heart. Water is absorbed from the small intestine, as is food. Excess water and electrolytes are removed from the blood by the kidneys which then produce urine. However, the Highland Maya do not attribute this role to the kidneys. Instead, excess water, whether from the blood or derived

from food, is expelled as urine. However, how this liquid is delivered to the bladder is not known.

Gastrointestinal Physiology

The first stop of food in its passage through the body is the stomach. However, it is debated whether there are one or two stomachs. For informants who believe there is only one stomach, the following processes described for two stomachs are combined in the sole organ. In the case of two stomachs, food comes to rest in the large first. This organ is merely a storehouse for eaten food where it is accumulated and mixed. Then, as more food is taken in for another meal, the food is pushed along to the small stomach where it begins to be processed.

This process, variously described as working, mixing, rotting, decomposing or fermenting, is when life force is extracted from the food and transferred to the blood. Along with this process the gallbladder exudes a small bit of fluid that is thought to somehow aid in digestion, but its role is not understood. However, too much of this fluid can cause colic, a severe pain in the abdominal region, which can lead to death.

It is in the stomach and intestine where *aire* – bad air – comes out of the food. According to untaped conversations, some foods naturally have this element and others acquire it through poor cooking. The gas comes out of the body as gas through the mouth or anus.

Some informants attribute the extraction of life force from food to the intestines as well as the stomach. There is also debate whether the food becomes feces in the stomach or the intestines. Further, it is unclear whether the extraction of life force is what converts food into feces or merely precedes it.

Regardless of the locus of life force extraction, and to whether food passes to the stomach via an intestine, the food then travels from the small stomach into the large intestine and then into the small intestine. Finally, the food exits the body as feces through the anus.

Casually, the gastrointestinal system of the Highland Maya appears similar to that of the biomedical system. As known to western doctors, food is taken into the mouth, where digestion begins through mechanical crushing and chemical breakdown by the saliva. It then passes through the esophagus to the stomach. There, digestion continues through mechanical and chemical means. Very little of the food is absorbed at this stage. The food, now mostly liquid, passes into the small intestine where absorption begins in earnest. Here, the pancreas, liver and gallbladder begin to play a role. The pancreas produces pancreatic juice that buffers acid from the stomach to create the proper pH for digestion in the small intestine. The liver produces bile, which is stored in the gallbladder. The bile is secreted into the small intestine by the gallbladder to emulsify fat, aiding in its digestion. Liquid along with nutrients is absorbed through the intestinal wall and into the blood all along the way. The liquid then passes to the large intestine where the final absorption of liquid solidifies the indigestible components into feces. It is then defecated (Tortora and Grabowski 1993: 766-811).

However, three main differences are evident. First, the journey and role of water in the body differs considerably between the two systems as discussed above. Second is the obvious reference to two stomachs. One may argue that this is a reference to the stomach and appendix but this argument is weak. The Highland Maya never see the inside of a human body short of those opened through accident or violence. However, the insides of cattle and sheep are often observed. These animals have multiple stomachs so must we, a common explanation given for organs known to exist but having unknown purpose (e.g. the liver and kidneys).

Finally, the path of food through the body for the Tzeltal is seen as a continual funneling down from larger to smaller passages throughout the body. This system continuously compresses the food and extracts every bit of its life force before its exit. The conversion to feces is a continuous process of compression and extraction along the route. Further, the movement of food through the system is seen as a simple pushing along by a continual addition of more food. However, consumed food travels along the food passages by peristalsis (a process of muscular movement in the esophagus and the intestines). Food will pass along in the absence of any new addition.

Moreover, the role of the liver and gallbladder in digestion is not known by the Maya. Additionally, the pancreas is only mentioned by one informant. In short, the Tzeltal conceive of their gastrointestinal system as a simple funnel.

Reproductive Physiology

Talking about sexuality and ‘women’s issues’ to a stranger is an uncomfortable situation for the Highland Maya (Table 51). However, it was clear that women might menstruate every month or only once every two to three months. It is not clearly known why, but it is just how women are, or as one informant put it, “It’s the work of God; he made women have periods.” It is only after menstruation that a woman can become pregnant. It is held that there are up to four days of menstruation and from between three days and one month afterwards, impregnation can occur. One informant made it clear with, “don’t bother to impregnate her when she is in her period, its after the period when she can get pregnant.” However, nobody knew what happened during or after menstruation to allow pregnancy. It is clear that, “the period no longer descends

Table 51. Selected transcribed quotations highlighting perceptions of reproductive physiology.

<i>komo ja' tonix ta jujun u bit'il ya yilik xchamelik te antsetike, yu'un bal tey nax bal yakal yilel xchamel, ma'yuk</i> Women menstruate each month, they don't just get it one month.
<i>bi la ut'il a te jujun ue o ta jujun u o ta che'che' u</i> Does it [menstruation] happen each one [month] or every other? <i>ta che'che' u oche' u</i> Every other or every third month.
<i>bi la yu'un te ya yil xchamelike</i> Why is there menstruation? <i>bi yu'un como jich la spas te Diose, jich la spas te jalametik te bit'il antsetike</i> It's the work of God; he made women have periods.
<i>ja' to nax a, ora bal ya smakix alal awun a te yakal ta yilel xchamel, ma'yuk ja' to ta me yu'un laj yo'tan yilel te xchamele jich ya xlijk' smakix a te alale</i> Don't bother to impregnate her when she is in her period, its after the period when she can get pregnant.
<i>No, ya no baja su menstruación porque ya queda embarazada.</i> The period no longer descends because she is pregnant.
<i>k'axemix ae, ora ya yik', como ja' ya xmajk' ek ts'i xchamele, ja' tey ya xk'atbuj ta alal te xchamelike</i> [A woman] can get pregnant after the period. It's the menstruation that becomes the fetus.
<i>bit'il ya yik' alal te antsetike, jich bit'il mut ya yalejsbaik yael, ja pajal, te kajwaltik yak'oj tal, te bit'il uch ya stek'tek' sbaik, para que jich ya x'ak'otal te Dios</i> The woman gets pregnant, for example like the chickens there, at God's will, have relations.
<i>bin ut'il ma ch'un biluk winik komo Dios yale jichuk bit'il mut me ma'yuk stat ma'yuk a, kapaluk bit'il ayotik awil me ay me ma x'alaj te antse ma'yuk ya xtal yan, ya xtubotik ta k'inal ya'el te bit'il ayotike, jauk me to me ay te jtatike eso, kapal mut me ay stat, me ma'yuk stat te mute ma'yuk ya xtoj', ma la pajk'an te mute ma'yuk ba ya xtoj'</i> It is the principal of the man as God created him, just like the birds, if there is no male we can't multiply, it's the same as if the woman is sterile, we can't procreate and we disappear, but when we find a man as the boss of a family, he creates another being, its like the birds that have a cock, but if there wasn't, that which the chicken lays doesn't incubate, well no chicks come out.
<i>ja'nix te ya xch'ita jch'u jo'tik te ay ek te stateke</i> The baby grows in the belly because it has a father.
<i>ja'la jich bit'il ya xwe'otik pero bi la ut'il ya stunix la xan ek'a te alale xiyawai</i> When we eat, how does the food get to the fetus? <i>ch'ich' ya stun stukel</i> It gets there in the blood.

because she is pregnant.” One informant claimed that the menstruation no longer came because the menstrual fluid became the fetus.

Due to the embarrassment noted above, little information about the sexual roles of procreation was elicited. However, a couple of informants were kind enough to suggest observing the rooster and chickens to understand the act. It is clear that a male is necessary for procreation but the exact contribution was never discussed.

The baby then grows in the uterus – an organ only named by one informant using the Spanish term ‘*matriz*’. Other informants only referred to a place in the belly. The fetus is nourished by life force delivered by blood, much like organs and muscles. About three to four months before birth, the fetus begins to move.

One informant went into great detail about how it was the enjoyment of the sex act that determined the sex of the baby — it was male if the father enjoyed it more and female if the mother enjoyed it more — and that if the mother were particularly excited there would be twins. The same loquacious informant claimed that the *me’ winik* may also have a role in determining the sex of the offspring, a claim also recorded by Stross (1976). All other informants denied any knowledge of how a baby gets its sex and how twins were produced. It was noted that a midwife could determine the sex of a baby after six months of pregnancy. It was also quickly acknowledged that they were often incorrect.

Physiology of Illness

Here I do not intend to engage in a thorough examination of illness and all of its multiple facets. Instead, a few overarching concepts regarding illness and its relationship with the various

Table 52. Selected transcribed quotations highlighting general characteristics of illness physiology.

<i>Si tiene enfermedad la sangre porque cuando se enferma uno llega ahí, porque ahí esta giran en el cuerpo la sangre y afecta también.</i> Yes there is illness in the blood because when one is sick it gets there, because the blood circulates through the body it is affected too.
<i>ya xbeen te me tulan k'inale, k'alal te me tulan te jko'tantike komo yich'oj yip te jch'ich'eltik te bit'il xbenotik, k'alal te me k'unej te jch'ich'eltike bit'il stsakotik te chamel, tey ya xkom kiptik xan yu'un ek, ja' ya yich' yip te jch'ich'eltike, ma'yuk te ch'ich'e ya xkom k'inal</i> It [blood] circulates when we feel good, when our heart is strong. Also, our blood has life force when we walk, but when the pressure drops from illness, so does the life force. Without blood we can't live.
<i>Lo siente, cuando viene la enfermedad se enferma también la sangre, porque lo sabemos, aunque quiere salir pero no se puede, aunque quiere andar a pasear por otro lado pero no puede caminar porque esta enfermo porque la sangre no esta girando bien, porque es muy debil, muy cansado, no puedes caminar</i> It is felt, when illness comes the blood becomes ill too, because we know that though one wants to come out, they can't. Though one wants to walk somewhere else but can't walk because they are sick, and the blood does not circulate well because they are very weak, very tired, you can't walk.
<i>ay nax te chamel ta jch'ich'eltike, ja'nix ya sok yu'un te chamel te jch'ich'eltike como ma ba lom lek yael te jch'ich'eltik como ja'te binti xti'wan kok jk'abtik, joltik, banti xti'wan como sokem te jch'ich'eltike como ay bi ya xti'wan ta jbak'etaltik,</i> Yes, there is illness of our blood, but it is because illness decomposes our blood. When our blood is not well, pain starts in our arms, in the head, in whatever part of our body. It causes pain because our blood is not well.
<i>ta me tsajk' ta chamel te jko'tantike, ta me staotik te chamele x'ochbel ta jko'tantik tey xljajotik</i> When illness arrives in our heart we die.
<i>Bien que lo sabemos como empieza la enfermedad cuando llega al corazon, lo sentimos como debil, cada dia cada tarde, ya no podemos caminar, ya no podemos hacer trabajo, nada, entra la enfermedad en el corazon, ya no gira la sangre, ya no trabaja el corazon.</i> We know how it starts when the illness reaches the heart. We feel weak, each day, each night, we can no longer walk, we can no longer work, nothing. The illness enters the heart, the blood no longer circulates, the heart no longer works.
<i>yanax niwan tal xchamel te me ay bi ya nopnoptatike yan te me ma'yuk bi ya noptike ma'yuk ya xtal xchamel</i> Maybe there is illness that comes if we think too much. If we don't think too much, the illness does not come.
<i>ja' bal ts'in te ay bi ya noptik ta jko'tantike, ja' nax te me ay ma bi ya yutotik ts'ine ma ba ya x'och ate jchameltike</i> If we think about something and don't do it, it makes us ill because we don't do it.

organs are presented (Table 52). As I did not actively pursue ideas about illness all of these data were volunteered by the informants and is necessarily incomplete.

Whenever we are sick, the illness enters the blood. “Yes there is illness of our blood because when one is sick it gets there, because our blood circulates through the body it is affected too.” Additionally, Maffi (1994) notes, “so that if it [blood] gets cold or becomes ‘weak’ ... illness may arise and with it a threat of death,” (203). Between these two perspectives, it is clear that illness and blood are related.

In severe cases, the illness will travel back to the heart and prevent the circulation of blood, leading to death. “It [blood] circulates when we feel good, when the heart is strong. Also, our blood has life force when we walk, but when the pressure drops from illness, so does the life force. Without our blood we can’t live” Further, illness in the heart diminishes the blood’s life force and that is why one feels weak. Additionally, disease decomposes the blood and causes pain throughout the body.

When blood delivers illness to the heart it is quite grave; “when illness arrives in our heart we die” and, “we know how it starts when the illness reaches our heart. We feel weak, each day, each night, we can no longer walk, we can no longer work, nothing. The illness enters our heart, our blood no longer circulates, our heart no longer works.” The source of illness in the heart may be illness traveling through the body in blood or, as one informant suggested after a particularly long and tedious interview session, “maybe there is illness that comes if we think too much. If we don’t think too much, the illness does not come.” Further, “if we think about something and don’t do it, it makes us ill because we don’t do it.” Heart illness disrupts thought, and causes pain and weakness throughout the body.

Illness of the lung stems from disease of the body that reaches the organ because circulation conducts the sickness to it when it delivers illness to the heart. When the disease reaches the lung the symptoms include blocking the passage of air to the heart or preventing the

Table 53. Selected transcribed quotations highlighting the illness causing capabilities of the gallbladder and the *me' winik*.

ay ts'i ta me lijk, ja' ay bi la spas ts'in te jch'ajtik ema ay ma ti t'uts ay bit'il st'us a'wa'y ts'i jch'ajtik ema ja' te ya xlijk ta a te chameltike

Yes, there is an illness in our gallbladder. Sometimes our gallbladder bursts and we could die.

bi la ut'il ya stak' a ts'i ya xt'om

How does it come to burst?

ja' ts'i ya xlijk k'ajk'altik ts'i ay ja' k'al ay ba'ay bi ya jtutik a

If we become angry while we eat something it starts.

bueno ta me ts'uj te jch'ajtike, ya xlijk' ti'wanuk ta jch'ujtik, mero k'ux ts'i ma xuix a

Well, our gallbladder leaks, it begins to cause pain and we become debilitated.

ja' nax a te xti'wane o ja' niwan a te xti'wane melek chajp a, xpich'ich'et ta yale yael te jch'ujtike

It [colic] just causes pain but we don't know why. It feels like it squeezes us.

ich nax ya staotik ya'el te me'winike ja' te ya xti'wane

It [me' winik] just starts by itself, because we have the illness it hurts.

bi la ya'el ya xti'wan ta bats'il lek te me'winike

What really hurts when we have me' winik.

ja' ts'i ya xti'wan te xwilwunxil ta ko'tantike

It hurts and jumps in the heart.

bi la yu'un te me'winik sbile

Why is its name me' winik [mother of man]?

ja' la te xnijke, ta me lijk' ta nijkel ts'ine ya xlijk' ti'wanuk jch'ujtik

Because it trembles, it begins to tremble when it causes pain in our belly.

bueno ay la wan binti ya'tel ek

Yes, and what is its work [the me' winik]?

ay nax ya'tel ja' yip ek a ts'i xlijk ta ti'aw te ya ka'ytik tsa'nele

It does have work, pain comes out of it and it causes diarrhea.

ay nax ya'tel komo ya xti'wan yawaeye, melek te me ma kejhaje ya smilotik, yan ta me yu'un kejhaje ya xlamaj te binti ya stijs ba e, ya xlijk' ch'abuk

Yes, it [me' winik] does have work because it causes pain, and if we don't take care of it, it kills us. But, if the pain is relieved it stops moving and we recover.

chamawae ma xnijk' stukel, ma ba ya xnijk' a te k'ala ma xti'wane, yan ta me k'ala ya xti'wane ma stak' xbenotik yu'un

We feel that it [me' winik] doesn't move when there is no pain. But when there is pain, we can't walk.

escape of inspired air. These symptoms present themselves as cough. This is seen as potentially deadly as air is fundamental to human existence. Minor symptoms of lung disease are general pain to the body and to the legs.

Headaches and body pains are believed to be caused by infected blood circulating in the brain. However they are felt to be a mere symptom of a general bodily malaise. Likewise, body illness affects the liver because the blood begins to break down and the body feels weak.

There are two organs that are thought to cause illness themselves: the gallbladder and the *me' winik* (Table 53). The gallbladder sweats and drips if we get angry while we eat. The fluid enters the body and causes debilitating pain. One informant noted that it possibly moves. The disease is thought to come very quickly and is felt as severe pain in the abdomen. Colic is very serious and if it progresses the gallbladder may burst and kill us. Likewise, the *me' winik* has its particular illness. As noted before, some consider the *me' winik* an illness as opposed to an organ. As well as abdominal pain that is so severe that it prohibits walking, the illness causes diarrhea and is potentially deadly.

Summary

In addition to the data presented in the previous chapter, two subjects are presented: reproduction and the physiology of illness. Reproduction is a topic not comfortably discussed by the Tzeltal. However, it is clear that it is believed that a woman can only be impregnated shortly after her period. It is also clear that a man is needed to impregnate a woman. Short of a few interesting comments made by individual informants, this is the extent of what was elicited.

Though I did not actively pursue the topic, the physiology of illness presented itself throughout the interviews. When one falls ill, the illness is distributed throughout the body by the

blood. One feels sick when the illness reaches the heart. In general, it was not claimed that any one part of the body could contain an illness. However, the kidney was mentioned as a locus of disease by a few informants.

Though it is not generally held that organs are the locus of illness, two entities are thought to cause illness. The gallbladder is thought to cause colic when one becomes angry while eating. The other entity is the *me' winik*; an organ not consistent with biomedical knowledge. There is debate among the Maya as to whether this is an organ or just an illness. If considered to be an organ, the *me' winik* is also thought to be a source of illness. However, it may just be the illness itself.

Until this point, all of the data come from the remote community of Ch'ixal Tontik. Though interesting in itself, it is important to know if these beliefs are held by the general population of the municipality. To that end, a binary fixed-response survey derived from these data was conducted in the municipal capital.

Chapter 10

Results of the Binary Fixed-Response Questionnaire

In order to test how generalizable the above findings are to the municipality of Tenejapa, a binary fixed response questionnaire was composed. The questions were created by drawing on the data from the semi-structured interviews and emergent issues (see Appendix C). The survey was administered in the municipal center to 100 municipal residents. Seventy-two lived in the town center and 28 were in town for the weekly market. Residents of the municipal seat represent all of the *parajes* of the municipality and do provide a reasonable transect. The surveys were administered in a snowball strategy by touring the town and recruiting anyone who was willing to cooperate. I attempted to recruit equal numbers of males and females. The final sample included 42 female and 58 male participants ranging in age from 24 to 62 (females, 25 - 56; males 24 – 62).

The responses to the survey were run through a consensus analysis with ANTHROPAC (Borgatti 1996a). The eigenvalue ratio between the first and second factor is 8.565, displaying a high level of consensus. The survey results can be trusted as representing one cultural model. Further, the culturally appropriate answers for each question are derived in this analysis (see Appendix E).

For the following discussion, the pertinent survey questions and the brief answer have been extracted from the survey to aid the reader in linking the survey to its analysis. Points of convergance and contrast with the semi-structured interviews are highlighted.

Cardiovascular

As is suggested by the interview data, both the lung, or lungs, and the heart are the same thing; or more precisely the lung is a part of the heart (Table 54). Unfortunately, the survey does not contain any questions that clear up whether there are one or two lungs. On the other hand, as there are two terms that refer to ‘lung’ – *putsil* and *sot’ot’il* – one survey question makes it clear that they refer to the same thing. However, though in most instances the responses to questions posed for both terms were the same, in some cases they differed. These particular instances will be noted below.

Both the interview and survey show agreement with regards to breathing. The movement of the lung draws air into the heart. Further, this movement causes the heart to move, or is the movement of the heart, which impels the blood. It is only after the air reaches the heart that the air then enters the part known as the lung. The air that is inspired is a significant source of life force. The life force is then delivered throughout the body by the blood.

Again, in line with the interviews, the survey suggests that thoughts are believed to originate in the heart. Here is one case where the *sot’ot’il* and the *putsil* differ. In the survey, the *sot’ot’il* is a source of thought while the *putsil* is not. However, the survey data do not support the interview data that suggest that the air we breathe has any role in forming thoughts. However, in the former, it is not known whether bad air may affect thoughts adversely. Further, in Ch’ixal Tontik, it is believed that the blood carries thoughts throughout the body; a thought to move a body part is carried to that part by the blood. The municipality as a whole does not disagree, but is not sure whether this is the case. Both populations further agree that blood delivers the message of pain from its source to the heart where it is felt.

Table 54. Survey questions regarding the cardiovascular system and their appropriate answers.

the air we breathe gives us our thoughts	no
If we breathe bad air, we have bad thoughts	don't know
the heart cleans the blood	yes
our emotions start in the heart	don't know
thoughts come up from the heart	yes
when we breathe air arrives in the heart	yes
air arrives in the heart and then in the lungs	yes
the heart is where we have our soul	yes
The heart feels good when we have sex	don't know
the blood provides the life force that the body needs to live	yes
when we get sick we feel weak because the blood takes the illness to the heart	yes
the air we breathe goes to the heart and gives life force to the blood	yes
when part of the body hurts the blood takes the pain to the heart so we feel it	yes
blood gives life force to the body	yes
when we think to move a part of the body, the blood takes the thought to that part	don't know
we get sick when there is a lack of life force in the blood	yes
the heart causes the blood to move	yes
blood is made in the heart	yes
when we get ill the blood takes the illness throughout the body	yes
when we breathe the lung movement causes the heart to move	yes
air arrives in the lung and then the heart	no
Thoughts begin in the lungs (sot'ot')	yes
the lungs (puts) clean the blood	no
the soul is in the lung (puts)	no
blood is made in the lung (puts)	no
our lungs (puts) feel good when we have sex	don't know
the lung (sot'ot') cleans the blood	don't know
the lung (puts) and the heart are the same thing	yes
blood is made in the lung (sot'ot')	no
The soul is in the lung (sot'ot')	don't know
when we breathe the air arrives in the lung (puts)	yes
emotions begin in the lung (puts)	no
our lungs (sot'ot') feel good when we have sex	don't know
emotions begin in the lung (sot'ot')	don't know
when we breathe the air arrives in the lung (sot'ot')	yes
thoughts begin in the lung (puts)	no
the lung (puts) and the lung (sot'ot') are the same thing	yes
our soul gives us emotions	yes
our soul gives us thoughts	yes
our emotions begin in the brain	yes
our thoughts begin in our brain	yes

As related to thought, emotions are believed to originate in the heart in Ch'ixal Tontik. On the other hand, the survey data suggest that the municipality as a whole is not sure on this topic. This is another place where the *sot'ot'il* and *putsil* have different responses. The *sot'ot'il*, like the heart, may or may not be the source of emotion, while the *putsil* is definitely not. However, the soul is believed to reside in the heart for both populations. Further both populations agree that the soul is the ultimate source of both thought and emotion. Therefore, the lack of assurance of the municipal population in claiming that thought comes from the heart may be clarified by the soul's place in it.

Additionally, the brain is believed by the wider population to play a role in thought and emotion. As this is acknowledged alongside an acceptance of the heart's role in thought and, through the soul, in emotion, this does not conflict with the views of Ch'ixal Tontik.

Finally, both the interview and survey data support that illness is carried from its source throughout the body by the blood. It is when the illness reaches the heart that we feel sick. The weakness and debilitation of sickness derives from the depletion of life force by the action of the illness in the heart.

Liquids

The survey data support the interview data with regards to liquid physiology (Table 55). As described above, liquids travel to both the heart and to the stomach. In the heart the liquid mixes with blood. It is also thought to do so in the *sot'ot'il*, but not in the *putsil*. In contrast to the interview data, liquids are not thought to mix with the blood in the stomach. Though, as in Ch'ixal Tontik, it is not known where urine is formed, the survey data are clear that urine derives

from the liquid that accompanies food in the stomach. Unlike the data for Ch'ixal Tontik, it is not known whether sweat is liquid that comes out of blood as life force is extracted by the body.

Table 55. Survey questions regarding the liquids system and their appropriate answers.

liquid mixes with blood in the lung (sot'ot')	yes
urine is made in the lung (puts)	don't know
liquid mixes with blood in the lung (puts)	no
urine is made in the lung (sot'ot')	don't know
the liquid we drink gives life force to the blood	yes
the liquid we drink converts into blood	yes
sweat is the liquid which comes out of blood when the life force is finished	don't know
liquid mixes with the blood in the heart	yes
The liquid we drink mixes with the blood in the heart	yes
urine is the liquid that comes out of the blood when the life force finishes	yes
when we drink liquid it passes from the mouth to the heart	yes
we feel thirst in the heart	yes
urine is made in the heart	don't know
the liquid we drink mixes with the blood in the stomach	don't know
when we drink the liquid passes from the mouth to the stomach	yes
urine is made in the stomach	don't know
urine is the liquid that mixes with food in the stomach	yes
liquid mixes with the blood in the stomach	no
we feel thirst in the stomach	don't know
the liquid that we drink mixes with food in the stomach	yes

Gastrointestinal

The ambivalence regarding the number of stomachs is not cleared up by the survey data (Table 56). There may be two or there may be one. Gastrointestinal physiology appears to be the same throughout the municipality. It is still held that the food enters the stomach via the (an) intestine. Once in the stomach the food is cooked or fermented and life force is extracted. It is here that the food is converted into feces. Likewise, it is here that gas is formed from the life force of the food as it is extracted and from air that enters the stomach when we breathe and eat.

Food then passes to the large intestine where life force continues to be extracted and the process of conversion into feces continues. Then, it is on to the small intestine where it is not known whether there is still life force to be extracted.

Table 56. Survey questions regarding the gastrointestinal system and their appropriate answers.

farts are the life force from food	yes
farts are the air that enters the stomach when we eat	yes
farts form in the stomach	yes
food converts into shit when the body extracts life force from it	yes
farts form when the body extracts life force from food	yes
food coverts into shit in the small intestine	yes
food passes through the large intestine then through the small intestine	no
farts form in the intestine	yes
food is converted into shit in the large intestine	yes
the life force in food is extracted in the large intestine	yes
food passes through the small intestine then through the large intestine	no
the life force in food is extracted in the small intestine	don't know
food passes from the mouth to the stomach via the intestine	yes
we feel hunger in the stomach	yes
the life force in food is extracted in the stomach	yes
the soul is in the stomach	no
thought starts in our bellies	no
the food we eat arrives in the stomach and gives life force to the blood	yes
blood is made in the stomach	no
there are two stomachs	don't know
The stomach feels good when we have sex	no
food converts into shit in the stomach	yes
food ferments in the stomach	yes
emotions start in the stomach	no
food cooks in the stomach	yes
when we breathe the air arrives in the stomach	yes
farts are the air that arrives in the stomach when we breathe	yes

Reproduction

Reproductive physiology, as mentioned above, is quite unclear to the Maya (Table 57). Though it is established in the interview that a woman can only be impregnated after her period, the survey data do not address this due to including an improperly phrased question. Two questions were planned: a woman could become pregnant before her period and a woman could become pregnant after her period. However, both questions became conflated into, “the woman becomes pregnant when she has sex after her period or before her period.” The survey makes clear that this is not the case, but that only means that she can’t become pregnant at both times.

Table 57. Survey questions regarding the reproductive system and their appropriate answers.

the me' winik of the father determines the sex of the baby	don't know
the woman becomes pregnant when she has sex after her period or before her period	no
a girl is conceived if the father enjoys sex more	yes
a girl is conceived if the mother enjoys sex more	yes
the woman becomes pregnant when she has sex after her period or before her period	no
a woman can become pregnant after only once having sex	don't know
a boy is conceived if the mother enjoys sex more	no
a boy is conceived if the father enjoys sex more	don't know
the baby is made out of menstruation that does not come out during the pregnancy	no
the me' winik is not an organ but just an illness	no
only women have a me' winik	don't know
everyone has a me' winik	yes

One clear difference between the interview data and the survey data regards the substance of the fetus. In Ch'ixal Tontik, it is believed that the baby forms from the menstrual fluid that is retained during pregnancy. The survey data suggest that the municipality as a whole do not hold this belief.

Moreover, sex determination of the offspring is still unclear. It is not known whether the father's *me' winik* plays any role in the determination of sex. Moreover, the suggestion that the parent who enjoys the sex act better determines the sex of the baby is left unanswered by these data. It would appear that a girl is conceived when either the mother or father enjoy sex better, that a boy is not conceived when the mother enjoys sex better and it is not known whether a boy is conceived when the father enjoys sex better. The message here is that it is not simply a binary equation. Instead, it seems that a girl is conceived unless the father enjoys the sex better, at which time it is a toss of the dice. This may reflect the preference for boys who do not come as often as desired. And finally, the population of Ch'ixal Tontik does not agree whether the *me' winik* is an organ or an illness, and whether it is found only in females or in everyone. However, the municipality wide belief is that it is an organ found in everyone.

Liver

The survey results regarding the liver bear out the interview data conclusions that not much is known about it (Table 58). It is noted, with confidence, that the liver does not clean the blood, process air, contain the soul, produce thoughts or produce emotions. Though absent in the interviews, the suggestion that the liver does not produce emotions is contrary to unpublished data collected by Elois Ann Berlin that make the claim. Beyond these themes, it is not known whether blood or urine are made in the liver, whether it has a role in digestion nor whether the liver is a locus of sexual feeling.

Table 58. Survey questions regarding the liver and their appropriate answers.

the liver cleans the blood	no
blood is made in the liver	don't know
urine is made in the liver	don't know
when we breathe the air arrives in the liver	no
emotions begin in the liver	no
the soul is in the liver	no
the liver helps the stomach with food	don't know
thoughts begin in the liver	no
The liver feels good when we have sex	don't know

Gallbladder

The survey data on the gallbladder directly conflict with the data from the interviews (Table 59). While informants in Ch'ixal Tontik stated that the gallbladder drips a fluid into the stomach while we eat, and that this fluid causes stomach pain, or colic, if it becomes too abundant, the survey data are clear that the belief is not held throughout the municipality.

Table 59. Survey questions regarding the gallbladder and their appropriate answers.

the gallbladder gives us stomach pain	no
The gallbladder helps the stomach with food	no

Kidneys

Though the informants in Ch'ixal Tontik are split as to whether there are one or two kidneys, this is not the case throughout the municipality (Table 60). The survey data are clear that there are two kidneys. However, following the interview data, nothing specific is claimed for

the organs. While López-Austin (1988), suggests that the kidneys may be the locus of orgasm for the Aztec, the interview data never mention this and the survey data are inconclusive with a resounding, “I don’t know”. Likewise, it is not known whether the kidneys clean the blood or produce urine. However, they do not aid in digestion, house a soul, produce emotions or thoughts or process air.

Table 60. Survey questions regarding the kidneys and their appropriate answers.

there are two kidneys	yes
thoughts begin in the kidney	no
there is just one kidney	no
The kidneys feel good when we have sex	don’t know
when we breathe air it arrives in the kidney	no
the soul is in the kidney	no
the kidneys clean the blood	don’t know
urine is made in the kidney	don’t know
the kidney helps the stomach with food	no
emotions start in the kidney	no
blood is made in the kidney	don’t know

Summary

The survey data show a high level of agreement between Ch’ixal Tontik and the rest of the municipality. It can be inferred from these data that the model of physiology presented above does hold for the Maya of Tenejapa. Though the model presented here is complete, it lacks analytical synthesis that provides clues to the theoretical underpinnings of Tzeltal ethnophysiology and the medical system. A brief exploration of patterns of metaphor provides that synthesis.

Chapter 11 Metaphoric References in Tzeltal Ethnophysiological Discourse

Analogy

Metaphoric reference is indeed present in Maya discourse. Maffi notes the use of ‘*ch’omate*’ (chayote) for vagina and ‘*sjoy ta beel*’ (his traveling companion) for penis (1994: 191). This is no surprise as these body parts, much as they are to us, are taboo in polite conversation, yet of great use in humorous and bawdy talk. Likewise, as is the case for English speakers, there are many distinct metaphoric references for genitalia. Further, cultural processes are used analogically to describe processes of the body (Table 61).

Table 61. Selected transcribed quotations highlighting analogy derived from cultural domains.

<i>El o’tanil es como reloj; empuja los manos. El o’tanil empuja el sudor. El sangre es como bateria en el reloj, deja que tiene fuerza el reloj.</i> The heart is like a clock; it pushes the hands. The heart pushes the sweat. The blood is like the battery in a clock. It makes the clock work.
<i>Las venas se conectan con el estomago. Fuerza sale en el sangre como café sale en agua que hierva.</i> Veins are connected to the stomach. Life force comes out [of the food] in the blood like coffee comes out in boiling water

However, much analogical reference to the body derives from animal husbandry (Table 62). When I asked how a woman is impregnated, I was referred to the chickens outside. Then when asked why a woman does not become pregnant when there is no man, poultry again came

to the descriptive rescue. Beyond things better left to example, the animal kingdom is used to explain the presence of our organs. Likewise, illness is similarly explained. However, the examples above are mere low-level manifestations that, though likely to be culturally consistent, show little structure. Therefore, the balance of this discussion will focus on upper level, structural metaphors as emerged from the interview data.

Table 62. Selected transcribed quotations highlighting analogy derived from livestock.

<i>bit'il ya yik' alal te antsetike, jich bit'il mut ya yalej sbaik yael, ja pajal, te kajwaltik yak'oj tal, te bit'il uch ya stek'tek' sbaik, para que jich ya x'ak'otal te Dios</i> The woman gets pregnant, for example like the chickens there, at God's will, have relations.
<i>bin ut'il ma ch'un biluk winik como Dios yale jichuk bit'il mut me ma'yuk stat ma'yuk a, kapaluk bit'il ayotik awil me ay me ma x'alaj te antse ma'yuk ya xtal yan, ya xtubotik ta k'inal ya'el te bit'il ayotike, jauk meto me ay te jtatike eso, kapal mut me ay stat, me ma'yuk stat te mute ma'yuk ya xtojok', mala pajk'an te mute ma'yuk ba ya xtojok'</i> It is the principal of the man as God created him, just like the birds, if there is no male we can't multiply, it's the same as if the woman is sterile, we can't procreate and we disappear, but when we find a man as the boss of a family, he creates another being, its like the birds that have a cock, but if there wasn't, that which the chicken lays doesn't incubate, well no chicks come out.
<i>bi yilel jko'tantik, ja' nax te a la bik'it nax te jko'tantik jichnax yala muk'ul, como ay smarca sluchiw ... ja'nix jich bit'il chambalam eke, jich jko'antik ek</i> How is our heart? It is small, its like it has horns, and it's oval ... its like the one of the animals, our heart is the same.
<i>melel jich stalel spasojetik te Dios bit'il ay te jsejkubtike, como spisl jich chambalmetik, ay sejkub, ay bi ay yu'un te chambalmetik, spisiltik jich a, ay wakax</i> It is the work of God that we have a liver, it's the same, the animals have a liver too. It's the way God made it, that animals have one, as do cows.
<i>ay te chamele, ay binti ay ta jbak'etaltik, ay binti ay chamel ta jbak'etaltik, komo spisl jich chambalmetik ay xchamul ek te chambalmetike, ay binti ya jpastik, a bi chamelil ay ta jbak'etaltik komo ma spaja te bi chambalamil ma'yuk xchamel jauk te krisianoetike ay nanix xchameltik, bayel binti ay ta jbak'etaltik</i> There is illness. There is always something in our body, just like all kinds of animals have illness. But we have to do something, there is always illness in our body. We don't compare ourselves to some animal that does not fall ill. Instead, humans always have illness, there are many symptoms of illness in our body.

Couplets

Maffi (1994) describes what she calls semantic pairs for the Tzeltal. By this is meant that paired concepts are used to refer to one semantic item. For example, the , “semantic pair *okil k’abal* ‘feet/legs hands/arms’ [is] used to refer both to the limbs and to the body in general. In the latter case ... the limbs metonymically stand for the whole body as its most important elements” (*ibid.* 190–191). Further examples include *me’il tatil* ‘mother father’ for parents, *mamal me’chunil* ‘old man grandmother’ for grandparents, *jme’tik jtatik* ‘mothers fathers’ for ancestors, *ni’il chikinil* ‘nose ear’ for face and *pom kantela* ‘incense candle’ for ritual paraphernalia (*ibid.* 129). Additionally these semantic pairs may refer to higher order categories such as animals (*chan balam* ‘snake jaguar’) or plants (*te ak’* ‘tree vine’), and may be the only way to refer to that semantic category. Not only is this semantic pairing evident in language, but also in the Mayan ethnohistoric texts where passages are written in coupleted pairs (Edmonson 1982; 1986; Hires 1981; Roys 1965; 1967).

One semantic pair important to the understanding of health and physiology presents itself in the interview data: ‘working walking’ (Table 63) Occasionally ‘walking’ is replaced with ‘standing,’ though the former is more common. To not be able to work and to walk is a semantic pair that refers to illness and is pervasive in discourse regarding the blood and the heart. However, as is the case in many, though not all, of the semantic pairs, they may be abbreviated. Illness may be described in terms of working. Further, though more rare, the inability to walk or stand alone may refer to illness.

Table 63. Selected transcribed quotations highlighting the semantic pair ‘working/walking.’

<i>ja' ya x'atejotik yu'un te jch'ich'eltike te bit'il kuxulotik yu'un te jch'ich'eltike</i> Because we have blood, that's how we live, that's how we go and work.
<i>Bueno estamos suspirando cuando empesando a caminar, a trabajar se suspira.</i> Well, we are breathing when we begin to walk, to work, we breathe.
<i>Bien que lo sabemos como empieza la enfermedad cuando llega al corazon. Lo sentimos como debil, cada dia cada tarde, ya no podemos caminar, ya no podemos hacer trabajo.</i> We know well how illness starts when it arrives in the heart. We feel weak, each day, each evening, we can no longer walk, we can no longer work.
<i>ju'uk ts'i ja' nix jko'tantik ema yu'un nanix ay yip a te jko'tantike meel yume ya k'antik ya x'a'tejotik xtunotik ya'wa'i ... ja' nix kiptik sok te jch'ich'eltik sok te jbak'etaltik te ya x'a'tejotike ja' kiptik, binti nix ut'ul ya x'a'tejotik te me ma'yuk kiptike</i> In our heart we have life force because that's where we want to work. That's how the thoughts come ... because we have life force our blood we can work; if we don't have our blood and life force we can't work.
<i>ja' ya xben te jch'ich'eltike ja' ya xben te kiptik, kiptik me ta a'tel ya'wa'i te ya x'a'tejotike xtunotike</i> As our blood circulates throughout the body, we have life force to work, if it were that we don't have blood we can't work.
<i>ja'me jicha sk'an, meel la sna'ix stojol binti kuxulotik, tek'elotikix, komo ya jna'tik stojol ts'i' ja'nanix kuxulotik a te la choltikix, te jko'tantike ja kuxulotik yu'un, te jputstike ja'te jkich'tik ik'e ya sbentes te jch'ich'eltike</i> That's it, we know how we live. We are standing and we know how we have life; our hearts give us life. Our lungs breathe and make the blood circulate.
<i>Lo siente, cuando viene la enfermedad, se enferma tambien la sangre. Lo sabemos, aunque quiere salir pero no se puede; aunque quiere andar a pasear por otro lado pero no puede caminar. Es porque esta enfermo; porque la sangre no esta girando bien, porque es muy debil, muy cansado, no puedes caminar.</i> It is felt that when illness comes, the blood also becomes sick. We know that, though you want to go out, you can't; though you want to go somewhere else, but you can't walk. Its because you are sick; because the blood is not circulating well. Because you are very weak, very tired, you cannot walk.

Of course, it is obvious that one certainly would not be able to work and may even be unable to walk when an illness is grave. For example, one informant describes an illness as, *chamawae ma xnijik' stukel, ma ba ya xnijik' a te k'ala ma xti'wane, yan ta me k'ala ya xti'wane ma stak' xbenotik yu'un* ('we feel that it [me' winik] doesn't move when there is no pain, but

when there is pain we can't walk'). Further, informants regularly note that lack of food or water prevents walking and working. I do not deny that these statements derive from empirically observed phenomena. However, following Lakoff and Johnson (1980), I note that these references are structured idioms that refer to health though they may appear to be non-metaphorical.

Salience

Highland Maya epidemiology and ethnosymptomology both show a distinct bias towards gastrointestinal, respiratory and skin illnesses. An epidemiological survey concludes that these are the three categories of disease most affecting the highland Maya (Berlin and Berlin 1996). In fact, the three ethnosymptomology chapters of Maffi's (1994) dissertation are on these three topics. It follows that ethnosymptomology of the most prevalent diseases would be the most elaborate. However, one would also predict that the physiology of the affected organs would also be elaborated due to the increased activity and thought devoted to these organs.

The heart interviews are easily twice as long as those of any other organ. The next longest interview topic is the gastrointestinal system, which includes three to five organs, depending on informant. What is said about the heart is also qualitatively different than that said about any other organ. Everything else receives, at best, a straightforward statement about what it does. The heart, on the other hand is talked about at length, with little or no prodding necessary. The heart is the only multi-function organ and is the only one that is said to be necessary for life in and of itself.

The heart beats and gives us life; the heart processes the liquids that we drink; the heart processes the air that we breathe and; the heart is the seat of thought and emotion. All but four

internal states elicited have heart as part of the term. The relation of the heart to internal states goes beyond Tzeltal and is evident in Tzotzil (Tables 64 and 65). The close relation of ones personality and emotions to the heart suggest a region wide saliency of the organ. And finally the heart is so important that the chest area is metonymically referred to by the same term as heart (Table 66).

Table 64. Tzotzil internal states referred to with heart terms from the municipality of Zinacantán (Laughlin 1975: 64-65)

<i>o'onil</i>	heart
<i>ko'onuk t xi'abteh</i>	I would like to work
<i>tey xa mu teyuk ti yo'on ibat ta anile</i>	he rushed off distractedly
<i>mu ta o'oniluk</i>	pay no attention to it
<i>muk' ta ko'on</i>	I don't care
<i>o'onin</i> or <i>o'onta</i>	take seriously, be diligent, heed, show concern for, care
<i>chib o'on</i>	unhappy
<i>jun o'on</i>	happy, contented
<i>k'ot ta o'on</i>	be offended

Table 64. Tzotzil internal states referred to with heart terms from the municipality of San Andrés (Vda. de Delgaty and Sánchez 1986: 465-467)

<i>batem yo'on</i>	pledged to something
<i>biquit yo'on</i>	resentment
<i>co'ol yo'on</i>	they agree
<i>cuxul to yo'on</i>	he is still conscious (not unconscious from alcohol)
<i>cuxul yo'on</i>	sober
<i>c'un yo'on</i>	resentment
<i>c'ux ta yo'on</i>	to love, to want, in pain
<i>chopol yo'on</i>	a bad person
<i>ch'anxi yo'on</i>	a calm person
<i>ch'ayem yo'on</i>	astonished, distracted, unconscious

Table 64. (Continued)

<i>it'ix yo'on</i>	jealous
<i>jmoj yo'on</i>	they agree
<i>jun yo'on</i>	happy, content
<i>lec yo'on</i>	friendly, a good person
<i>muc c'usi chal yo'on</i>	does not long for or want anything
<i>mu xla j yo'on</i>	spiteful
<i>muc xtun yo'on</i>	a bad person
<i>mu'yuk c'usi spatoj o yo'on</i>	doesn't have hope for anything
<i>oy pucuj ta yo'on</i>	very bad person
<i>oy ta yo'on</i>	longing
<i>oy xi'el ta yo'on</i>	fearful
<i>sbic'tal yo'on</i>	to covet
<i>sbolil yo'on</i>	the badness of the heart
<i>sc'ac'al yo'on</i>	anger
<i>sc'an yo'on</i>	it is one's will
<i>slequil yo'on</i>	one's kindness
<i>smuc'ul yo'on</i>	valor
<i>spatol yo'on; spatobil yo'on</i>	greetings, compliment
<i>taquin yo'on</i>	thirst
<i>ta sbolibtasbe yo'on</i>	shrewdness
<i>ta scotol yo'on</i>	all of one's heart, one's complete being
<i>ta scux yo'on</i>	rest
<i>ta schibajesbe yo'on</i>	discouraged
<i>ta sch'ay ta yo'on</i>	forget
<i>ta sjic yo'on</i>	to sigh, desire, long for
<i>ta slajesbe yo'on</i>	to calm, to reconcile
<i>ta slecubtasbe yo'on</i>	to make good, to make friendly
<i>ta sliquesbe sc'ac'al yo'on</i>	to provoke anger, to incite, to irritate
<i>ta sloq'ues yo'on; ta sloq'ues sc'ac'al yo'on</i>	to avenge
<i>ta smuc ta yo'on</i>	to deny
<i>ta spasbe proval yo'on</i>	put to the test
<i>ta spatbe yo'on</i>	joyful, content, with hope
<i>ta spat yo'on</i>	joyful, content, with hope
<i>ta sta yo'on</i>	satisfied
<i>ta sq'uelbe yo'on</i>	to put to the test
<i>ta sten ta yo'on</i>	to abandon, to forget
<i>ta stsatsubtasbe yo'on</i>	to console, to give courage
<i>ta stsatsub yo'on</i>	to comfort, to give encouragement
<i>ta stse'in yo'on</i>	to laugh on the inside

Table 64. (Continued)

<i>ta sutes yo'on; ta sut yo'on</i>	to repent
<i>ta sventainbe yo'on</i>	to charge with (as in a duty or obligation)
<i>ta xac' to yo'on</i>	to accept
<i>ta xal yo'on</i>	a presentiment
<i>ta xbic'taj yo'on</i>	ambitious
<i>ta xbolib yo'on</i>	stunned, corrupted
<i>ta xc'ot ta yo'on</i>	convinced
<i>ta xchibaj yo'on</i>	to discomfort, create doubt
<i>ta xch'aybun yo'on</i>	distracted
<i>ta xet'es yo'on</i>	satisfy
<i>ta xlaj yo'on</i>	finished (as in work)
<i>ta xlecub yo'on</i>	to make friendly
<i>ta xloc' ta yo'on</i>	decide
<i>ta xlo'ilaj yo'on</i>	think of one self
<i>ta xmac yo'on</i>	to suffocate
<i>ta xnoj yo'on</i>	to will the heart (with good or bad things)
<i>ta xpatbun yo'on</i>	to give hope
<i>ta xpich' o yo'on</i>	longing, greed
<i>ta xtijbun yo'on</i>	to call to attention; to make repent
<i>ta x'ayan ta yo'on</i>	occurs, comes to mind
<i>ta x'ech' yo'on</i>	satiated
<i>ta x'it'ixaj yo'on</i>	wants, ambitious
<i>tey ta yo'on</i>	lend constant attention
<i>tuc' yo'on</i>	just
<i>tsatsal yo'on</i>	courage
<i>tsots yo'on</i>	courageous
<i>xbebun yo'on</i>	constantly long for
<i>xcuxet yo'on</i>	content
<i>xchibet yo'on</i>	doubting
<i>xchibet yo'on chac'</i>	doubting, hopeless
<i>xojtaquinbe yo'on</i>	to know well
<i>xpatet yo'on</i>	happy
<i>xti'et yo'on</i>	angry
<i>x'ibet yo'on</i>	dizzy, nauseus
<i>yo'onuc ta sc'an</i>	to want
<i>yo'onuk ta xmajvan</i>	wants to fight
<i>yutsil o'onil</i>	kindness
<i>yutsil yo'on</i>	is kind

Table 66. Selected transcribed quotations highlighting the saliency of the heart.

<i>banti ay te jputstik ta bak'etal</i> Where in the body is our lung? <i>ay ta ko'tantik</i> In the heart. <i>ta ajk'ol a bal ay te jko'tantike o ja' la bal alan ay te jputstike</i> Is our lung above or below our heart? <i>ja' ajk'ol ay te jko'tantike</i> Above our heart
<i>banti ay te jsejkubtik ta jbak'etal?</i> Where in our body is our liver? <i>li ay ta jko'tantiki</i> There, in our heart. <i>bi la ut'il ay ta jko'tantik te jsejkubtike, ta xujk' la bal ay o ta yan i la bal ay</i> Is our liver in front of or behind our heart? <i>te jsejkubtik, jich ay jsejkubtik to jich ay ko'tantik to</i> Our liver is next to our heart.
<i>banti ay te o'tanil ta bak'etal</i> Where is the heart in the body? <i>ta jko'tantik</i> In our heart.
<i>banti ay te o'tanil,</i> Where is the heart? <i>li' ta jko'tantik,</i> There, in our heart.

As noted above, the second longest interviews are those regarding the gastrointestinal system. The flow of food from the mouth to the stomach, or stomachs, and then through the intestines and out the anus is well described. The intestines do metonymically refer to the entire alimentary track. This is evidenced by the quotes claiming that food passes from mouth to stomach via the intestines. However, the gastrointestinal system is not believed to hold any

further role, and it is not widely discussed beyond this function. Therefore, I can, with absolute confidence, claim that, among the organs discussed, the heart stands as the most salient.

It's Not Like the Heart

The saliency of the heart is further supported by references to the heart when describing other organs (Table 67). A common theme is that the organs are not like the heart. Usually this is elaborated with themes of not doing anything, not beating or not thinking or feeling.

Table 67. Selected transcribed quotations highlighting the “its not like the heart” analogy.

<i>ma 'yuk ya 'tel te jsejkubtike, jich nax ay stukul, ma ba ya xk'opoj stukul, ma ba jich te bi'til jko'tantik te xk'opoj stukele, ma be xk'opoj jich nax ay</i> There is no work of our liver, its just there because it doesn't talk. It's not the same as our heart that talks.
<i>ju'uk, ma x'a'tej stukul, jtul nax te ya x'a'tej te jko'tantike, ja' nax jun, yan teye ma' niwan x'atej stukul</i> No it [the liver] does not work. Only one works and it is our heart. Only with our heart do we think where we want to go.
<i>ma me jna' ta me ay binti nix ya spas xkal ek e, ma xkaetik bit'il ay te jk'intik</i> Our kidneys don't do anything, they don't feel.

The Talking Heart

The heart is not simply the locus of thought. To the Tzeltal, the heart forms thought and then communicates those thoughts to the body by ‘talking.’ When the heart talks we must obey it, and must do the tasks that it sends us to do (Table 68). One informant likens the heart to a father who tells us what to do and when to do it. It is common for informants to describe the heart as making demands that must be met.

Table 68. Selected transcribed quotations highlighting the “talking heart” metaphor.

<i>melel ts'i ya x'a'tejotike', chikan, ja nax a te jko'tantike, ya ba p'ojtik si', ya bal x'a'tejotik ta a'tel, ma'yuk yan ja' nax te jko'tantik, bi ya jletik bel ya'tik, jabal te si', jabal te a'tel, tulnanix yael te winik te mach'a ya spasbetik yael te jko'tantike</i> Only our hearts know when we work. If we look for firewood, if we work, there is no other, only and always our hearts. Whatever we look for be it firewood or work, we are like a person our hearts send.
<i>bueno ja'nix yak'oj yip ts'i jko'tantik bit'il x'at'ejotike como bats'i chuybil ja' te jko'tantike ja' yak' yip, ya xch'unbetik smantal bi jpastik, ja' nax stukel te jko'tantike</i> It is always our hearts that give us life force when we work, it's the only one we can obey to do something.
<i>ya yik'otik ta at'el yael, ya nax xch'untik bit'il yik'otik, li' nix ta jko'tantik te ya jch'untik te ya yik'otik ta at'ele, pero li' ta jko'tantik te ya yik'otik ta at'el te jtatike, ta jko'tantik ya xk'pojtal</i> If it calls us to work we obey, and it is in our hearts that we obey to do the work. Its like our father that takes us to work, but the advice is from our hearts.
<i>Porque cuando tiene gana quiere comer pues lo siente porque el corazon lo manda, el cuerpo lo manda. Ellos son los que quejan ellos son los que quieren comer.</i> Because when it wants to eat, well, it is felt because the heart demands, the body demands. They are the ones that complain, they are the ones that want to eat.
<i>ja' nax ya sna' te banti ya xbaotik, binti xi' bi ya spatik, ya x'a'tejotik, ya x'a'yan te jko'tantik</i> It [heart] only makes us think and remember where we should direct ourselves, what to think about or whether to work. Our hearts talk.
<i>Lo mismo el corazon, es lo que lleva donde nos podemos ir. Es el corazon que lo sabe donde vamos a trabajar. Ahi viene los pensamientos y asi lo podemos aceptar,</i> The same heart, its what takes us where we can go. The heart knows where we will go to work. From there come the thoughts and that is how we can accept them.

Summary

Analogy and metaphor are clearly present in Highland Maya discourse regarding organs and their functions. The natural world provides a source domain for metaphoric reference to the body. In this society where invasive surgery does not exist, it is the slaughtered cow that best provides data regarding organs. It is clearly stated that the cow has two intestines and, thus so do we. Elois Ann Berlin (personal communication) collected from one informant the same

reasoning behind the belief of two stomachs. Therefore, the livestock that the Tzeltal raise provide models for the internal structures of the body.

However, the semantic pair ‘working/walking’ and the ‘talking heart’ metaphor provide the best support for Lakoff and Johnson’s (1980) argument that metaphor goes beyond art and becomes structure. These metaphors are drawn upon by the Tzeltal in their physiological discourse in a fashion inconsistent with elaborated artistic speech: they are used by all of the informants and there is apparently no alternative means of communicating these concepts.

Chapter 12

Conclusions

The Highland Maya Have a Shared Ethnophysiology

The Highland Maya of Tenejapa do share concepts of physiology. Three procedures establish this: free lists, paired comparisons and a binary fixed-response survey. The free list establishes the domain of internal organs, which includes the limited list of: heart, lung, stomach (or stomachs), intestines, kidney (or kidneys), liver and gallbladder. However, bones, brain, throat and pancreas are also mentioned, but only by one respondent each. Additionally blood is included in the domain, though not an organ proper. Through a multi-dimensional scaling analysis, it is shown that a spatial orientation organizes Highland Maya thought about the internal organs.

Next, a paired comparison test establishes the relative importance of all of the organs, including blood, to the maintenance of life. Though the results of this experiment fall short of meeting the criteria for claiming cultural consensus, distinct patterns emerge. The heart and blood are invariably the most important in the maintenance of life for all demographic clusters, while the ranking of relative importance of the other organs follows a strong general tendency.

Finally, the binary fixed-response questionnaire is developed from semi-structured interviews. This survey, administered to residents of the municipality, provides data showing a high level of agreement beyond the community of Ch'ixal Tontik. These data surpass the minimum requirements for the claim of cultural consensus.

These experiments suggest that, for the limited domain of internal organs, the Tzeltal of Tenejapa share concepts of organ functions and broader body processes. However, the paired comparison test only establishes the centrality of the heart and blood to this system while the importance of other organs is debatable. However, I am convinced that this is a patterned phenomenon.

Highland Maya Ethnophysiological Theories are Expressed through Non-Idiosyncratic Metaphor

Throughout the semi-structured interviews, analogy, metaphor and metonym are evident. Though some idiosyncratic analogies are presented (the heart as clock, life force coming out in the blood as coffee does in water), the vast majority of analogies are derived from the animals that people raise. This stands for both organs themselves (we have two intestines like cows) and for physiological processes (reproduction is like that of the chickens).

There is no general term for healthy in Tzeltal. However, the use of a specific couplet, or semantic pair, for the concept of 'healthy' permeates much of the discussion of physiology: working and walking (sometimes working and standing). Though it is empirically observable that illnesses of a certain severity do prevent working, walking or even standing, this is not merely an observation. Throughout the interviews, health is systematically represented by this semantic pair or one of the constituents of the semantic pair. This suggests that the semantic pair has evolved from the realm of description to a meaningful semantic unit.

Additionally, the 'talking' heart metaphor is used by all informants. This is particularly evident in the sentiment expressed in, "If it calls us to work we obey, and it is in the heart that we obey to do the work. Its like a father that takes us to work, but the advice is from the heart," and

other similar statements. As the semantic pair does for health, this metaphor permeates discussion about the heart. Finally, '*o'tanil*,' or heart is a polysemous term denoting the heart as well as the chest area. This metonymic relationship establishes the salience of the heart to the Tzeltal Maya.

As these metaphoric utterances are widespread and used regularly, it becomes obvious that something more than on the spot elaboration is occurring. These metaphors are inextricable from the concepts of health and the heart. Health is signalled by working and walking. Though this is an obvious aspect of health, it is not inevitably the model for it. There is no similar metaphor for health in American English. However, for the Tzeltal, one is virtually unable to talk about health in any other way. Likewise, when describing the heart's role in thought, The Highland Maya rely on the concept of talking. The heart talking to the body through the blood is the only way thought can be cognized by the Tzeltal. This metaphor is much more strongly held than the working/walking couplet as it is nearly always mentioned in conjunction with thought.

The Heart is the Most Salient Organ and ,Thus, Exhibits High Metaphoric Reference

The heart is, without a doubt, the most salient of all of the organs according to the Highland Maya. The metonymic relationship of the heart with the chest area is indicative of this. Further, as discussed above, the heart is discussed at length and is believed to have a multiplicity of functions. It is the only organ to have more than one role, save the blood which essentially is involved in all of the heart's activities.

Additionally, the gastrointestinal system, limited to the stomachs and intestines, is also salient. It and the cardiovascular system are the only parts of the body believed to have distinct

and obvious functions. However, the gastrointestinal system is described in precise terms without any rich metaphorical content.

Therefore, the position that salient items will present increased metaphoric reference can only be held to be true with qualifications. It is true that the most salient organ receives the most metaphoric reference, but the next salient system does not.

Discussion

Pulsing

The role of pulsing in illness diagnosis among the Highland Maya is well described in the literature (see especially Nash 1967b; Pozas Arciniega 1959). There is further evidence for a long time depth for pulsing and blood analysis of illness among the Maya found in some books of *Chilam Balam* (Hires 1981; Roys 1967). Nash (1967b) describes the pulsing diagnosis as the curer entering into a conversation with the blood. It is obvious that this is a metaphor for feeling variations in pulse strength and rhythm. However, illness is thought to be spread throughout the body via the blood and become symptomatic when it reaches the heart. Also, it should be remembered that the Tzeltal perceive their hearts as talking to the body through the blood. Thus, it is clear that when curers enter a conversation with the blood, this is not just a simple metaphor for a specific diagnostic technique, but, instead, a trope derived from their ethnophysiology as structured by a higher-level metaphoric framework.

It is only through an understanding of the ethnophysiology of the Tzeltal that this becomes clear. As mentioned above, the traditional curers of Chiapas do not appear to possess any distinct physiological knowledge. However, this is an obvious oversimplification. It is highly unlikely that a curer will forget all of the physiological lore of the culture in their training. Thus,

it is inevitable that the ethnophysiology will play a role in curing. Though the curer is not looking for bodily symptoms, they are still asking the patient's heart for some critical information regarding what is causing the illness. By engaging the 'talking heart' metaphor, the curer is sharing a covert ethnophysiological moment with the patient.

How Generalizable are these Data?

In conclusion I would like to present some examples from other work to establish that the ethnophysiology of the Tzeltal Maya is not just an idiosyncratic and unique system. I will focus on a few examples from the Yucatec Maya to establish a certain amount of regional unity, and will present examples from the Rarámuri of Chihuahua to show some similarities that extend across Mexico.

The Yucatec Maya believe that air is drawn into the heart and blood is pushed through the veins by each breath (Redfield 1934: 210). Circulation is thought to make the body grow strong and provide it with air (*ibid.*). The Rarámuri claim blood is derived from the liquids that are consumed and its role is to keep the body from drying out (Merrill 1988: 88). The heart, for the Yucatec, is the organ of thought and internal states, aided by the brain and eyes, and holds a preeminent position among the organs (Redfield 1934: 210). It is located in the abdomen (*ibid.*). The Rarámuri variously believe in one or multiple souls (Merrill 1988: 89). The soul, or the largest soul, resides in the chest where it is responsible for emotions speech and thought (*ibid.*).

Regarding other organ systems, the Yucatec place digestion in the stomach and intestines where food cooks (Redfield 1934: 210). The process is aided by the liver (*ibid.*). The animal world is referenced by the Rarámuri who note that the, "body contains many internal organs like those of the animals they butcher and that these organs have necessary functions," (Merrill 1988:

89). Further, the Yucatec consider reproduction, “as they breed cattle and select corn, so the people regard healthy parentage as a guarantee of strong children,” (Redfield 1934: 210).

As these examples demonstrate, the ethnophysiology of the Highland Maya is not unique. Both the Yucatec and Rarámuri have remarkably similar ethnophysiological concepts as do the Tzeltal. However, I do not wish to imply that the ethnophysiology I found in Ch’ixal Tontik stands as a pan-Mesoamerican belief system. Instead, I do wish to leave the reader with a sense of its use as a starting point for discovering general Mesoamerican patterns and local variations on it.

Reccomendations for Health Care Providers

Miasma

Air is believed to be drawn into the heart and many believe that it plays a role in the formation of thought. According to the survey, the general population of Tenejapa is not sure whether this is true. Considering these two premises, inhaled smoke is seen to also be drawn into the heart, and may play a role in unhealthy thoughts. However, there is a daily exposure to excessive smoke in the kitchen. This leads to obvious respiratory distress, especially in older women who have spent countless hours by the side of the smoky kitchen hearth. I cannot count how many middle age to older women that I have seen with clear symptoms suggestive of emphysema.

I would like to suggest the application of the idea of smoke entering the heart as a means of addressing this health issue. The cardio-pulmonary effects of regular smoke inhalation are well known to biomedically-trained doctors. These effects need to be emphasized in terms of smoke inhalation as occurs in the kitchen. The productive coughs of older women should be

highlighted and referenced as damaging the heart. It is unlikely that fire hearth food preparation will cease, but a better-ventilated kitchen structure or chimneys should be promoted.

Reproductive Physiology and Overpopulation

The Tzeltal idea that a woman can't become pregnant until after her period, though biologically incorrect, poses no distinct health problems. When a family wants many children, this belief only serves to provide plausible denial regarding patrimony. However, as mentioned earlier, population growth is extreme and resources are limited. It has become impossible for everyone to remain in their community due to lack of land for agricultural pursuits. Family planning may alleviate this situation.

Yet, this is a region where birth control is not an option for a high percentage of the population. Catholicism is still the primary religion in the area, so this part of the population has a moral mandate against contraceptive use. For many of the rest, the cost of contraceptives is prohibitive. Therefore, the best strategy for family planning initiatives is to promote the rhythm method of limiting sex to the infertile days of the month.

Here lies a problem. Without full knowledge of the local population's ethnophysiology, a health professional is not likely to alleviate the population problem and can potentially create family discord by not addressing the differences in belief. In order to limit reproduction, the Maya will have sex precisely at the most fertile times of the month. When the woman becomes pregnant, the father will deny patrimony and may accuse the mother of infidelity.

Thus, it is of the utmost importance to be sensitive to these local beliefs regarding fertility. Family planning efforts must address the discord between the systems with effective

education techniques, and without the embarrassment that limits dialog. Otherwise, all of the money and effort put into these programs will be a waste.

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Appendix A: Paired Comparison Questionnaire

CH'ICHELTIK	MUKUL BIKILTIK
K'INTIK	SEKUBTIK
CHIN TSUKUMTIK	PUTS'TIK
CHIN TSUKUMTIK	CH'ICHELTIK
CH'AJTIK	SEKUBTIK
CHIN BIKILTIK	SEKUBTIK
CHIN TSUKUMTIK	MUKUL TSUKUMTIK
PUTS'TIK	CHIN BIKILTIK
K'INTIK	CHIN BIKILTIK
CHIN TSUKUMTIK	SEKUBTIK
CHIN BIKILTIK	CHIN TSUKUMTIK
MUKUL BIKILTIK	CHIN TSUKUMTIK
SEKUBTIK	KO'TANTIK
MUKUL TSUKUMTIK	SEKUBTIK
MUKUL BIKILTIK	CHIN BIKILTIK
CH'ICHELTIK	K'INTIK
CHIN BIKILTIK	CH'AJTIK
CH'ICHELTIK	MUKUL TSUKUMTIK
SEKUBTIK	PUTS'TIK
MUKUL BIKILTIK	K'INTIK
KO'TANTIK	CHIN TSUKUMTIK
CH'ICHELTIK	CH'AJTIK
MUKUL TSUKUMTIK	K'INTIK
MUKUL BIKILTIK	MUKUL TSUKUMTIK
MUKUL BIKILTIK	KO'TANTIK
KO'TANTIK	CH'AJTIK
CH'ICHELTIK	SEKUBTIK
MUKUL BIKILTIK	SEKUBTIK
PUTS'TIK	K'INTIK
PUTS'TIK	CH'ICHELTIK
CHIN BIKILTIK	MUKUL TSUKUMTIK
CHIN BIKILTIK	KO'TANTIK
PUTS'TIK	MUKUL BIKILTIK
KO'TANTIK	PUTS'TIK
CH'AJTIK	MUKUL TSUKUMTIK
MUKUL TSUKUMTIK	PUTS'TIK
K'INTIK	CHIN TSUKUMTIK
CHIN TSUKUMTIK	CH'AJTIK
K'INTIK	CH'AJTIK
KO'TANTIK	K'INTIK
CH'ICHELTIK	CHIN BIKILTIK
CH'AJTIK	PUTS'TIK
CH'ICHELTIK	KO'TANTIK
MUKUL BIKILTIK	CH'AJTIK
MUKUL TSUKUMTIK	KO'TANTIK

Appendix B: Paired Comparison Questionnaire, English Translation

our blood	our large intestine
our kidney	our liver
our small stomachtik	our lung
our small stomachtik	our blood
our gall bladder	our liver
our small intestine	our liver
our small stomachtik	our large stomach
our lung	our small intestine
our kidney	our small intestine
our small stomachtik	our liver
our small intestine	our small stomachtik
our large intestine	our small stomachtik
our liver	our heart
our large stomach	our liver
our large intestine	our small intestine
our blood	our kidney
our small intestine	our gall bladder
our blood	our large stomach
our liver	our lung
our large intestine	our kidney
our heart	our small stomachtik
our blood	our gall bladder
our large stomach	our kidney
our large intestine	our large stomach
our large intestine	our heart
our heart	our gall bladder
our blood	our liver
our large intestine	our liver
our lung	our kidney
our lung	our blood
our small intestine	our large stomach
our small intestine	our heart
our lung	our large intestine
our heart	our lung
our gall bladder	our large stomach
our large stomach	our lung
our kidney	our small stomachtik
our small stomachtik	our gall bladder
our kidney	our gall bladder
our heart	our kidney
our blood	our small intestine
our gall bladder	our lung
our blood	our heart
our large intestine	our gall bladder
our large stomach	our heart

Appendix C: Binary Fixed-Response Survey

1	Te ko'tantik ja' ya slekutes te jch'ich'eltik
2	Te snopojibale ya xlijk ta sot'ot'tik
3	Te jputstik ja' ya slekutes te jch'ich'eltik.
4	Te we'eltik ya xk'axbel ta kejtik ya xk'ot sbabial ta bikiltik i ta patil ta tsukum
5	Te jch'uleltik ay ta jputstik
6	Te ja' ya skap sba sok jch'ich'eltik ta tsukum
7	Te sejk'ubtik ja' ya slekutes te jch'ich'eltik
8	Te chuxil ja'te ja' ya xlok' ta jch'ich'eltik te k'alal ya xlaaj yip
9	Ya kaytik wi'nal ta tsukum
10	Ja' yak'be yip bak'etaltik te jch'ich'eltikte bit'il ya xkuxinotik.
11	Ya sta yal ants te k'alal ya sjunta wayel smamalal te k'alal matoba yilo ate xchamele
12	Te chuchil ya spas sba ta sot'ot'tik
13	Te ja' ya kuch'tike ya skap sba sok te jch'ijch'eltik ta ko'tantik
14	Ay cheb k'intik
15	Te jch'ich'eltikya spas sba ta putstik
16	ya kaytik lek stojol ta jputstik te k'alal ya spasta alal
17	Te tsisil ja' yip te we'eltik
18	Te ja' ya skap sba sok te jch'ich'eltik ta sot'ot'tik
19	Te sot'ot'tik ja' ya slekutes te jch'ich'eltik.
20	Te jch'ich'eltikya spas sba ta sejk'ubtik
21	Te yip te we'lil ya xlok'ta tsukum
22	Te jch'uleltik ay ta tsukum
23	Te ja' ya skap sba sok jch'ich'eltik ta ko'tantik
24	Te snopojibale ya xlijk ta jk'intik
25	Te chuchil ya spas sba ta sejk'ubtik.
26	Te k'alal jchamelotik ya kaytik te ma'yum kiptik melel te jch'ich'eltik ja' ya yich'bel chamel ta ko'tantik.
27	Te chuchil ya spas sba ta ko'tantik.
28	Te tsitsil ja'te ik'ya xk'ot ta tsukumte k'alal ya xwe'otik
29	Te k'alal ya kuch'tik ja' ya x'ochbel ta kejtik ta tsukum
30	Te k'alal ya kich'tik te ik' ya xk'ot ta sejk'untik
31	Te snopojibale ya xlijk ta jhc'ujtik
32	Te ik' ya kich'tike ya yak'betik snopojibal
33	Te we'eltik ya xk'atp'o ta tsa' tajch'in bikiltik
34	Te chuchil ya spas sba ta tsukum
35	Ja' nax ay jun k'intik
36	Te chuxil ja'te ja' ya skap sba sok te we'eltik ta tsukum
37	Te we'eltik ya xk'ax babel ta muk'ul bikiltik i ta

	patil ta jch'in bikiltik
38	Ach'ix ya xtal alal te me ya smulan spasel te state
39	Ach'ix ya xtal alal te me ya smulan spasel te sme'e
40	Ta ko'tantik ja'teya xlijk ate sputs'k'inal ya kaytike
41	Te jch'uleltik ya yak'betik sbuts'k'inal kaytik
42	Te jputstik sok ko'tantik pajalik
43	Te tsitsil ya spas sba ta jbikiltik
44	Te jchik'tik ja'te ja' ya xlok' ta jch'ich'eltik te k'alal ya xlaaj yip
45	Te ko'tantik ja'te'ya xjach ate snopojibal ku'untik
46	Te ik'ya kich'tik ya xk'ot ta ko'tantik ya yak'be yip ch'ich'eltik
47	Ta jchimantik ya xjach te sbuts'k'inal ya kaytik
48	"Tema ya kich'tik jik'ma xtune, ma xtun snopojibal ku'untik a"
49	Te k'alal ya kich'tik te ik'ya xk'ot ta ko'tantik
50	Te sbuts' k'inal ya xlijk ta sejk'ubtik
51	Te tsitsil ya spas sba ta tsukum
52	"Te me'winik maba sjoy bak'etaltik, ja' nax jun chamel"
53	Te we'lil ya tuntike ya xk'ot ta tsukum i ya yak'be yip te jch'ich'eltik
54	Te jch'uleltik ya yak'betik snopojibal
55	Ya sta yal ants te k'alal ya sjunta wayel smamalal te k'alal matoba yilo ate xchamele
56	Te jch'ich'eltik ya spas sba ta sot'ot'tik
57	Ya stak'sta yal ants te me ya sjun ta wayel ch'ojok te smamalal
58	Te chuchil ya spas sba ta jputstik
59	Ya kaytik wi'nal ta ko'tantik
60	"Te k'alal ya xti'wan te jbak'etaltike, ja'te jch'ich'eltik ya yich'bebel xk'uxul ta ko'tantik yu'un jich ya na'tik stojol a te ya xti'wane"
61	Te jch'uleltik ay ta sejk'ubtik
62	Ta kaytik lek stojol ta k'intik te k'alal ya spasta alal
63	Te jch'ich'eltik ya spas sba ta tsukum
64	Te ja' ya kuch'tike ya skap sba sok te jch'ich'eltik ta tsukum
65	Te jch'uleltik ay ta jsot'ot'tik
66	Kerem ya xtal alal te me ya smulan spasel te sme'e
67	Te jch'ijch'eltik ya yak'be yip te bak'etaltik
68	Te k'alal ya kich'tik te ik' ya xk'ot ta k'intik
69	Ja' nax te antsetike ay sme'swinikik.
70	Kerem ya xtal alal te me ya smulan spasel te state
71	"Te k'alal ya noptik ya stij sba te bak'etaltik, Te jch'ich'eltik ya yich'bel te snopojibal ja'te jejch bak'etaltike"
72	Ta jchinamtik ya xjach te snopojibal ku'untik
73	Ya kaytik takin ti'il ta tsukum
74	Aywan cheb tsukumtik
75	Te me'winik te tatil ja' ya snop te me kerem o ach'ix te alale
76	Te jch'uleleltikay ta jk'intik

77	Te jk'intik ja' ya slekuteeste jch'ich'eltik
78	Te ja' ya kuch'tike ya skap sba sok te we'eltik ta tsukum
79	"Te ik' ya xk'ot ta ko'tantik, i patil ta putstik"
80	Te chuchil ya spas sba ta k'intik.
81	Ya stsakotik chamel te me k'alal ma'yuk yip te jch'ich'eltike
82	Te we'eltik ya xk'atp'o ta tsa'te k'alal ya slok'esbe yip te bak'etaltik
83	Ya kaytik lek stojol ta ko'tantik te k'alal ya spasta alal
84	Te ko'tantik ja' te'ay ate jch'uleltik.
85	Te we'eltik ya xk'atp'o ta tsa'ta jmuk'ul bikiltik
86	Te yip te we'lil ya xlok'ta jmuk'ul bikiltik
87	Jpisil junax ay sme'swinikik
88	Te sejk'ubtik ya skolta tsukum yu'un te we'eltik
89	Te k'alal ya kich'tik te ik'ya xk'ot ta jputstik
90	Te snopojibale ya xlijk ta sejk'ubtik
91	Te ja' ya kuch'tik ya xk'atp'o ta jch'ich'eltik
92	Te ch'ich'e ja' ya xk'ajta ta alal ja'te bit'il maba ya xkoj xchamel baluneb u te antse.
93	Te sbuts' k'inal ya xlijk ta jputstik
94	Ya kaytik lek stojol ta sot'ot'tik te k'alal ya spasta alal
95	Te ko'tantik ya yak' stij sba te jch'ich'eltik
96	Ya kaytik takin ti'il ta ko'tantik
97	Te we'eltik ya sk'ax babil ta jch'in bikiltik i ta patil ta jmuk'ul bikiltik
98	Te jch'ich'eltikya spas sba ta ko'tantik
99	Te jk'intik ya skolta tsukum yu'un te we'eltik
100	Te sbuts' k'inal ya xlijk ta jsot'ot'tik
101	Te k'alal ya kich'tik te ik' ya xk'ot ta sot'ot'tik
102	"Te k'alal ya kich'tik ik'e, ya stij sba te pulmontike ya xlijk stij sba te ko'tantike"
103	Ya kaytik lek stojol ta tsukum te k'alal ya spasta alal
104	"Te ik'ya xk'ot ta jputstil, i patil ta ko'tantik"
105	Te we'eltik ya xk'atp'o ta tsa' ta tsukum
106	Te snopojibale ya xlijk ta jputstik
107	Te we'eltik ya xk'ataj ta tsukum
108	Te jch'ajtik ya xti'wan tsukum yu'un
109	Te k'alal ya kuch'tik ja' ya x'ochbel ta kejtik ta ko'tantik
110	Te jch'ajtik ya skolta tsukumyu'un te we'eltik
111	Te sbuts' k'inal ya xlijk ta tsukum
112	Te putstik sok te sot'ot'tik ja' sjoy sba sok
113	Te we'eltik ya spas sba ta tsukum
114	Te k'alal ya kich'tik te ik' ya xk'ot ta tsukum
115	Te sbuts' k'inal ya xlijk ta jk'intik
116	Te jch'ich'eltikya spas sba ta k'intik
117	Te k'alal ya stsakotik chamel ja' ya yich'bel te jch'ich'eltik ta sjunul bak'etaltik te chamel
118	Te tsitsil ja'te ik'ja'te ik' ya xk'ot ta tsukum te k'alal ya kich'tik ik'
119	Te ja' ya kuch'tike ya yak'be yip te jch'ich'eltik
120	Te tsitsil ya spas sba ta bak'etaltik te k'alal ya xlojk' yip te we'eltik

121	Te ja' ya skap sba sok jch'ich'eltik ta putstik
122	Te yip te we'lil ya xlok' ta jch'in bikiltik
123	Ya kaytik lek stojol ta sejk'ubtik te k'alal ya spasta alal

Appendix D: Binary Fixed-Response Survey Answer Sheet

Nombre _____ Edad _____ Paraje _____

1	si / no	42	si / no	83	si / no
2	si / no	43	si / no	84	si / no
3	si / no	44	si / no	85	si / no
4	si / no	45	si / no	86	si / no
5	si / no	46	si / no	87	si / no
6	si / no	47	si / no	88	si / no
7	si / no	48	si / no	89	si / no
8	si / no	49	si / no	90	si / no
9	si / no	50	si / no	91	si / no
10	si / no	51	si / no	92	si / no
11	si / no	52	si / no	93	si / no
12	si / no	53	si / no	94	si / no
13	si / no	54	si / no	95	si / no
14	si / no	55	si / no	96	si / no
15	si / no	56	si / no	97	si / no
16	si / no	57	si / no	98	si / no
17	si / no	58	si / no	99	si / no
18	si / no	59	si / no	100	si / no
19	si / no	60	si / no	101	si / no
20	si / no	61	si / no	102	si / no
21	si / no	62	si / no	103	si / no
22	si / no	63	si / no	104	si / no
23	si / no	64	si / no	105	si / no
24	si / no	65	si / no	106	si / no
25	si / no	66	si / no	107	si / no
26	si / no	67	si / no	108	si / no
27	si / no	68	si / no	109	si / no
28	si / no	69	si / no	110	si / no
29	si / no	70	si / no	111	si / no
30	si / no	71	si / no	112	si / no
31	si / no	72	si / no	113	si / no
32	si / no	73	si / no	114	si / no
33	si / no	74	si / no	115	si / no
34	si / no	75	si / no	116	si / no
35	si / no	76	si / no	117	si / no
36	si / no	77	si / no	118	si / no
37	si / no	78	si / no	119	si / no
38	si / no	79	si / no	120	si / no
39	si / no	80	si / no	121	si / no
40	si / no	81	si / no	122	si / no
41	si / no	82	si / no	123	si / no

**Appendix E: Binary Fixed-Response Survey, English Translation, with Percent and
Weighted Percent of Responses for Yes, No and Don't Know**

Question Number	Question in English	%Wtd% yes		%wtd% no		%wtd% don't know	
1	the heart cleans the blood	57	57.29	21	21.14	22	21.57
2	Thoughts begin in the lungs (sot'ot')	47	47.77	31	30.95	22	21.28
3	the lungs (puts) cleans the blood	5	4.50	75	76.21	20	19.29
4	food passes from the mouth to the stomach via the intestine	71	73.01	19	17.64	10	9.35
5	the soul is in the lung (puts)	5	4.33	85	86.47	10	9.21
6	the liquid we drink mixes with the blood in the stomach	15	14.22	27	26.16	58	59.62
7	the liver cleans the blood	8	7.39	79	80.44	13	12.16
8	urine is the liquid that comes out of the blood when the life force finishes	93	93.99	5	4.13	2	1.88
9	we feel hunger in the stomach	95	95.57	4	3.49	1	0.93
10	the blood provides the life force that the body needs to live	97	98.11	2	1.89	0	0.00
11	the woman becomes pregnant when she has sex after her period	1	0.53	97	97.55	2	1.92
12	urine is made in the lung (sot'ot')	0	0.00	49	47.37	51	52.63
13	The liquid we drink mixes with the blood in the heart	95	96.67	2	1.64	2	1.69
14	there are two kidneys	97	97.43	3	2.57	0	0.00
15	blood is made in the lung (puts)	1	0.98	92	92.65	7	6.37
16	our lungs (puts) feel good when we have sex	1	0.98	31	29.01	68	70.01
17	farts are the life force from food	99	99.07	0	0.00	1	0.93
18	liquid mixes with blood in the lung (sot'ot')	1	0.92	69	69.40	30	29.68
19	the lung (sot'ot') cleans the blood	12	12.33	42	39.90	46	47.77
20	blood is made in the liver	1	1.05	40	38.24	58	60.71
21	the life force in food is extracted in the stomach	99	98.96	1	1.04	0	0.00
22	the soul is in the stomach	5	4.68	92	92.46	3	2.86
23	liquid mixes with the blood in the heart	98	98.92	1	1.08	0	0.00
24	thoughts begin in the kidney	0	0.00	96	96.28	4	3.72
25	urine is made in the liver	6	4.82	39	38.46	55	56.72

	when we get sick we feel weak because the blood takes the illness to the heart	94	94.93	6	5.07	0	0.00
26							
27	urine is made in the heart	3	2.27	32	30.82	64	66.91
28	farts are the air that enters the stomach when we eat	97	98.75	2	1.25	0	0.00
29	when we drink the liquid passes from the mouth to the stomach	98	98.43	2	1.57	0	0.00
30	when we breathe the air arrives in the liver	0	0.00	98	98.09	2	1.91
31	thought starts in our bellies	10	9.09	88	89.28	2	1.63
32	the air we breathe gives us our thoughts	1	1.06	94	95.96	3	2.98
33	food coverts into shit in the small intestine	93	93.85	6	6.15	0	0.00
34	urine is made in the stomach	1	0.75	42	39.92	57	59.34
35	there is just one kidney	3	2.01	91	93.27	5	4.72
36	urine is the liquid that mixes with food in the stomach	96	97.78	3	2.22	0	0.00
37	food passes through the large intestine then through the small intestine	2	1.56	90	91.87	7	6.57
38	a girl is concieved if the father enjoys sex	96	97.01	4	2.99	0	0.00
39	a girl is concieved if the mother enjoys sex	96	96.80	4	3.20	0	0.00
40	our emotins start in the heart	0	0.00	40	37.64	60	62.36
41	our soul gives us emotions	92	93.30	7	6.70	0	0.00
42	the lung (puts) and the heart are the same thing	97	97.33	1	0.87	2	1.79
43	farts form in the intestine	97	97.52	2	1.73	1	0.75
44	sweat is the liquid which comes out of blood when the life force is finished	9	8.52	39	38.40	52	53.09
45	thoughts come up from the heart	96	96.23	2	1.89	2	1.88
46	the air we breathe goes to the heart and gives life force to the blood	97	97.08	1	1.05	2	1.88
47	our emotions begin in the brain	97	97.08	0	0.00	3	2.92
48	If we breathe bad air, we have bad thoughts	0	0.00	38	35.71	62	64.29
49	when we breathe air arrives in the heart	99	99.02	1	0.98	0	0.00
50	emotions begin in the liver	0	0.00	94	94.15	6	5.85
51	farts form in the stomach	100	100.00	0	0.00	0	0.00
52	the me'winik is not an organ but just an illness	1	1.02	67	65.74	32	33.24
53	the food we eat arrives in the stomach and gives life force to the blood	96	96.00	1	0.88	3	3.12
54	our soul gives us thoughts	95	95.93	5	4.07	0	0.00

55	the woman becomes pregnant when she has sex before her period	2	1.49	94	94.76	4	3.75
56	blood is made in the lung (so'tot')	3	2.17	96	96.79	1	1.05
57	a woman can become pregnant after only once having sex	1	0.75	22	19.64	77	79.61
58	urine is made in the lung (puts)	0	0.00	19	16.73	81	83.27
59	we feel hunger in the heart	98	98.35	1	0.78	1	0.88
60	when part of the body hurts the blood takes the pain to the heart so we feel it	98	98.70	2	1.30	0	0.00
61	the soul is in the liver	1	0.53	96	96.68	3	2.79
62	the good feeling of sex is felt in the kidneys	0	0.00	51	49.28	49	50.72
63	blood is made in the stomach	2	1.58	93	94.81	4	3.61
64	liquid mixes with the blood in the stomach	7	6.06	53	53.31	40	40.62
65	The soul is in the lung (so'tot')	0	0.00	48	46.99	51	53.01
66	a boy is conceived if the mother enjoys sex	5	5.23	87	87.27	8	7.49
67	blood gives life force to the body	89	91.14	5	4.72	5	4.14
68	when we breathe air it arrives in the kidney	3	2.91	89	89.81	8	7.27
69	only women have a me'winik	8	7.20	29	27.91	63	64.89
70	a boy is conceived if the father enjoys sex	1	1.02	22	20.28	76	78.70
71	when we think to move a part of the body, the blood takes the thought to that part	1	0.88	20	17.89	79	81.24
72	our thoughts begin in our brain	97	98.94	0	0.00	1	1.06
73	we feel thirst in the stomach	2	1.72	47	45.31	51	52.97
74	there are two stomachs	3	2.96	30	28.08	67	68.96
75	El me'winik of the father determines the sex of the baby	1	0.75	24	22.28	75	76.97
76	the soul is in the kidney	1	0.75	83	84.30	16	14.95
77	the kidneys clean the blood	0	0.00	22	20.66	77	79.34
78	the liquid that we drink mixes with food in the stomach	97	97.48	2	1.53	1	1.00
79	air arrives in the heart and then in the lungs	98	98.12	2	1.88	0	0.00
80	urine is made in the kidney	0	0.00	41	38.85	59	61.15
81	we get sick when there is a lack of life force in the blood	95	95.62	3	2.69	2	1.69
82	food converts into shit when the body extracts life force from it	89	89.76	9	8.29	2	1.95
83	the good feeling of sex is felt in the heart	9	8.64	11	9.56	80	81.80
84	the heart is where we have our soul	91	92.53	4	3.72	4	3.75
85	food is converted into shit in the large intestine	95	96.72	2	1.39	2	1.89
86	the life force in food is extracted in	95	96.72	4	3.28	0	0.00

	the large intestine						
87	everyone has a me'winik	92	93.96	3	2.52	4	3.52
88	the liver helps the stomach with food	6	5.25	38	37.34	56	57.41
89	when we breathe the air arrives in the lung (puts)	94	95.37	5	4.63	0	0.00
90	thoughts begin in the liver	0	0.00	93	94.28	6	5.72
91	the liquid we drink converts into blood	98	98.48	1	0.78	1	0.74
92	the baby is made out of menstruation that does not come out during the pregnancy	1	0.98	67	65.56	32	33.46
93	emotions begin in the lung (puts)	6	4.99	91	92.33	3	2.69
94	the good feeling of sex is felt in the lung (so'tot')	1	0.92	36	34.69	62	64.39
95	the heart causes the blood to move	99	100.00	0	0.00	0	0.00
96	we feel thirst in the heart	96	96.96	3	2.30	1	0.74
97	food passes through the small intestine then through the large intestine	3	2.42	91	92.10	6	5.48
98	blood is made in the heart	94	94.73	4	3.75	2	1.52
99	the kidney helps the stomach with food	0	0.00	99	99.26	1	0.74
100	emotions begin in the lung (so'tot')	0	0.00	19	18.15	80	81.85
101	when we breathe the air arrives in the lung (so'tot')	100	100.00	0	0.00	0	0.00
102	when we breathe the lung movement causes the heart to move	92	93.39	8	6.61	0	0.00
103	the good feeling of sex is felt in the stomach	8	6.61	56	56.03	36	37.36
104	air arrives in the lung and then the heart	4	4.13	87	86.93	9	8.93
105	food converts into shit in the stomach	98	98.09	2	1.91	0	0.00
106	thoughts begin in the lung (puts)	5	4.62	91	91.42	4	3.95
107	food ferments in the stomach	98	98.11	1	0.86	1	1.02
108	the gall bladder gives us stomach pain	3	2.91	97	97.09	0	0.00
109	when we drink liquid it passes from the mouth to the heart	98	98.27	2	1.73	0	0.00
110	The gall bladder helps the stomach with food	0	0.00	92	92.09	8	7.91
111	emotions start in the stomach	0	0.00	81	80.77	19	19.23
112	the lung (puts) and the lung (so'tot') are the same thing	82	83.49	7	6.56	10	9.95
113	food cooks in the stomach	98	98.36	1	0.71	1	0.93
114	when we breathe the air arrives in the stomach	99	99.07	0	0.00	1	0.93
115	emotions start in the kidney	2	1.62	88	88.56	10	9.82
116	blood is made in the kidney	5	4.91	24	21.42	71	73.67

117	when we get ill the blood takes the illness throughout the body	97	97.31	0	0.00	3	2.69
118	farts are the air that arrives in the stomach when we breathe	99	99.07	0	0.00	1	0.93
119	the liquid we drink gives life force to the blood	99	99.07	0	0.00	1	0.93
120	farts form when the body extracts life force from food	98	99.06	0	0.00	1	0.94
121	liquid mixes with blood in the lung (so'tot')	100	100.00	0	0.00	0	0.00
122	the life force in food is extracted in the small intestine	1	0.94	43	42.46	56	56.60
123	the good feeling of sex is felt in the liver	0	0.00	43	42.59	57	57.41