-The Physics of Sand and the Fire History of California?

- Sympoiesis (Haraway) vs autopoiesis and symbiosis

-Modeling Glaciers

-On Haraway - https://youtu.be/3BzrmLyk95A?si=ZZWeMl2jQHV\_gNru&t=836

**Physics of Sand and McPhee**

In geology, it would be known as a debris flow. Debris flows amass in stream valleys and more or less resemble fresh concrete. They consist of water mixed with a good deal 0£ solid material, most of which is above sand size. Some 0£ it is Chevrolet size.

Boulders bigger than cairs ride long distances in debris flows. Boulders grouped like fish eggs pour downhill in

debris flows. The dark material coming toward the Genofiles was not only full of boulders; it was so full of automobiles

it was like bread dough mixed with raisins. On its way down Pine Cone Road, it plucked up cars

**Gilbert et al, a Symbiotic View of Life**

Recognizing the“holobiont” the multicellular eukaryote plus its colonies of persistent symbionts—as a critically important unit of anatomy, development, physiology, immunology, and evolution opens up new investigative avenues and conceptually challenges the ways in which the biological subdisciplines have heretofore characterized living entities.

Technology: The development of such complex formu- lations of individuals and systems depends on myriad factors, of which technology constitutes a major component in the characterization process. We perceive only that part of nature that our technologies permit and, so too, our theories about nature are highly constrained by what our technologies enable us to observe. But theory and technology act on each other reciprocally: we construct those technologies that we think are important for examining a particular perspective of nature.

Symbiosis as core principle …

The discovery of symbiosis throughout the animal kingdom is funda- mentally transforming the classical concep- tion of an insular individuality into one in which interactive relationships among spe- cies blurs the boundaries of the organism and obscures the notion of essential identity. Our aims in this overview are to: outline the data demonstrating that animals are symbiotic complexes of many species living together; demonstrate how a thoroughly symbiotic perspective opens important ar- eas of research and offers fundamentally new conceptions of the organism; and ex- plore what this new evidence means for biology, medicine, and for the conserva- tion of biodiversity.

**Haraway, Tentacular Thinking**

Autopoeisis vs Sympoisis

Nobody lives everywhere; everybody lives somewhere. Nothing is connected to everything; everything is connected to something.

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The earth of the ongoing Chthulucene is sympoietic, not autopoietic. Mortal Worlds (Terra, Earth, Gaia, Chthulu, the myriad names and powers that are not Greek, Latin, or Indo-European at all)11 do not make

themselves, no matter how complex and multileveled the systems, no matter how much order out of disorder might be produced in generative autopoietic system breakdowns and relaunchings at higher levels of order.

Autopoietic systems are hugely interesting—witness the history of cybernetics and information sciences; but they are not good models for living and dying worlds and their critters. Autopoietic systems are not closed, spherical, deterministic, or teleological; but they are not quite good enough models for the mortal sf world. Poiesis is symchthonic, sympoietic, always partnered all the way down, with no starting and

subsequently interacting “units.”12 The Chthulucene does not close in on itself; it does not round off; its contact zones are ubiquitous and continuously spin out loopy tendrils. Spider is a much better figure for

sympoiesis than any inadequately leggy vertebrate of whatever pantheon. Tentacularity is symchthonic, wound with abyssal and dreadful graspings, frayings, and weavings, passing relays again and again, in the

generative recursions that make up living and dying.

After I used the term sympoiesis in a grasp for something other than the lures of autopoiesis, Katie King told me about M. Beth Dempster’s Master of Environmental Studies thesis written in 1998, in which she

suggested the term sympoiesis for “collectively-producing systems that do not have self-defined spatial or temporal boundaries. Information and control are distributed among components. The systems are evolutionary and have the potential for surprising change.” By contrast, autopoietic systems are “self-producing” autonomous units “with self defined spatial or temporal boundaries that tend to be centrally controlled, homeostatic, and predictable.”13 Dempster argued that many systems are mistaken for autopoietic that are really sympoietic. I think this point is important for thinking about rehabilitation (making livable

again) and sustainability amid the porous tissues and open edges of damaged but still ongoing living worlds, like the planet earth and its denizens in current times being called the Anthropocene. If it is true that neither biology nor philosophy any longer supports the notion of independent organisms in environments, that is, interacting units plus contexts/rules, then sympoiesis is the name of the game in spades. Bounded (or neoliberal) individualism amended by autopoiesis is not good enough figurally or scientifically; it misleads us down deadly paths. 33

Coal and the steam engine did not determine the story, and besides the dates are all wrong, not because one has to go back to the last ice age, but because one has to at least include the great market and commodity reworldings of the long sixteenth and seventeenth centuries of the current era, even if we think (wrongly) that we can remain Euro-centered in thinking about “globalizing” transformations shaping the Capitalocene.51 One must surely tell of the networks of sugar, precious metals, plantations, indigenous genocides, and slavery, with their labor innovations and relocations and recompositions of critters and things sweeping up both human and nonhuman workers of all kinds. The infectious industrial revolution of England mattered hugely,

but it is only one player in planet-transforming, historically situated, new enough, worlding relations. The relocation of peoples, plants, and animals; the leveling of vast forests; and the violent mining of metals

preceded the steam engine; but that is not a warrant for wringing one’s hands about the perfidy of the Anthropos, or of Species Man, or of Man the Hunter.

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The sciences of the Anthropocene are too much contained within restrictive

systems theories and within evolutionary theories called the Modern Synthesis, which for all their extraordinary importance have proven unable to think well about sympoiesis, symbiosis, symbiogenesis, development, webbed ecologies, and microbes. That’s a lot of trouble for adequate evolutionary theory.(8) Anthropocene is a term most easily meaningful and usable by intellectuals in wealthy classes and regions; it is not an idiomatic term for climate, weather, land, care of country, or much else in great swathes of the world, especially but not only among indigenous peoples.

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Encountering the sheer not-us, morethan- human worlding of the coral reefs, with their requirements for ongoing living and dying of their myriad critters, is also to encounter the knowledge that at least 250 million human beings today depend directly on the ongoing integrity of these holobiomes for their own ongoing living

and dying well. Diverse corals and diverse people and peoples are at stake to and with each other.

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**Carey et all, “Coupled Human-Physical Dynamics: Impacts of Glacier Recession and Declining Meltwater on Mountain Societies”**

This article provides a systematic review of international research on human impacts of glacier meltwater variability in mountain ranges worldwide, including the Andes, Alps, greater Himalayan region, Cascades, and Alaska. It identifies four main areas of existing research: (1) socioeconomic impacts; (2) hydropower; (3) agriculture, irrigation, and food security; and (4) cultural impacts. The article also suggests paths forward for social sciences, humanities, and natural sciences research that could more accurately detect and attribute glacier runoff and human impacts, grapple with complex and intersecting spatial and temporal scales, and implement transdisciplinary research approaches to study glacier runoff. The objective is ultimately to redefine and reorient the glacier-water problem around human societies rather than simply around ice and climate. By systematically evaluating human impacts in different mountain regions, the article strives to stimulate cross-regional thinking and inspire new studies on glaciers, hydrology, risk, adaptation, and human–environment interactions in mountain regions…

The role of glaciers versus human forces of change (e.g., institutional change, reallocation of water rights, demographic shifts, or new land and water use practices) is, in other words, often unacknowledged. Studies concluding that water scarcity is a result of glacier loss—without attention to human variables driving water competition or restricting water access—often do not attribute water variability or human impacts to specific drivers. They are thus problematic for several reasons: They are based on speculation and tangential evidence; they do not differentiate between water availability and water allocation; they lack robust consideration of stakeholder competition for water; and they fail to consider the ways in which glacial ice, snowpack, precipitation, and groundwater interact to affect stream flow throughout glacier-fed watersheds. A central challenge for glacier runoff research is to integrate the diversity of biophysical and social processes, simultaneously disentangling them to understand which forces should be addressed in water management practices.

**Supplemental**

**Haraway – “Anthropocene, Capitalocene, Plantationocene, Chthulucene: Making Kin”, *Environmental Humanities***

If there is to be multispecies ecojustice, which can also embrace diverse human people, it is high time that feminists exercise leadership in imagination, theory, and action to unravel the ties of both genealogy and kin, and kin and species.

My purpose is to make “kin” mean something other/more than entities tied by ancestry or genealogy. The gently defamiliarizing move might seem for a while to be just a mistake, but then (with luck) appear as correct all along. Kin-making is making persons, not necessarily as individuals or as humans. I was moved in college by Shakespeare’s punning between kin and kind—the kindest were not necessarily kin as family; making kin and making kind (as category, care, relatives without ties by birth, lateral relatives, lots of other echoes) stretch the imagination and can change the story. Marilyn Strathern taught me that relatives in British English were originally “logical relations” and only became “family members” in the 17thcentury—this is definitely among the factoids I love. 15 Go outside English, and the wild multiplies. I think that the stretch and recomposition of kin are allowed by the fact that all earthlings are kin in the deepest sense, and it is past time to practice better care of kinds-asassemblages (not species one at a time). Kin is an assembling sort of word. All critters share a common “flesh,” laterally, semiotically, and genealogically. Ancestors turn out to be very interesting strangers; kin are unfamiliar (outside what we thought was family or gens), uncanny, haunting, active.16 Too much for a tiny slogan, I know! Still, try. Over a couple hundred years from now, maybe the human people of this planet can again be numbered two or three billion or so, while all along the way being part of increasing well being for diverse human beings and other critters as means and not just ends. So, make kin, not babies! It matters how kin generate kin.17

**Guattari, “Molecular Revolution” (118)**

**“**Transversality in the group is a dimension opposite and complementary to the structures that generate pyramidal hierarchization and sterile ways of transmitting messages. Transversality is the unconscious source of action in the group, going beyond the objective laws on which it is based, carrying the group’s desire.

**Deleuze and Guattari, ‘A Thousand Plateaus”**

A rhizome has no beginning or end; it is always in the middle, between things, interbeing, intermezzo. The tree is filiation, but the rhizome is alliance, uniquely alliance. The tree imposes the verb "to be" but the fabric of the rhizome is the conjunction, "and ... and ... and..."This conjunction carries enough force to shake and uproot the verb "to be." Where are you going? Where are you coming from? What are you heading for? These are totally useless questions. Making a clean slate, starting or beginning again from ground zero, seeking a beginning or a foundation-all imply a false conception of voyage and movement (a conception that is methodical, pedagogical, initiatory, symbolic ... ). But Kleist, Lenz, and Büchner have another way of traveling and moving: proceeding from the middle, through the middle, coming and going rather than starting and finishing.25 American literature, and already English literature, manifest this rhizomatic direction to an even greater extent; they know how to move between things, establish a logic of the AND, overthrow ontology, do away with foundations, nullify endings and beginnings. They know how to practice pragmatics. The middle is by no means an average; on the contrary, it is where things pick up speed. Between things does not designate a localizable relation going from one thing to the other and back again, but a perpendicular direction, a transversal movement that sweeps one and the other away, a stream without beginning or end that undermines its banks and picks up speed in the middle.

We form a rhizome with our viruses, or rather our viruses cause us to form a rhizome with other animals. As Francois Jacob says, transfers of genetic material by viruses or through other procedures, fusions of cells originating in different species, have results analogous to 11 those of "the abominable couplings dear to antiquity and the Middle Ages."6 Transversal communications between different lines scramble the genealogical trees. Always look for the molecular, or even submolecular, particle with which we are allied. We evolve and die more from our polymorphous and rhizomatic flus than from hereditary diseases, or diseases that have their own line of descent. The rhizome is an anti-genealogy. The same applies to the book and the world: contrary to a deeply rooted belief, the book is not an image of the world. It forms a rhizome with the world, there is an aparallel evolution of the book and the world; the book assures the deterritorialization of the world, but the world effects a reterritorialization of the book, which in turn deterritorializes itself in the world (if it is capable, if it can).

**Donna Haraway, Cyborg Manifesto**

Contemporary science fiction is full of cyborgs—creatures simultaneously animal and machine, who populate worlds ambiguously natural and crafted. Modern medicine is also full of cyborgs, of couplings between organism and machine, each conceived as coded devices, in an intimacy and with a power that were not generated in the history of sexuality. Cyborg “sex” restores some of the lovely replicative baroque of ferns and invertebrates (such nice organic prophylactics against heterosexism). Cyborg replication is uncoupled from organic reproduction. Modem production seems like a dream of cyborg colonization work, a dream that makes the nightmare of Taylorism seem idyllic. And modern war is a cyborg orgy, coded by C3 I, command-control -communication-intelligence, an $84 bil - lion item in 1984’s U.S. defense budget. I am making an argument for the cyborg as a fiction mapping our social and bodily reality and as an imaginative resource suggesting some very fruitful couplings. Michel Foucault’s biopolitics is a flaccid premonition of cyborg politics, a very open field.

By the late twentieth century, our time, a mythic time, we are all chimeras, theorized and fabricated hybrids of machine and organism—in short, cyborgs. The cyborg is our ontology; it gives us our politics. The cyborg is a condensed image of both imagination and material reality, the two joined centers struc- turing any possibility of historical transformation. In the tradi- tions of “Western” science and politics—the tradition of racist, male-dominant capitalism; the tradition of progress; the tradi- tion of the appropriation of nature as resource for the produc- tions of culture; the tradition of reproduction of the self from the reflections of the other—the relation between organism and machine has been a border war. The stakes in the border war have been the territories of production, reproduction, and imagination. This essay is an argument for *pleasure* in the con- fusion of boundaries and for *responsibility* in their construc- tion. It is also an effort to contribute to socialist-feminist cul- ture and theory in a postmodernist, non-naturalist mode and in the utopian tradition of imagining a world without gender, which is perhaps a world without genesis, but maybe also a world without end. The cyborg incarnation is outside salvation history. Nor does it mark time on an oedipal calendar, attempt- ing to heal the terrible cleavages of gender in an oral symbiotic utopia or post-oedipal apocalypse. As Zoë Sofoulis argues in her unpublished manuscript on Jacques Lacan, Melanie Klein, and nuclear culture, “Lacklein,” the most terrible and perhaps the most promising monsters in cyborg worlds are embodied in non-oedipal narratives with a diferent logic of repression, which we need to understand for our survival.1 The cyborg is a creature in a postgender world; it has no truck with bisexuality, pre-oedipal symbiosis, unalienated labor, or other seductions to organic wholeness through a fnal appropriation of all the powers of the parts into a higher unity. In a sense, the cyborg has no origin story in the Western sense—a “fnal” irony since the cyborg is also the awful apocalyptic telos of the “West’s” escalating dominations of abstract individuation, an ultimate self untied at last from all dependency, a man in space. An origin story in the “Western,” humanist sense depends on the myth of original unity, fullness, bliss and terror, represented by the phallic mother from whom all humans must separate, the task of individual development and of history, the twin potent myths inscribed most powerfully for us in psychoanalysis and Marxism. Hilary Klein has argued that both Marxism and psychoanalysis, in their concepts of labor and of individuation and gender formation, depend on the plot of original unity out of which diference must be produced and enlisted in a drama of escalating domination of woman/nature.2The cyborg skips the step of original unity, of identifcation with nature in the Western sense. This is its illegitimate promise that might lead to subversion of its teleology as Star Wars.

The cyborg is resolutely committed to partiality, irony, intimacy, and perversity. It is oppositional, utopian, and completely without innocence. No longer structured by the polarity of public and private, the cyborg defnes a technological polis based partly on a revolution of social relations in the oikos, the household. Nature and culture are reworked; the one can no longer be the resource for appropriation or incorporation by the other. The relationships for forming wholes from parts, including those of polarity and hierarchical domination, are at issue in the cyborg world. Unlike the hopes of Frankenstein’s monster, the cyborg does not expect its father to save it through a restoration of the garden—that is, through the fabrication of a heterosexual mate, through its completion in a fnished whole, a city and cosmos. The cyborg does not dream of community on the model of the organic family, this time without the oedipal project. The cyborg would not recognize the Garden of Eden; it is not made of mud and cannot dream of returning to dust. Perhaps that is why I want to see if cyborgs can subvert the apocalypse of returning to nuclear dust in the manic compulsion to name the Enemy. Cyborgs are not reverent; they do not re-member the cosmos. They are wary of hol - ism, but needy for connection—they seem to have a natural feel for united-front politics, but without the vanguard party. The main trouble with cyborgs, of course, is that they are the ille - gitimate ofspring of militarism and patriarchal capitalism, not to mention state socialism. But illegitimate ofspring are ofen exceedingly unfaithful to their origins. Their fathers, afer all, are inessential. I will return to the science fction of cyborgs at the end of this essay, but now I want to signal three crucial boundary breakdowns that make the following political-fctional (political- scientifc) analysis possible. By the late twentieth century in U.S. scientifc culture, the boundary between human and animal is thoroughly breached. The last beachheads of uniqueness have been polluted if not turned into amusement parks: language, tool use, social behavior, mental events—nothing really convincingly settles the separation of human and animal. And many people no longer feel the need for such a separation; indeed, many branches of feminist culture afrm the pleasure of connection of human and other living creatures. Movements for animal rights are not irrational denials of human uniqueness; they are a clear-sighted recognition of connection across the discredited breach of nature and culture. Biology and evolutionary theory over the past two centuries have simultaneously produced modern organisms as objects of knowledge and reduced the line between humans and animals to a faint trace re-etched in ideological struggle or professional disputes between life and social science. Within this framework, teaching modern Christian creationism should be fought as a form of child abuse

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I want to conclude with a myth about identity and boundaries that might inform late-twentieth-century political imaginations. I am indebted in this story to writers like Joanna Russ, Samuel R. Delany, John Varley, James Tiptree Jr., Octavia Butler, Monique Wittig, and Vonda Mclntyre. 28 These are our storytellers exploring what it means to be embodied in high-tech worlds. They are theorists for cyborgs. Exploring conceptions of bodily boundaries and social order, the anthropologist Mary Douglas (1966, 1970) should be credited with helping us to con sciousness about how fundamental body imagery is to worldview, and so to political language.

But there are also great riches for feminists in explicitly embracing the possibilities inherent in the breakdown of clean distinctions between organism and machine and similar distinctions structuring the Western self. It is the simultaneity of breakdowns that cracks the matrices of domination and opens geometric possibilities.

**Audronė Žukauskaitė, Gaia Theory: Between Autopoiesis and Sympoiesis**

At the same time as Lovelock and Margulis were trying to conceptualize the Gaia theory, the Chilean biologists Humberto Maturana and Francisco Varela were working on the theory of autopoiesis. The concept of autopoiesis was coined in the 1970s and it refers to the minimal organization of life, such as a cell (*auto* means “self” and refers to self-organizing systems, and *poiesis* means “making or creating”). The first publication on the theory of autopoiesis entitled “Autopoiesis: The Organization of Living Systems” appeared in English in 1974 ([Varela, Maturana, Uribe 1974](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref24)) with the help of Heinz von Foerster, founder of cybernetics. Autopoiesis refers to the minimal organization of a living system, which can both maintain itself in a closed circular process of self-production and interact with an environment in order to get nutrients and energy. In this respect an autopoietic organization is defined by several features. First, it is defined by self-maintenance, which means that the cell’s main function is to maintain its individuality despite the many chemical reactions taking place in it (Maturana, [Varela 1980](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref25)). It also means that an autopoietic entity is autonomous, capable to reproduce itself from within. In this sense an autopoietic organization is operationally closed. Second, an autopoietic unity interacts with the environment and gets information or energy from it. What distinguishes living systems from non-living systems is that the interaction between a living system and its environment creates a “structural coupling”: “a living system relates to its environment *structurally* – that is, through recurrent interactions, each of which triggers structural changes in the system. For example, a cell membrane continually incorporates substances from its environment; an organism’s nervous system changes its connectivity with every sensory perception” [(Capra, Luisi 2014](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref1): 135). In other words, every encounter with the environment produces a structural change in the system which then again becomes autonomous. In this sense autopoietic entities are “structurally determined”, that is, they are determined not by external forces (as in the case of non-living systems) but by their own internal structure. This leads to the third characteristic of living entities – life is an emergent property which cannot be reduced to the properties of the components. Emergence can be seen as the necessary part of self-organization.

Thus an autopoietic entity is self-maintaining and autonomous, it is structurally coupled with its environment and is constantly creating emergent properties that change the internal structure. Such a definition might seem contradictory, because autonomy and coupling with the environment seem to go in different directions. However, what it is important to understand is that this self-transcending movement is the necessary condition of life. As Evan Thompson observes, “the self-transcending movement of life is none other than metabolism, and metabolism is none other than the biochemical instantiation of the autopoietic organization. That organization must remain invariant – otherwise the organism dies – but the only way autopoiesis can stay in place is through the incessant material flux of metabolism. In other words, the operational *closure* of autopoiesis demands that the organism be an *open system*” ([Thompson 2009](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref23): 85). Thus, the main feature of autopoietic systems is that they have to change in order to be alive – total closure or homeostasis would lead to death. This feature is also something that is shared by second-order systems. As Cary Wolfe points out, “all autopoietic entities are *closed* (…) on the level of *organization*, but *open* to environmental perturbations on the level of *structure*” ([Wolfe 1995](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref26): 53). In this sense, autopoietic systems are structurally open and operationally closed at the same time.

Haraway takes the term of sympoiesis from[Beth Dempster’s (2000](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref4)) work, where she makes a distinction between sympoietic and autopoietic systems. Autopoietic systems, as defined by Maturana and Varela, are characterized by two basic features: first, they produce relations between their components that allow them to reproduce the same pattern of relations (they are self-referential); second, they have the ability to reproduce their own boundaries (they are self-defining). Autopoietic systems are organizationally closed, but structurally open: this means that they are not absolutely autonomous but that they internally define their boundaries and relationships with the environment. Sympoietic systems are organizationally ajar, with loosely defined boundaries. “Lacking self-defined boundaries, sympoietic systems consequently lack the same degree of control and are open to a continual flux of organizationally relevant information. (…) This dynamic, though restricted, flux of information allows sympoietic systems to evolve continuously by adapting to changing conditions and by generating new ones” ([Dempster 2000](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref4): 9). Autopoietic and sympoietic systems manage information in different ways: autopoietic systems carry a kind of “packaged” information, whereas sympoietic systems carry different bits of information in their components (which are autopoietic in themselves) and lack a central control. This makes sympoietic systems more flexible and adaptive, in the sense that they can easily adapt to changing environments, and also create something new, produce new forms of organization (in this regard they are allopoietic): “autopoietic systems follow some sort of path from a less to a more developed stage, whereas sympoietic systems are continually, although not necessarily consistently, changing” ([Dempster 2000](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref4): 10-11). This explains why sympoietic systems have bigger potential for change: if autopoietic systems are homeostatic, predictable and development-oriented, then sympoietic systems are allopoietic (producing otherness), unpredictable, and evolutionary oriented. In this sense sympoietic systems, which also include autopoietic systems as their components, have the ability to maintain their identity and the status quo, and, at the same time, have the potential to create changes and to adapt to changes coming from the environment.

Haraway adopts the theory of sympoiesis and suggests that “Gaia is a system mistaken for autopoietic that is really sympoietic” ([Haraway 2016](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref7): 180, n 38). We can add that autopoiesis explains the functioning of bounded units or individuals, whereas sympoiesis is a term to explain the collaborative assemblages which acquire their identity in the process of interaction and becoming. By fusing different components, sympoiesis creates more complex life forms and gives rise to new emergent properties. Haraway refers to Margulis’s notion of the holobiont, which indicates an organism plus persisting symbionts. A good example of such a holobiont is *Mixotricha paradoxa*, a critter that lives in the gut of an Australian termite and helps it to digest cellulose. *Mixotricha paradoxa* looks like a single-celled critter, but after a closer examination it seems to consist of multiple bacterial symbionts. Margulis and Sagan (2001) described it as a “beast with five genomes”: it is a composite organism containing a protist and at least four different types of bacteria. For Haraway, the notion of holobiont questions the idea of a self-organized individual and indicates that all living beings are dynamic organizing processes: “Like Margulis, I use *holobiont* to mean symbiotic assemblages, at whatever scale of space and time, which are more like knots of diverse intra-active relatings in dynamic complex systems, than like the entities in a biology made up of preexisting bounded units (genes, cells, organisms, etc.) in interactions that can only be conceived as competitive or cooperative” ([Haraway 2016](https://www.redalyc.org/journal/6945/694574419013/html/#redalyc_694574419013_ref7): 60). Haraway does not specify what these “dynamic complex systems” mean but it is clear from her description that they preclude any existence of bounded individuals.