Chapter 2: Towards Organic Health

Tracing the Sources of Sickness:

Ernst Haeckel, who first coined the term *ecology*, characterized the interconnected relationships of organisms as the “external physiology” through which “system equilibrium” is established and maintained (Haeckel 1870, quoted in Geertz 1971, 3). In this chapter, I suggest that we can broaden biomedical definitions that situate disease strictly within the human body to appreciate the ecological importance of *external pathology*. I argue that, in many instances, diagnosable pathogens, syndromes, or injuries are themselves symptomatic of broader sicknesses that have destabilized equilibriums not only within individual human bodies, but across an extended social and ecological anatomy.

While this perspective undoubtedly shares an ethical stance with the newly emerging public health discourse on the Social Determinants of Health (WHO 2008), it is important to outline a fundamental difference. The World Health Organization, in the preamble to its 1946 constitution, defines *health* as: “a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity” (WHO 1948). This definition is an important ideological statement, establishing health as more than normative physiology. Yet, in policy and practice, medical teaching institutions and global health organizations continue to distinguish diseases as the physiological realities of the body that actually reduce health, while environmental and social interactions remain factors that merely influence the risk of acquiring a disease. As Merrill Singer argues, “normal practice in biomedicine, whether it is diagnostic, research, or treatment capacities, is guided by the conceptualization of diseases as distinct, discrete, and disjunctive entities that exist (in theory) separate from other diseases and from the
social groups and social contexts in which they are found” (Singer and Claire 2003, 424). Thus, although the 2005 establishment of the Commission on the Social Determinants of Health (WHO 2008) is a step in the right direction, it perpetuates a fundamentally divided logic; social and physical environments can shift risk factors, but health and disease, much like the genetic neo-Darwinian logic of life, as we shall see, take place exclusively within bodies.

In contrast to this public health framework, I seek to present an ecological approach to health by applying Tim Ingold’s relational thinking. I suggest that social and environmental interactions are not merely grafted upon a universal biological substratum, but are locally integrated and mutually reproduced by the “whole-organism-in-its-environment” (Ingold 2004). By applying Ingold’s conception of an organism as a nexus in a continuous field of relationships (Ingold 1990), I seek to explore three anthropological questions. First, how does relational thinking allow us to integrate biological, social, and ecological relationships within the human organism? Secondly, in what ways does relational thinking allow us to resituate biomedical notions of parasitism along a continuum of relational equilibrium that extends beyond individual bodies? Finally, what are the lessons that biomedical theory and practice can incorporate from traditional indigenous health frameworks that emphasize the relationships between unbounded human organisms and their environments? What is at stake here is more than the application of helpful analogies and metaphors; I contend that effective medicine for the next century requires a fundamental reevaluation of the reductionist discourse that currently dominates our definitions of “organic” life. A conception of disease in a relational frame necessitates new responsibilities for a medical profession that seeks to trace and target the true sources of sickness.
What is the human organism?

The notion that an individual human being equals an individual organism appears self-evident to most Western thinkers. However, this obvious equation ignores the fact that our physical bodies contain millions of diverse cellular entities—not all of which share the same DNA—from macrophages to mitochondria to intestinal bacteria. These beings coordinate and compete for energy in intricate ways to the extent that the designations of multi-cellular systems that are the human body, unicellular beings that are parts of the body, and microbes that live in or on the body are distinctions that are shaped largely by our ideational frames of biology, immunology, politics and selfhood (Martin 1990). Moreover, when we look beyond our bodies, we are confronted with even more challenges in defining human organisms as unequivocally individual; our specific metabolic needs, reproductive behaviors, personal motivations—even our unique perceptions of the world—are, in many ways, reflections of the collective environments in which our discrete persons have evolved and adapted (Ulijaszek 2007). I will argue in this chapter, that as scientific constructs, the distinction between “ecosystem” and “organism” is inherently nebulous. When we search for organic boundaries, we are forced, above all, to recognize that organisms exist in complex relationships; that, perhaps, an organism is no thing but a complex relationship.

Through a longstanding Western tradition, from Descartes to Darwin to Durkheim to Dawkins, we have been constrained to conceive of organisms as distinct living things. The human organism has come to represent a particularly special living thing endowed with a psycho-social mind. Owing to pervasive and persistent dualistic thinking, we conceptually separate the biological organism below from the social personality above; Durkheim’s famous words “man is twofold” have been taken quite literally (Durkheim 2001, 18). According to this split, while socialized minds can intermingle, each biological body must be understood as separate from every other. Many sociobiologists, like E.O. Wilson (1975), have attempted to unify social and biological spheres, but ultimately sustain a divided logic. According to Ingold, sociobiological theories have resulted in a series of unacceptable dualities in the biological and social sciences, where the “lowest common denominator” of human experience is explained biologically a function of our commonly evolved genome, yet humanity’s uniqueness in opposition to the animal world is seen as a function of our exceptional “capacity for culture” (Ingold 1990, 210). Thus, a human being is represented as the manifestation of a socializable
“human essence superimposed upon a general animal substrate” (ibid, 210). In this framework, biological and social processes are functionally isolated on opposite sides of the division. In discrete individuals, the organism is reduced to expression of predetermined biological traits, and the person is conscripted as a replicator of evolved culture-trait; the former being transmitted through sexual reproduction, the latter through social education.

Figure 5: Neo-Darwinian Transmission of Genes and Culture (Ingold 2001, 394)

In this neo-Darwinian conception, human organisms remain distinct and partitioned containers, filled with independently functioning allotments of physiological/biological and psychological/social stuff. Ingold comments on this point in “Biology and Culture in a Relational World”:

The implied essentialisation of biology as a constant of human being, and of culture as its variable and interactive compliment, is not just clumsily imprecise. It is the single major stumbling block that up to now has prevented us from moving towards an understanding of our human selves, and of our place in the living world, that does not endlessly recycle the polarities, paradoxes and prejudices of western thought (Ingold 2004, 217).

As a way of tracing connections across arbitrary Western divides, Ingold’s “relational thinking” resolves this problematic separation of biological and social life. More importantly, relational thinking allows us to dissolve the egocentric isolation of human individuals from their collective environments. It is worth elaborating Ingold’s anti-essentialist approach to see the
powerful ways it challenges predominate scientific discourses in both biological and social spheres respectively to provide a more ecologically salient picture of the human organism.


Through the undeniable progress of biological science in the last two centuries, we have been compelled to conceptualize organisms as discretely active units, delineated in space by their lipid membranes, facilitating internal metabolic activities, and animated by the productive and reproductive qualities of their deoxyribonucleic acid. The American Heritage Science Dictionary (2009) defines an organism as: “An individual form of life that is capable of growing, metabolizing nutrients, and usually reproducing. Organisms can be unicellular or multicellular. They are scientifically divided into five different groups (called kingdoms) that include prokaryotes, protists, fungi, plants, and animals.” It seems impossible to refute the patent reality of this most basic biological definition. In this century, thanks to the overwhelming achievement of the neo-Darwinian synthesis—effectively combining Mendelian particulate heredity, Darwinian natural selection, Fisher population genetics, and modern molecular genomics of DNA—we have come to appreciate neo-Darwinian theory not only as an explication of the evolutionary process, but as the comprehensive scientific explanation of organic life. As the preeminent neo-Darwinist Richard Dawkins affirms “no other theory that has ever been suggested is in principle capable of explaining life” (Dawkins 1986, 288).

Darwinian theory effectively explains the impact of natural selection on the evolution of variable organisms; this theory is not disputed in this dissertation. However, the “gene’s-eye-view” of neo-Darwinian theory (Dawkins 1976) has recast organisms as individual containers of genetic events, directed by pre-determined genotypes and interfacing with other organisms and their environments through the expression of variable phenotypes. While biologists concede that the environment shapes the parameters of gene expression, the fundamental logic of life, our bio-logs, exists unquestionably within the genome. It is precisely on this point, in quiet opposition to hegemonic neo-Darwinian discourse, that relational thinking diverges, allowing space for alternative views of organic life. Relational thinking suggests that rather than defining organisms as living things coded by the genes, we should recognize them as the embodiments of life processes within an organic field that extends beyond the translation and transcription of DNA:
The field of relations, rather than genotypic inputs and phenotypic outputs, corresponds precisely to what we call the organism. Moreover it is to the generative properties of this field that the term life essentially refers. No mystical or vitalistic connotations are intended here. Life is not something separately infused into inert matter. It is rather a name for what is going on in the generative field within which organic forms are located and “held in place.” Thus life is not “in” organisms, but organisms are “in” life. (Ingold 1990, 215)

This type of relational thinking does not disavow the existence and function of DNA, or the well-established evolutionary facts of genetic variation across populations. Yet, while neo-Darwinian theory explains changes in genetic frequencies across populations over time, it wholly fails to articulate the dynamic developmental processes through which any unique organism actually becomes alive. The interactions through which life forms develop are not between gene code and environments—two spheres which never actually come into contact—but between the organism itself and the environment. However, an organism is never a constant thing, but the continually changing embodiment of a whole history of interactions, including the activities of prior generations, that shape its life course to that point (Ingold 2004, 218).

Ingold’s argument here is far subtler than a simple reassertion of “nurture” over “nature.” He suggests that by equating life to the expression of the programmed information of genotype into manifest phenotype, neo-Darwinian theory creates another artificial dualism. It drives a conceptual wedge between phylogeny, the evolutionary history of a species, and ontogeny, the development of an organism (Ingold 1990; 2002; 2004). This is because the “population thinking” of neo-Darwinian biology “requires us to think of evolutionary change as aggregated over populations of numerous discrete individuals, each of which is uniquely specified in its essential constitution independently of, and prior to, its life in the world” (Ingold 2004; 219). An organism is seen as a pre-specified form, pre-determined by the evolutionary environment of its ancestors prior to its actual development on earth. By essentializing organisms as bounded packages of gene expression, organic life is conscripted and isolate, existing solely within the detached individuals of an evolutionary sequence rather than along the continual lines of interaction and growth that connect them with other organisms and their environment. Rejecting this determinism, Ingold argues that we should focus on epigenesis, the process of coming to life. For Ingold, epigenesis incorporates more than the prearranged expression of genes subject to some variability based on environmental factors. Rather, the full “generative field” that allows
and shapes conversion of genotype into phenotype emerges as the “organism” itself. This field includes biological interactions, as well as social and ecological relationships:

What goes for the relations between internal parts of the whole organism also goes for the relations between the organism and its environment. Organic forms come into being and are maintained because of a perpetual interchange with their environments not in spite of it... But since an ‘environment’ can only be recognized in relation to an organism whose environment it is—since, in other words, it is the figure that constitutes the ground—the process of formation of the organism is the process of formation of its environment... Moreover, the interface between them is not one of external contact between separate and mutually exclusive domains, for enfolded within the organism itself is the entire history of its environmental conditions. (Ingold 1990, 216).

Rather than speaking of distinct organisms, Ingold suggests that we would be better served by speaking of the “whole-organism-in-its-environment” (Ingold 2001). For Ingold, evolution is not defined sequentially by expressed genes within discrete organisms under external environmental conditions, but as the perpetuation of self-replicating relational fields. Organisms emerge through the embodied *enfolding* of these relationships, just as their social and physical environments emerge as an *unfolding* of the same relational field. (It will be important in the next section, to distinguish *interactions* from *relationships*; the former defined as singular exchanges, the latter persisting through time and space.) This relational conception meaningfully blurs the boundaries between individuals, between successive generations, and between organisms and environments (see Figure 6 below).
While Ingold’s relational fields may seem pertinent only to social development, a quiet chorus of relational thinkers has emerged with compelling biological evidence supporting the reevaluation of neo-Darwinian reductionism in genetic, physiological, and ecological frames. From separate fields of microbiology and physiology, Lynn Margulis and Denis Noble reach similar relational conclusions highlighting the evolutionary importance of relationships in both the speciation and development of multi-cellular organisms.

In a *Symbiotic Planet*, Margulis emphasizes the central importance of relationships between different organisms across evolutionary history, and argues that cooperation rather than
competition has been the driving force behind the successful emergence of new species. (Margulis 1998). Margulis’ work over the past 30 years has established the importance of symbiogensis, the merging of distinct organisms into new forms, first proposed by Russian scientist Konstintin Mereschkowsky in 1909. Margulis’ Endosymbiotic Theory (EST) established that mitochondria organelles in eukaryotic cells emerged not from selectively advantageous mutations in the prokaryotic genome, but rather through the establishment of a symbiotic relationship formed when heterotrophic aerobic mitochondrial ancestors invaded anoxic archeabacteria. In this mutually beneficial relationship, ample nutrients and a homeostatic environment were provided by the host bacterium and oxidative respiration was facilitated by mitochondria for the cell. This relationship was so powerful that it persisted through generations, resulting in the eventual integration of two distinct genomes into one eukaryotic organism. Heavily disparaged by mainstream biologists for decades, EST is now taught as a fundamental evolutionary event in high school biology textbooks.

In “The Origins of Species: Acquired Genomes and Individuality,” Margulis argues that the “neo-Darwinism is insufficient to explain species origin” (Margulis 1993, 122) because it does not take into account the emergence of cooperative relationships. Margulis argues that symbiogensis, the emergence of novel organisms by the acquisition of hereditary genomes through protracted physical associations, is not unique to mitochondria in eukaryotes; it is a universal process throughout multi-cellular life. Margulis suggests that by forming relationships, “different” organisms integrate on at least four levels; through directly shared DNA; mutual gene products (RNA and proteins), coordinated metabolites, and synchronized higher-level behaviors (ibid, 122). Championing the significance of symbiosis, Margulis argues that “individuality is relative”:

The majority of eukaryotes are individuals in which three or more genomes and their protein synthetic systems are irreversibly integrated and required for development and maintenance of the individual though most of the life history of the component organisms. Coniferous trees for example contain at least three: nucleocytoplasm, mitochondria, chloroplasts, and usually mychorrhizae (Margulis 1993, 122).

The example of the relationships that constitute a coniferous tree is particularly iconic as endosymbiotic theory forces us to reconceptualize the tree of life in general. Thus Margulis, presents a relational picture of evolution: “the prevalence of merged lineages will reveal the net, rather than the tree of evolution. Reexamination of the ‘individual’ as unit of selection where all
eukaryotic individuals are composite is a requirement for assessing species biodiversity” (ibid, 125). The notion of merged lineages resonates strongly with Ingold who points to Alfred North Whitehead’s metaphysics of concrescence, the “advance from disjunction to conjunction,…the production of novel togetherness” (Whitehead 1978, 21) in an argument for the evolutionary importance of “growing together” (Ingold 2007b). Similar to Margulis, Ingold presents a concrescent revision of the tree of life in Perception of the Environment.

For Ingold, organisms are defined not by boundaries in space, but rather they emerge as function of the cohesive dynamics of cooperation and energy coordination, self-organizing relational fields of metabolism and homeostasis that perpetuate beyond individuals through time and space. This relational view suggests that the distinction between organism and ecosystem is arbitrary; as well as the anthropocentric division between organic and inorganic processes. Margulis’ colleague, James Lovelock, emphasizes this point in explaining their controversial Gaia Hypothesis. Their theory posits that the Earth’s biosphere is not merely favorable for life; it is a self-regulating system that maintains careful atmospheric concentrations of oxygen,
carbon, and nitrogen, the equivalent of planetary homeostasis and metabolism (Lovelock 1979; 2005). Lovelock also relies on a tree analogy to complicate the divide between life forms and the “inert” environment, arguing that both together constitute a global organism. He points to the redwood tree that is 97 percent dead matter yet is obviously alive:

The wood of the interior and the bark on the outside were once living tissue but have become just dead wood. The thin circumferential skin of living cells is what keeps the tree alive and growing. In a very similar way the Earth is covered with a surface layer of living organisms...Neither the air above nor the rocks beneath are alive, but both have been extensively processed by living organisms, just like the bark and the wood of the tree...Like the bark which is grown for the protection and sustenance of the living cells of the tree, the air has grown in composition so that it always sustains a favorable climate and favorable chemical environment for life” (Lovelock 2005, 32).

This analogy of the entire Earth as a self-regulating organic system resonates with Ingold’s proposition that life is not a quality that exists exclusively within organisms, but rather organisms exist within a broader process called life that extends into a physical environment. This inversion confronts neo-Darwinian logic that holds firm to the notion that genes are the essential blueprint for an organism. Thus, Dawkins disputes Gaia theory on the premise that there is no selective mechanism through which atmosphere-regulating genes could have evolved in discrete organisms (Dawkins 1982, 236). Relational thinking however allows for such hypotheses by recognizing that life is coded in relationships that extend beyond the function of DNA.

Denis Noble, prominent voice in the field of Systems Biology, extends the notion of relational thinking from the cellular sphere of EST to the physiology of multi-cellular organisms. He argues that the logic of life is not codified in the genome (Noble 2006). As Noble explains: “We inherit the world. The peculiar chemistry of water, lipids and many other molecules whose form and properties are not coded for by DNA—all is given. And yet the central biological dogma of our times is that inheritance is solely through DNA” (ibid, 46). Noble’s systems approach challenges the persistent metaphors derived from the Central Dogma of Biology, through which our “selfish” genes (Dawkins 1976) are understood as the engineers and generals of all higher-level physiological structures and functions. Through downward causation, biofeedback, and transcription control, Noble illustrates how function is not determined strictly “one-way” or “bottom-up” from genes to organism, but in a two-way relationship in which genes are frequently conscripted by the organism-in-its-environment to facilitate contingent processes:
Like Ingold, who points to the “self-organizing dynamics and form-generating potentials of relational fields” (Ingold 2004, 218), Noble suggests that the logic of life resides in the interactions of “self-assembling complex systems” (Noble 2006, 35). Like Margulis, Noble agrees that the emergence of multi-cellular organisms was driven by cooperation as much as competition. Noble notes that the persistence of mutually beneficial relationships allows diverse cells to thrive as cohesive multicellular organisms: “Their characteristic is what I will call cellular harmony: in a healthy organism they must co-operate in a harmonious way in the interest of the whole, despite the fact that they also have their own ‘selfish’ interests which, if given free rein, lead to diseases like cancer. I say ‘must cooperate’ since, like the genes, they are all in the same boat” (ibid, 96).

From a physiological perspective, Noble’s systems biology resonates with Ingold in challenging the neo-Darwinian assumption that DNA is the only component of inheritance between successive generations of organisms. Noble argues that within multi-cellular organisms, the functioning cell in its environment, rather than DNA, acts as the true blueprint for progeny (ibid, 95). Human development starts not from genetic scratch, but from a fertilized ovum that contains cytoplasmic determinants and a functioning system of cellular organization (ibid, 49). The self-organizing principles of this system are passed on in addition to the DNA. Thus while most somatic cells in the human body share a common genome, they are capable of diverging radically based on the transmission of acquired transcription patterns: “Specialized cell types in
the body have a remarkable feature. When they divide to generate new cells, they transfer the information concerning their acquired pattern of gene expression to the daughter cells. This is called epigenetic inheritance. It does not depend on differences in the DNA sequences” (Noble 2006, 95). Liver cells divide into new liver cells not because of special liver DNA, but because previous cell generations developed epigenetic patterns that were then transmitted.

Yet, arguments such as those put forward by Ingold, Margulis and Noble, are considered heretical according to mainstream neo-Darwinist theory that holds firm to the impossibility of acquired heritable traits. Biologists quickly disparage notions of acquired heredity as “Lamarkism” after Jean-Baptiste Lamarck, who first proposed in *Philosophie Zoologique*, that evolution was driven by advantageous traits accumulated during the course of an organism’s lifetime (Lamarck 1809). Lamarck infamously described the lengthening of giraffes’ necks straining to reach higher leaves to illustrate his argument. Lamarck’s contribution to evolutionary theory may have been taken more seriously had he pointed to the inheritance of acquired relationships. Today, numerous examples of what we can call Lamarkian inheritance have been documented, such as the parallel transmission of mitochondrial and nucleic DNA during eukaryotic mitosis (Margulis 1999), induced cilia patterns transmitted through generations of protozoa (Beisson and Sonneborn 1965; Nanney 1977), epigenetic transcription factors passed from one specialized cell to its progeny in the development of multi-cellular organisms (Jablonka and Lamb 1995; Colvis et al 2005), metabolic imprinting passed from grandmother to mother to developing fetus (Barker 2001; McMillen and Robinson 2005), or the selectively advantageous symbiosis of acquired bacterial gut “micro-bioms” passed on infectiously through successive generations in populations of termites, rats, and even humans (Chaffron 2007; Gross 2007; Turnbaugh 2006).

The point from these examples is not that acquired traits have greater evolutionary significance than random mutations in the genome, but rather that through the persistence of relationships, the epigenesis of each organism is fundamentally implicated in the previous life activities of other organisms. Organic life does not reset with each instance of DNA replication, nor is it not contained exclusively within individuals. Rather it flows through relational webs that connect the biology of organisms with the contingencies of their environments across generational time and space.
More importantly, for the human organism, the notion of acquired inheritance allows us to meaningfully integrate the artificial divide between biological and social traits. A human being develops physiologically and intellectually as function of relationships with other persons, a category of “communicative acts” frequently defined as *sociality* (Ingold 2001, 52). As anthropological discourses on *phenomenology, embodiment, habitus,* and, have long established, social structures not only shape the quality of human consciousness, they are powerfully reflected in physiological development and bodily experiences that in turn further influence *sociality* (Mauss 1973, Merleau-Ponty 1962, Bourdieu 1977, Csordas 1993 and 1999; Geurts 2002, Sharma 1996, Lock 1994, Strathern and Stewart 1998, Crossley 1996). The growth of every human body is patterned through the cultural organization of diets, kinesthetics, sexuality, labor and production, domestic habits and habitats, medicine and health care, natural resource use, and political landscapes. Thus, the epigenesis of any human being involves the inheritance of acquired patterns of cellular function in utero, as well as the dynamics of self-organizing cultural systems that are enfolded in the body through engagement with the world.

It is worth pointing to Margret Lock’s related paradigm of *local biologies,* which maintains that human physiology is always dependent on social life: “the biological and the social are coproduced and dialectically reproduced, and the primary site where this engagement takes place is the subjectively experienced, socialized body. The material body cannot stand, as has so often been the case, as an entity that is black-boxed and assumed to be universal, with so much socio-cultural *flotsam* layered over it. The material and the social are both contingent—both local” (Lock 1994, 484). At the same time as the biology of human organisms is shaped by a social world, human societies are generated through what John Blacking calls “biological solidarity” (Blacking 1977, 9). In *Towards an Anthropology of the Body,* Blacking argues that society is not only social, it is a biological system:

> Human society is not merely *like* a single organism, it is a biological phenomenon, a product of the evolutionary process. Thus we ought to talk not of the species man, but the species man and fellow-man. Cooperation and social interaction are not the consequence of rational contract or of habits learned during a long period of infant-mother dependency, they are biologically programmed and a necessary condition for the growth of distinctly human organisms (Blacking 1977, 8).

Yet, as Ingold explains, biological programming is not strictly genetic, it is relational. Ingold fleshes out epigenesis through notions of *dwelling, livelihood,* and *enskilment* to show ways in which both the biology and sociality of human organisms emerge as a function of
engagement with the world (Ingold 2001). Social life is thus an integral aspect of the organic logic of human beings:

Every organism is an open system, generated within a relational field that cuts across the interface with its environment. For the developing human organism, that field includes the nexus of relations with other humans. It is this nexus of social relations that constitutes him or her as person. Thus the process of becoming a person is integral to the process of becoming an organism…. The human being then is not two things but one; not an individual and a person, but quite simply, an organism. As the person is an aspect of the organism, so social life is an aspect of organic life in general. (Ingold 1990, 220).

When we recognize that humans are generated and maintained through ongoing relationships, we come to appreciate the arbitrariness of relying on skin to demarcate the boundaries between organism and ecosystem. The human field of relationships spans intracellular micronutrient metabolism, the coordination of energy across organ systems, invasions and infestations of beneficial and harmful microbes, interpersonal familial dynamics, social networks within households and communities, regional cultural, political and economic structures, and population-level natural resource use. When we situate the human organism in this continuous field, the separate constructions of individual, society, and ecosystem conflate. I assert that this conflation is critical when it comes to understanding human wellbeing.

Relational Equilibrium: Parasitism and Symbiosis.

One of the major contributions of medical anthropology has been the critical delineation of “disease”, “illness,” “sickness” categories (Lewis 1975; Eisenberg 1977; Young 1982; Kleinman 1988). While this delineation has been very useful in distinguishing the scientific classification of disease from the lived experience of illness and social processes of sickness, I suggest, that these categories can be meaningfully reintegrated into a unified paradigm by conceptualizing the human organism as an enfolding of relationships. In this frame health can be understood as the embodiment of the relational equilibrium of the whole-organism-in-its-environment. I argue that we should rely on a distinction between parasitism, defined broadly as a short-term interaction of unequal energy consumption, versus symbiosis, defined as a long-term relationship of mutually beneficial energy coordination, as a fundamental diagnostic differential.

In recognizing the evolutionary fitness of cooperative relationships, we can distinguish the pathogenicity of opportunistic competition. Particularly in terms of infections, I argue that disease is not merely the presence of invasive germs within bodies; infectious microbes are
pathogenic only in relation to an imbalanced consumption of energy, when they recklessly exploit resources even if it means weakening or killing their host systems. More broadly, with relational thinking we can identify the emergence of parasitism on clinical, socio-economic, and ecological scales.

An eloquent example of this type of relational approach is described in Peter Brown’s in an essay entitled *Microparasites and Macroparasites*. Brown recognizes parasitism by a broad definition that “refers to a common evolutionary strategy in which organisms usurp food and other forms of energy from other individuals (usually from other species)” (Brown 1987, 155). To be fair, Brown borrows his terminology from W. H. McNeil, who writes in *Plagues and Peoples*, that “one can properly think of most human lives as caught in a precarious equilibrium between the microparasitism of disease organisms and the macroparasitism of large-bodied predators, chief among which have been other human beings” (McNeil 1976, 5). Brown extends this argument and makes a pivotal distinction when he effectively translates the notion of parasite from the biological lexicon of infection into a socio-ecological diction of agricultural economics. Brown applies relational thinking to illustrate a common pathogenic process: `Microparasites, like viruses, bacteria, protozoa, and helminthes, find in human tissue a source of food and an environment suitable for reproduction…Macroparasites are large-bodied organisms—including other humans—who can exploit their human host for food (and more generally other forms of energy); either directly in the case of cannibalism or [predation], or indirectly, coercing hosts to surrender a portion of food or energy which they have produced. (Brown 1987, 160)`

On this point, Brown is careful to point out that he does not use the term macroparasite in a moral sense connoting social evil, but in an effort to “take the widespread evolutionary strategy of parasitism and apply it to human social relations and ideology, both of which are the product of an evolutionary process. The strength of this approach is that it considers the interaction of biology and culture within a single paradigm” (Brown 1987, 161). This single paradigm is relational, and with it Brown is able to compare the energy costs of malaria infection versus absentee landlords on the health of peasant families in rural Sardinia. Based on statistical modeling of the amount of calories consumed by periodic *plasmodium falciparum* infections in comparison to calories exacted by landlords at harvest time, Brown is able to demonstrate that macroparasitism, as he defines it, is an energy drain that is more than three and half times as detrimental to peasant farmer health as plasmodial microparasitism (*ibid*, 165). The value of this approach is the way in which it allows us to highlight common pathogenic relationships at
multiple ecological levels that converge within the human organism. Brown situates the farmer’s body at the nexus of a parasitic field: “When microparasites and macroparasites coexist, there are always three mouths to feed, and the host nearly always gets fed last” (ibid, 161). The three mouths image illustrates the motility of relational thinking; starting at the level of the human body it enfolds the concept of parasitism inward to diagnose the physiological impact of plasmodia and then outward to diagnose the exploitive economic practices that unfold across the Sardinian landscape. The health of these farmers is caught in a vicious cycle not simply of poverty, but of parasitism.

The notion of macroparasitism resonates with what anthropologists like Merrill Singer describe as a Syndemic: “A syndemic is a set of intertwined and mutually enhancing epidemics involving disease interactions at the biological level that develop and are sustained in a community/population because of harmful social conditions and injurious social connections” (Singer 2003, 429). Syndemic theory, like macroparasitism, can be differentiated from social determinants of health model because it directly situates social life within human pathology: “Ultimately, social factors, like poverty, stigmatization, racism, sexism, ostracism, and structural violence may be of far greater importance than the nature of pathogens or the bodily systems they infect” (ibid 428).

The syndemic interaction between various forms of parasitism are also important not only in tracing the sources of sickness across body boundaries, but for the way in which it allows us to place health and disease into a meaningful evolutionary context. If we agree with Margulis and Noble that cooperative relationships are fundamental to evolutionary fitness, we may have to acknowledge that unbalanced relationships of competition are, in many ways, less-evolved. Relationships remain parasitic so long as they strengthen one affiliate at net cost to the whole system of which they are an integral part. It has been posited by numerous parasitological studies that natural selection favors reduced virulence in pathogens, as fitter hosts better facilitate long-term transmission (Lipsitch and Moxon 1997). Classic examples of reduced parasite virulence include myxomatosis infection in Australian rabbits, and the apathogenic evolution of simian immunodeficiency virus, SIV, in primates (Nowak and May 1994).

However, recent analytic studies of parasite reproductive rates suggest that rather than tending toward benign infection, virulence may selectively increase when hosts are “coinfected” or “superinfected” by multiple parasites (Nowak and May 1994, Regoes and Nowak 2000). This
trend is supported in “The Evolution of Cooperation,” by Robert Axelrod and William Hamilton, who apply Game Theory to show that reciprocity between hosts and parasites is promoted by greater probability of long-term relations. These models differentiate trends towards healthy *relationships* compared to opportunistic *interactions*, in that repeated or continuous exchange between actors A and B—“iterated play”—favors cooperation over exploitation. Yet, the probability of long-term relations decreases when hosts are exposed to systemic injuries, multiple parasitic infections, or malfunction from aging, thus increased parasitism becomes evolutionarily advantageous (Axelrod and Hamilton 1981, 1395). Ultimately, these analytic models suggest that competition between parasites for host resources selects for more virulent forms of parasitism.

![Figure 9: Evolutionary Game Theory—“The Prisoners Dilemma” (ibid, 1392)](image)

The notion of co-infection has important syndemic implications then, if we allow ourselves to acknowledge that parasitism exists within multi-cellular bodies, as in the case of virulent infections/infestations, within social networks through “asymmetric economic exchange” (Brown 1987), or between reckless populations and the ecosystems from which they derive resources. When micro and macroparasites compete, the host’s health is sacrificed in an evolutionary arms race. We have numerous examples of the way extremely virulent strains of microbes have emerged and propagated through economically exploited communities and agriculturally depressed environments. Farmer describes these conditions under the framework of “structural violence,” illustrating the emergence and transmission of multidrug resistant tuberculosis in Peruvian slums for example, promoted through overcrowded housing, lack of health care, and inadequate nutrition (Farmer 1999 and 2005). Similarly, McMichael provides an ecological explication of the persistence of the Seventh Cholera Pandemic linking nitrate and
phosphate pollution, freshwater nutrient enrichment, and the explosive expansion of urban slum populations (McMichael 2004).

From the perspective of the environment, when microparasites decrease human life spans, shortening probability of long-term relations between humans and their ecosystems, human populations demonstrate dramatically decreased environmental stewardship (Allison and Seeley 2004). In the next chapter, I show how the macroparasitism of Nile perch fishing industry has intensely promoted the transmission of HIV microparasites across human populations, and led to intense resource degradation throughout the Lake Victorica Basin. We see how the introduction of an aquatic parasite, Nile perch, has promoted virulent parasitism across the Lake Victoria Basin in industrial practices, structuring of financial markets, infection patterns, household gender dynamics, and unsustainable agricultural strategies. In this context, we may have to acknowledge that HIV itself is one of many “opportunistic” infections.

If we situate health as relational equilibrium, we recognize that the inequitable distribution of wealth across countries is not merely an unfortunate economic circumstance, but the pathology of societal malignancy that literally weakens the health of nation-states. A significant body of research has documented the adverse health impact of social inequity (Wilkinson 1992; Farmer 1999 and 2005). Wilkinson demonstrates that despite weak correlations with GDP per capita, national mortality rates are closely linked to societal measures of inequality of income: “Rather than the richest, it is the countries where income differentials between rich and poor are the smallest that have the highest average life expectancy” (Wilkinson 1992, 1083). The evidence of inequity counters International Development rhetoric that supports economic growth in and of itself as a means of buoying health status across nations. This is even more apparent when we appreciate the way in which economic development has frequently promoted class divisions, unsustainable industrialization, rapid urbanization, and ecological deterioration. In terms of relational equilibrium between populations and the environment, we see that the way industrialized populations compete for the Earth’s resources and recklessly discharge waste is remarkably similar to the way a maladapted parasite feeds off its host. Speaking from a Gaian perspective, James Lovelock presents the diagnosis of Disseminated Primatemia: the pathology of a feverish global organism experiencing climate change as a result of virulent human populations (Lovelock 2005, 155).
Symbiosis stands on the opposite end of a relational spectrum from parasitism. While symbiosis is originally defined as a close physical association between members of different species, it is used primarily in contemporary ecological discourse in reference to *mutualistic* relationships (Saffo 1993). For the purposes of this dissertation, I define symbiosis as a mutually beneficial association between diverse affiliates that increases overall fitness of the cooperative. This definition resonates biologically with Margulis’ “endosymbiotic theory” of eukaryotic evolution as well as Noble’s articulation of “cellular harmony” within multi-cellular systems. Like parasitism, I argue that we can appreciate symbioses not only in biological and ecological terms, but across fields of social interaction as well. Symbiosis emerges as the primary qualifying attribute of what I call “organic” health.

**Towards Organic Health:**

A recognition of symbiotic relationships allows us to embed health within constituent networks of microbes, human bodies, communities, and ecosystems; in other words, to situate health within an organic field. To appreciate health as symbiosis it is worth elaborating here on the use of “organic” terminology in anthropological and popular discourse. In contemporary western society, “organic” has become a buzzword adjective for everything from whole foods, to computer software, product design methodologies, and corporate management hierarchies. Particularly relevant to this discussion are Durkheim’s original notion of *Organic Solidarity*, Sir Albert Howard’s philosophical underpinnings of the *Organic Agriculture* movement, and the elaboration of *Organic Nature* developed by Arturo Escobar in his anti-essentialist political ecology.

Durkheim’s notion of “Organic Solidarity” embraces the concept of symbiosis in a societal frame. Durkheim, in the *Division of Labor in Society*, describes the social cohesion that emerges through the mutual specialization of work responsibilities: “Society becomes more effective in moving in concert, at the same time as each of its elements has more movements that are peculiarly its own (Durkheim 1984, 85). In contrast to his mechanical solidarity where individuals are united through common status and labor, organic solidarity refers to the establishment of unity through diversification and mutual interdependence: “A structural-functional system of specialized parts, each of which exchanges with other parts and each of which makes a contribution to the persistence or evolution of the whole” (Pope and Johnson...
1983, 682). Moreover, organic solidarity joins different individuals through relational interdependence across all sizes of social groups, including families and marriages (Durkheim 1984, 78-79) Pope and Johnson: “These relations between individuals vary from the fleeting relations of exchange on the market, to enduring contractual relations, to lifelong social and political relations. The relations may be between two individuals or between the individual and the collectivity. These collectives may be as small as a married couple or as large as the modern nation-state” (ibid 682). These webs of interdependent human relationships are analogous for Durkheim to an organism comprised of various organ systems.

I assert that we should revive organic solidarity not merely as an analogy for the integrity of complex societies, but like John Blacking emphasizes, as a biological feature of the species “man and fellow man” (Blacking 1977, 9). In terms of biological fitness, organic solidarity allows us to see that individuals entangled in groups of other organisms are only as healthy as the strength of the relationships they share with one another and their environment. Although Durkheim spoke of solidarity as a social force, contemporary medical anthropologists recognize that the processes that activate social solidarity span biological, cultural and ecological spheres. McElroy, in Medical Anthropology in Ecological Perspective, emphasizes that human societies “create survival-promoting relationships within an environmental system. These are relationships within the group, with neighboring groups, and with the plants and animals of the habitat. A central premise of medical anthropology is that the group’s level of health reflects the nature and quality of these relationships” (McElroy and Townsend 1996, 14). Organic solidarity is an expression of symbiotic relationships that facilitate improved fitness for all participants in a collective; specialization and division is not driven by competition so much as cooperation and coordination within an interconnected system.

In many ways this type of solidarity represents an ideal underpinning the philosophy of the “Organic Agriculture” movement. Sir Albert Howard, arguably the father of sustainable agriculture, argues in texts such as The Soil and Health and An Agricultural Testament that soil, humus, plant, animal, and man are parts of a unified organic system: “There is no break in the chain from soil to man; this section of the wheel of life is uninterrupted throughout; it is also an integration; each step depends on the last. It must therefore be studied as a working whole” (Howard 1940, 23). Thus, according to Michael Pollan, Organic refers to a “program not just for agriculture but for social renovation” (Pollan 2004, 239). The early organic movement, acted
“on the ecological premise that everything’s connected to everything else” and “sought to establish not just an alternative mode of production (the chemical-free farms), but an alternative system of distribution (the anti-capitalist food co-ops), and even an alternative mode of consumption (the ‘countercuisine’)” (ibid, 234). Emphasis on curbing chemicals and antagonism towards the genetic modification of crops underlies Howard’s original conception of organic as “pre-modern, arguably even anti-scientific,” a refusal to rely on “oversimplifications” like nitrate-phosphate-potassium soil formulations, and “technological silver bullets” (ibid, 234). As Howard explains: “Instead of breaking up the subject into fragments and studying agriculture in piecemeal fashion by analytical methods of science…we must adopt a synthetic approach and look at the wheel of life as one great subject and not as a patchwork of unrelated things” (Howard 1940, 22). Organic emerges from this discourse as both a philosophical repudiation of scientific reductionism and a practice for promoting equitable interactions within human societies and between populations and their landscapes.

Escobar picks up the discussion of organic through a cross-cultural analysis of ‘nature’ constructions. He distinguishes between three representations of nature: organic, techno, and capitalist (Escobar 1999). Escobar highlights numerous ethnographic works documenting the way in which non-modern cultures articulate reality as organic: for many societies “the entire universe is conceived as a living being with no strict separation between humans and nature, individual and community, and community and the gods (ibid, 10). For Escobar, these constructions of nature “reveal a complex image of social life that is not necessarily opposed to nature (in other words, on in which the natural world is integral to the social world) and which can be thought about in terms of human relations such as kinship, extended families, and vernacular or analogical gender…a ‘vast community of living energy’ (ibid, 11). Escobar argues that understanding communities of living energy requires more than strict biological or ecological methodologies, it requires an appreciation of local forms of knowledge:

The study of organic nature thus goes well beyond the study of ecosystems with their functions, structures, boundaries, flows, and feedback loops, with people as simply one more element of the ‘the system.’ Ecosystems ecology is an outsider’s and top-down perspective that overlooks organic nature’s experiential and constitutive relational dimensions. The political ecology of organic nature also transcends analyses of production, governmentality, and the commodity. ‘The anthropology of local knowledge’ serves as a shorthand for what is missing from these analyses, however valuable and necessary (ibid, 11).
Ultimately, it is possible to identify five fundamental threads in these diverse discourses on the notion of organic, and weave them into a unified conception:

Table 1: Organic Threads.

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<th>“Organic Solidarity”</th>
<th>1) Evolutionary fitness of cooperative collectives</th>
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<td>“Organic Agriculture”</td>
<td>2) Promotion of symbiotic relationships within and between human populations and their environments</td>
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<td>3) Rejection of techno-scientific reductionism</td>
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<td>“Organic Nature”</td>
<td>4) Appreciation of the co-substantiality of biological, social and ecological processes</td>
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<td>4) Emphasis on local forms of knowledge</td>
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It is precisely these aspects that are highlighted in numerous ethnographies of indigenous ethno-medical frameworks (Adelson 1998, Roseman 1991, Katz 1982). A particularly relevant organic model is illustrated in Peter Geissler’s ethnographic account of perceptions of intestinal worms among the Luo of Western Kenya. According the Geissler, the traditional Luo conception of health, emphasizes relationships of balance, dispersion, and appeasement, and reflects a concrescent conception of the human body and its environment: “the ‘traditional’ view of worms draws no clear line between person and their environment, inside and outside. The worm is part of the environment and at the same time in the body; the order of things is not based on the opposition of living things to one another, but the relationships between them. In this view, lives overlap, grow into each other” (Geissler 1998, 74).
For the Luo, \textit{njokni} or worms, exist in a complex and ambivalent relationship with their human hosts, at times performing vital digestion, “mincing things, permeating and shifting boundaries, transforming kinds of energy and matter into others, maintaining life” and at other times generating illness by reacting aggressively to “outside influences, which can stem from the behavior of the person harboring them and from the natural and social environment. For example, the worms are affected by hunger or bad food. The latter can be rotten or forbidden according to food taboos or affected by sorcery, evil eye, evil mouth, or ancestral spirits” (\textit{ibid}, 75). For the Luo, a population in which intestinal worms are highly endemic, the pathogenicity of worms is not attributed solely to their internal actions in isolation, but also by the way in which human relationships influence their attitude. Parasitism for the Luo is positioned in relationships that span internal and external states. As we shall see in the next chapter, this organic worldview has important implications in terms of traditional resource management and social support networks among the Luo on Lake Victoria.

Geissler’s ethnographic account paints a picture of an indigenous health cosmology that reflects sensitive perceptions of the relationships between human bodies and their ecosystems. In appreciation of local perceptiveness, we can now turn to the concepts of \textit{body ecologic} introduced by Elisabeth Hsu, and \textit{sentient ecology} as proposed by Ingold and David Anderson. Hsu uses a Chinese example to augment Lock and Schper-Hughes articulation of the “three
bodies” (Lock and Scheper Hughes 1987) with a fourth, the *body ecologic*: “In many medicines, humans are considered co-substantial with the natural environment, and accordingly, as is argued here... convey culture-specific knowledge about experiences of ecological processes” (Hsu 2007, 92). Ingold and Anderson point to the intuitiveness of arctic caribou herders who “attend” (Ingold 2001, 25) to animals and plants in relationships that they understand as equally biological, social, and ecological:

By the term “sentient ecology,” I wish to place in the forefront of this ethnography that Evenki hunters and move on the tundra in such a way that they are conscious that animal and the tundra itself are reacting to them. To place a more formal edge on the phrase, one might say that Evenki views of ecology stress an ‘intergentivity’ where animal and human person ‘attend’ to each other. Evenki categories diffuse the ‘ontological dualism’ pervasive in western philosophy... These ideas are allied with Bateson’s argument for an ‘ecology of Mind’ which encourages would-be individual agents to recognize the links of communication which tie them to 'the environment of other social units, other races, and the brutes and the vegetable.’ (Anderson 2000, 117; Bateson 1972).

I suggest that anthropological frames like body ecologic and sentient ecology should be understood in the context of respectful local awareness of the *organic* nature of human experience. It is precisely this respectful awareness that is lacking in much contemporary biomedical discourse that disparages indigenous health insights as superstitious, and champions reductionist deduction to the exclusion of relational exploration. In the following chapters, I flesh out an organic framework with an ethnographic account of health and disease among the Suba of Mfangano Island. I apply the concepts of macroparasitism and microparasitism to describe the syndemic enfolding of the global Nile perch industry and HIV/AIDS within the bodies of people living on Mfangano. At the same time, by examining the local perceptions of ecological change, increased sexual mobility, shifting household dynamics, witchcraft practices, and the development process, we can learn much from the way the Suba and Luo attend to the unfolding of this pathological field along the shores of Lake Victoria.