



## SYMBIOAUTOTHANATOSIS: SCIENCE AS SYMBIONT IN THE WORK OF LYNN MARGULIS

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### ABSTRACT

Lynn Margulis's writing about symbiosis has profoundly influenced contemporary evolutionary theory, as well as continental and analytic philosophy of science, the materialist turn, and new materialism. Nonetheless, her work, and all symbiosis or evolution, is founded on a paradox: symbiosis fictionalizes customary accounts of the origin and evolution of species, yet it is impossible to speak of symbiosis (cross-species association) unless species-boundaries have been posited in advance. Thus, a tension is legible throughout Margulis's work between the drive to surpass the limits of species-definitions as they have been traditionally understood, and a need to maintain them in order that there can be "symbiosis" at all. Margulis criticized neo-Darwinian accounts of evolution in part because she saw symbiogenesis as debunking the theory that life was defined by individualistic competition. More recently, Myra Hird has suggested that *the gift*, such as it has been theorized by certain anthropologists and philosophers, could adequately figure symbiosis and the ethical relations founded on it. I turn to Derrida's writing on the gift to suggest that, if a gift worthy of the name chances to happen, it necessarily exceeds scientific, theoretical, and philosophical knowledge.

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At the 1933 meeting of the American Society of Parasitologists, questions of nomenclature were raised that required the formation of a Committee on Terminology. Foremost among them was uncertainty about the usage of *symbiosis* and a family of related terms. Was symbiosis a neutral term that referred to any sort of close association among the living, or did it refer only to those unions that were mutually advantageous? It had been used, throughout what was already a long history, both as an umbrella term for parasitism, commensalism, and mutualism, and as a synonym for mutualism. The committee traced the word to what they thought was its origin, though they made a common mistake, attributing it to Anton de Bary rather than an 1877 paper by Albert Bernhard Frank (Sapp 1994, 6, 131–32). Regardless, they found it was originally a neutral term, but still felt that the current state of ambiguity made a simple decision on their part impossible: “the present confusion necessitates the definition of the term whenever it is used” (Committee on Terminology 1937, 328).

Even where definitions have been given, something like this confusion has persisted, which is perhaps a sign that we are dealing with something more than a simple question of terminology. Or, that terminology is not a domain admitting of linear borders and voluntaristic decision. Symbiosis has grown today into a program of research that has transformed the understanding of life and its evolution, while also providing a novel biological model for human or “posthuman” ethico-political life. Thinkers from multiple, inter- or syn-disciplinary fields, including Lynn Margulis, Donna Haraway (2008; 2016), and Zakiyyah Iman Jackson (2020), have found an impetus for thought in symbiosis, I would argue, precisely because of this undecidability between the neutral and the good. Mutual benefit seems at once to offer an example of the generosity of the living, exceeding the economy of instinctual survival, and yet is entirely circumscribable within the logic of competitive survivalism (each organism seeking its own gain). Anticipating somewhat, I will say that the many theorists of the life sciences who have turned to anthropological and philosophical studies of the gift to try to figure a symbiosis beyond economy, do so as an effect of this undecidability.

Margulis’s re-elaboration of evolutionary theory, which made symbiotic union (close, cross-species association) the engine of life’s transformations, has been enormously influential, not only for contemporary biology but for much of feminist materialist thought today. Margulis’s work

came at the forefront of a growing dissatisfaction with the dominant trends of twentieth-century evolutionary theory. The Modern Synthesis union of genetics and natural selection presupposed that everything of relevance to heredity was received at birth from one's natural parents. Something like a paradigm shift has taken place in evolutionary theory over the past several decades, as symbiogenesis, epigenetics, developmental systems theory, niche construction theory, and plasticity have broadened our conception of heredity; it is now recognized that life has been formed and transformed through chance encounters with and even intentional cultivation of its biotic and abiotic environment—well beyond the nuclear family.<sup>2</sup> Within this field, the clearest result of Margulis's influence is the focus on the holobiont (a term coined by Margulis to encompass a traditionally conceived organism together with its symbionts) as a model organism and unit of selection (Gilbert, Sapp, and Tauber 2012; McFall-Ngai et al. 2013; Gilbert 2019).<sup>3</sup>

Margulis was also an early critic of the tendency toward mathematical abstraction in population genetics, arguing that it abandoned engagement with the actual complexity of life's ecological relations. Though genetics claimed to be discovering the factors that determined the development of particular traits, it was frequently criticized for ignoring the study of development altogether. For the most part, "phenotypic" adult traits were correlated with genetic differences, while the ideology of a "genetic program" served as a blanket answer to how those traits might develop.<sup>4</sup> The study of development has led to an increasing recognition of the plasticity of the organism, whose development is responsive to a milieu that includes complex interactions with its environment and symbionts. On the one hand, this challenged many of the assumptions of those who pictured development following from a deterministic program written in an individual's genes. On the other hand, as much as the work of Margulis and other scientist-heretics challenged assumptions that dominated twentieth-century evolutionary

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<sup>2</sup> For reasons that are perhaps essential, and which I hope to explore more fully elsewhere, these competing frameworks, while they have radically changed the study of life, have not unified around a single theoretical conception of the object of biological or evolutionary study. Several authors have attempted theoretical syntheses of the sometimes cooperating and sometimes competing approaches to evolution today, for example Oyama 2000, West-Eberhard 2003, Jablonka and Lamb 2014, Gilbert and Epel 2015. The work of Scott Gilbert perhaps most clearly demonstrates the influence of Margulis's thought (Gilbert, Bosch, and Ledón-Rettig 2015).

<sup>3</sup> Margulis (1990; 1991) introduced the term "holobiont" in two essays, though she defined it slightly differently in each case (Suárez 2018, 86–87).

<sup>4</sup> There is more than one way to narrate this complex history, in which genetics seems alternately to dismiss and usurp development (Keller 2002, 73–102; Amundson 2005).

theory and met with the resistance of population geneticists, there is a complicity or undecidability between these internalizing and externalizing representations of heredity that remains to be explored. In either case, if anything about the living is to be scientifically understood or predictable, if the scientist is able to say anything besides “who knows?” about the possibilities of life, it necessarily must be made to fit a form of programmaticity, however networked its inputs and nested its if-thens.

In what follows, I examine Margulis’s interventions in evolutionary theory to explore these complicities with the theories she rejects. The rush to declare oneself free of certain inherited errors or sins perhaps unites the “paradigm shift” that is today sometimes called the “Extended Evolutionary Synthesis,” and the realist and materialist philosophies that have risen to prominence among humanists and in interdisciplinary science studies. Without pretending that the myriad works marching under the banner of a “turn” or “return” to matter today could all be summarized as sharing a single theoretico-philosophical impetus or essence, one can identify widespread tendencies in their basic view of the natural world and its relationship to scientific discourse that are recognizable as well in Margulis’s theorizing: 1) *The critique of the mechanistic view of nature and life*—in keeping with what Latour and many others frame as the overcoming of a dichotomy instituted by Descartes, Margulis sees her work as discovering or recovering a non-mechanistic life that today would likely be called agential, vibrant, and so on. In short, if genetics saw the organism as passively shaped into an survival machine (guided by the cybernetic program of its genes), Margulis hopes to recover the possibility of understanding life as actively and responsively shaping itself. 2) *Nature as pure production*—It follows directly from the critique of mechanism that nature should be understood not as obedient to a programmatic set of laws but as a source of invention, creativity, novelty, and becoming. For Margulis, this is most visible in her drive to recapture symbiogenesis as the *origin* of species and speciation, an origin that she argues population genetics has forsaken. In turn, this allows her work to harmonize with the enormous influence of Deleuze and Guattari on continental science studies and materialism. In fact, *A Thousand Plateaus* frequently invokes symbiosis (though it does not cite Margulis) as an instance of rhizomatic, non-filiational becoming.<sup>5</sup> 3) *Posthumanism*—true to a tendency that is

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<sup>5</sup> “Finally, becoming is not an evolution, at least not an evolution by descent and filiation. Becoming produces nothing by filiation; all filiation is imaginary. Becoming is always of a different order than filiation. It concerns alliance. If evolution includes any veritable becomings, it is in the domain of *symbioses* that bring into play beings of totally different scales and kingdoms, with no possible filiation” (Deleuze and Guattari 1987, 238; oddly, the edition of the French text I have, printed in 2016, does not have italics in this passage,

perhaps more traditional than it lets on, Margulis argues that her opponents' scientism has proven false because it imposed unnatural concepts on nature (such as competition), concepts derived from "anthropocentric" cultural relations, whereas she hopes to produce a universally and transhistorically valid theory. In this, her argumentation is the perfect mirror of, for example, Meillassoux's (2009) anti-"correlational" realism, which pretends to oppose philosophy by positing the most traditional ideal of universalizing scientific thought such as could be derived from the philosophical tradition itself.<sup>6</sup> The drive for *ontology* (the desire to suppress "epistemological" questions of knowledge's fallibility) that is recognizable in many fields today is continuous with this tendency.

It would not be possible here to examine every text in which these implicit or explicit similarities can be observed. Rather, I hope to intervene in the field where these tendencies have become commonplace by returning to Margulis's texts and reading the faltering step of these operations. In short, wherever a science, theory, philosophy, ism, or ontology hopes to oppose pure productivity to mechanism it necessarily reinstates the differences it hopes to suppress or overcome. The porosity of this threshold prevents "new" approaches to materiality (as vibrant, agential, alive, inventive) from being purely and simply distinct from "old" approaches to nature and matter (as mechanistic, passive, inert). There is no creative origin located in a pure beyond of economic relations (of life as competition for survival and reproduction), nor is there an economic system without excess, but rather an undecidability of production and reproduction that makes the origin descend from its derivation, even in the form of its all-too-human scientization or mathematicization.

Though it is thought to surpass the arbitrary imposition of groundless concepts on nature, symbiosis only comes to pass where the very species-identities it fictionalizes have been posited in advance. Far from overcoming the economy of identity or individualism and vertical filiation, there could be no symbiosis without this economization. Thus, evolution is not simply symbiogenesis in the sense of the crossing of genealogical branches, but is

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though the original printing appears to, as well as other translations). Deleuze and Guattari have had an enormous influence on science studies and contemporary materialism, which I would argue is due as much to the consideration of biological themes in their work as it is to the shared investment of all these authors in the desire for the *new*. For examples of Deleuzian materialism or biophilosophy see Braidotti 2011; De Landa 1997; Ansell-Pearson 1999; Bennett 2010; Colebrook 2010; Shaviro 2010; Grosz 2011; Protevi 2013; Roy 2018. For a deconstruction of the theme of production as it crosses Deleuzian, Marxist, and biological discourse, see Thomas Clément Mercier's (2021) "Re/pro/ductions: *ça déborde*."

<sup>6</sup> I have considered these tendencies in the work of other authors associated with new materialism and speculative realism in earlier essays (Basile 2018b; 2019; 2020).

necessarily a symbiosis of disciplines or discourses as well. A discourse that can only be fictional and fictionalizing is nonetheless the origin of the origin and the ground of all truth, a dependence and descendance that I propose to call *symbioautothanatosis*.<sup>7</sup>

### 1. SYNOEDIPAL RIDDLES: MARGULIS'S ENDOSYMBIOSIS

The work of Lynn Margulis represented an event in the scientific community's view of symbiosis (Margulis [Sagan] 1967; Margulis 1998). Beginning in the late sixties, she undertook to prove that certain organelles unique to the lineage of eukaryotic cells, including mitochondria and chloroplasts, were originally independent unicellular organisms that united symbiotically with a proto-eukaryotic host.<sup>8</sup> A cell capable of feeding on another cell's waste is incorporated within its partner, and eventually exports most of its genes (and vital functions) to the nucleus of its host cell. Ultimately, the pair comes to reproduce as one. The debates surrounding Margulis's advocacy of this theory were settled in the minds of many biologists once it was discovered that these organelles retained their own DNA, closely related to that of prokaryotic cells, and that these relatives were thought to be phylogenetically distinct prior to the origin of the eukaryotic cell (Gray and Doolittle 1982; Gray 1992).<sup>9</sup>

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<sup>7</sup> I thank Thomas Clément Mercier and Eszter Timár, whose conversations, readings, and thoughts inhabit every word of this text, including this word "symbioautothanatosis," which I believe was first spoken by two or three of us in unison. They have been so generous that it would be impossible to identify the individual gifts that make up this symbiotic text—this non-appearance perhaps being the condition of a true gift.

<sup>8</sup> Eukaryotic cells, which are defined by the possession of a true nucleus, make up not only a class of single-celled organisms, but the entire kingdoms of fungi, plants, and animals. It is impossible to narrate the history of a science or to define its terms without feigning the unity of figures that have been in flux throughout their history, today more than ever. While symbiosis is now understood as the origin of the eukaryotic cell, it has also been that cell's dissolution, at least in a theoretical sense. That is, the firm boundary line that once distinguished prokaryotic cells (bacteria and archaea) from eukaryotic cells and the multicellular organisms formed of eukaryotic cells has been displaced by the very force that gave birth to their lineage. Today, it is recognized that symbioses, including those with prokaryotic cells, are essential to eukaryotic life (that is to say, even if these cells can be distinguished, there are no purely "eukaryotic organisms"). The vast majority of cells on or within our skin are prokaryotic, as well as the majority of the genetic material within that space. These symbionts are increasingly understood to be essential to our health and life. Philosopher of biology John Dupré (who offers one example of Margulis's influence on analytic philosophy), has placed in question the very concepts of a monogenomic and even a unicellular organism, on the basis of the prevalence of such symbioses (2012, 116–27, 163–87).

<sup>9</sup> This last piece of evidence was decisive in the minds of certain biologists, but Margulis rejected it for the same reasons (explored below) that she rejected the creation of the domain Archaea (O'Malley 2017, 35).

In other words, not only did these organelles have genes and other features in common with prokaryotic cells thought to be much older than the eukaryotic cell, but these prokaryotic predecessors were understood to have separated from the lineage that led to the eukaryotic cell long before its rise. This cast doubt on what is, in logical terms, the only possible competitor theory to the Serial Endosymbiosis Theory which Margulis championed (1998, 33–49). Either mitochondria and chloroplasts arrived from outside the cell, or else they must have arisen within it. This inside/outside binary saturates the logical and topological space of possibility.<sup>10</sup> The “autogenous” or “direct filiation” theory of the organelle would imply that in the course of its reproductions, a predecessor to those cells we today know as eukaryotic retained in its cytoplasm a primitive form of itself, which then specialized into the metabolic functions it now performs there. It was even hypothesized, in the course of these debates, that prokaryotic cells, such as we know them today, could have originated from these organelles, rather than vice versa—all of the arguments connecting the two structures necessarily succumb to this symmetry (Sapp 1994, 187). An “origin” can only be the feigned or dissimulated product of its own traces read from the imbricated surface of what is not simply a present contemporaneity. The legibility of this presence or present depends not only on its inscription with a conceptuality and taxonomy that implies heterochronous temporalities, but this inscription is itself received as a “phylogenetic” inheritance by a science or scientist who can only be the legatee of the origin they propose to master.

I am not trying to recuperate the endogenous or autogenous theory, but to think symbiosis otherwise.<sup>11</sup> Whether we imagine the “autogenous” origin or “xenogenous” return of these organelles, a degree of misrecognition is required to maintain any theory of genesis. It is no less the case, according to the exogenous theory typically associated with symbiosis, that the cell returning to live within its host is a product of the same lineage. Both of these cells, according in principle to any phylogenetic analysis, originated

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<sup>10</sup> “There are really only two ways such genomic partitioning can be explained” (Gray and Doolittle 1982, 2).

<sup>11</sup> What follows should make clear that it is more or less irrelevant to the movement I am attempting to trace whether the independent phylogeny of eukaryotic cell and organelle can be proven or disproven. In either case, the decision rests on an ungroundable definition of “eukaryotic” and its others. Still, it is worth remembering that these phylogenies can only be the contingent and revisable products of the distribution of identities they seek to ground. In the case of the phylogeny that some take as proof of Serial Endosymbiosis Theory, it was formed on the basis of similarities and differences that could be identified among 16S rRNA. While this produced a surprisingly robust set of experimental confirmations regarding the common qualities of the families of cells so identified, it was also based on the since disproven conviction that this structure would not be affected by horizontal gene transfer (Kitahara and Miyazaki 2013).

from the same “universal common ancestor.”<sup>12</sup> It is only by means of a misrecognition, such as the one that plagued Oedipus, that the return of this familial endowment comes to appear as a foreigner and guest. At the same time, even the “endogenous” story does not necessarily imply familial and filial unity. That one of these theories represents the Darwinian or neo-Darwinian self-propagation of a lineage while the other represents the intrusion and displacement of that lineal continuity depends on a common source or theory that is in a sense the origin of the origin. Whether one imagines the continuity or rupture of these pure lines, the idea that a lineage is formed by the proper reproductions of a bounded cell is a presupposition both explanations hold in common. If it were possible, without any visible barrier even needing to be crossed, for the innate possibilities of an organ or organism to transform or transgress the given, for possibility and impossibility to trade places, then “life” would be exposed to a syn- or hetero-nomy older than any encounter with its near or distant relatives.

## 2. DARWIN DISPLACED

For all of the transformations it introduced into evolutionary history and theory, Margulis’s work nonetheless betrays its dependence on these limits of phylogenetic thought. Everywhere that she places in question the genetic grounding of life’s innate possibilities, it is only to locate innate possibilities of being one step above or below their traditional locus. She puts forward criticisms that would place in question the very scientificity of science, but only to critique particular representations of population genetics, without recognizing that these same criticisms would apply to the symbiotic and symbiolic representation of life that she champions. The fictionality of phylogeny, and of the notions of species and nature with which it is entwined, is not a circumstantial limit of a particular representation of evolution, any more than it is the mark of a fault or sin that distances human knowledge from the tree of life; rather, species, nature, and everything attached to the value of origin depends on the artifice that makes it impossible.

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<sup>12</sup> Though Margulis and Sagan are critical of the unifying logic of the common ancestor (often referred to as the Last Universal Common Ancestor—LUCA), they grant it in the same breath: “The long-term symbiosis that led to species origin by symbiogenesis requires integration of at least two differently named organisms. No visible organism or group of organisms is descended ‘from a single common ancestor’” (2002, 7). They can only challenge the unity of ancestry for “visible organisms” (a visibility that they, not without reason, take as definitive of the species, the *eidos*) by positing a unified life (the “differently named organism”) underneath them of which they are the re-composition.

Margulis's criticism of "neo-Darwinian" population genetics follows this pattern of incorporating the "errors" it denounces. All of Margulis's criticisms of the field are apt, but fundamentally they apply just as well to her preferred formalisms. Population genetics treats life as a calculable set of genes. Values can be assigned to represent the effects of factors such as breeding tendencies, selection, mutation, migration, and drift on the intergenerational transmission of these genes, and the resulting formulae can be used to predict the change of genotype frequencies in a population. Margulis argues that this formalization creates a "mechanistic" picture of life that eschews empirical study and deals only with idealized quantifications that are not "directly measurable."<sup>13</sup> This critique of mechanism suggests a transformed picture of evolution and of life:

My view is that neo-Darwinist fundamentals, derivative from the mechanistic life science worldview, are taught as articles of true faith that require pledges of allegiance from graduate students and young faculty members. I include as examples of such fundamentals a non-autopoietic definition of life; a bodiless, linear concept of evolution; and an uncritical acceptance of the mesmerizing concept of adaptation. (Margulis and Sagan 1997, 271–72)

Margulis's critique of "adaptationism" focuses on the passive role in which it places the living. Adaptation implies an organism honed through random events of differential survival, and thus a purely mechanical or efficient image of causality.<sup>14</sup> What appears as an adaptation, in Margulis's view, is both the constant self-maintenance of an autopoietic individual, and self-maintenance within an environmental context that is also autopoietically created

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<sup>13</sup> Margulis includes tables in this essay that contrast neo-Darwinist terms she argues are mere groupthink to those she claims are "independent of language and culture" (Margulis and Sagan 1997, 275). Somewhat ironically, given her critiques of efficient causality and of the "physicomathematics envy" of population geneticists (1997, 266), the tables of culturally contingent neo-Darwinist terms include any term that implies a purpose or final causality (such as cooperation), while her table of "universal science" includes the basic properties of physics and chemistry (mass, length, volume, velocity, pressure, etc.). Without attempting in any way to recuperate the self-evidence or cultural independence of neo-Darwinian concepts, I would nonetheless posit that Margulis's work depends on just as contingent and deconstructible a set of assumptions.

<sup>14</sup> "The mechanistic worldview has many problems, one of which is the failure of neo-Darwinist biologists to think physiologically in general and to recognize the principles of autopoiesis in particular. Biologists are failing to embrace alternatives to a mechanical universe run by their supposed superiors: physicists, chemists, and mathematicians" (Margulis and Sagan 1997, 267).

and maintained by the living.<sup>15</sup> This connects her theory of symbiotic evolution to her endorsement of James Lovelock's Gaia hypothesis, according to which the earth is itself a metabolically self-sustaining, living individual (Margulis and Sagan 1997, 127–44).<sup>16</sup> Regardless of how we assess each of these interventions in evolutionary thought, it remains to ask what can be done if Margulis's theory of evolution *and anything that could count as theoretical or scientific* must depend in turn on something like mechanistic modeling.

To know whether one has escaped the orbit of *mathesis* and efficient causality, one would have to know the essence of these categories. It may not be as simple as avowing the absence of arithmetical symbols to prove that there is no "mathematical" residue to one's thinking.<sup>17</sup>

If a symbiotic union can lead to a new organism or way of life, then a formula that predicts or postdicts random genetic mutations will tell us

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<sup>15</sup> Several obstacles stand in the way of offering a straightforward definition of the term "autopoiesis" as it circulates in Margulis's discourse. Though she frequently invokes the term and does define it, she nonetheless attributes quite heterogeneous and contradictory values to it. The term is used, on the one hand, to grant a basic, elemental status and even "self"-hood to the bacterial cell, on the grounds that it self-produces. To an extent, this is coherent with Maturana and Varela's use of the term, who understand the cell as the most basic autopoietic unit and multicellular organisms to be built of these units. On the other hand, Margulis equates this self-production with a spontaneous originality of life that extracts it from all mechanism, while Maturana and Varela explicitly claim they are creating a mechanistic account of life (Margulis and Sagan 1997, 267; Maturana and Varela 2012, 75–76). Maturana and Varela also correctly argue that their theory can explain nothing about the origin of the variations that shape evolution, while Margulis takes it as a return to originality itself (Maturana and Varela 1992, 115). Moreover, while Maturana and Varela cite Margulis's work and invoke symbiosis, their definition of it is incompatible with many of her formulations (Maturana and Varela 1992, 87–88). For Maturana and Varela, only endosymbiosis would count as symbiosis, while other interactions of cells and organisms would not. One could even go as far as to say that the notion of operational closure Maturana and Varela attribute to the autopoietic system, which assumes that it has, in fact, no environment or world but rather only pre-programmed possibilities of plasticity, guarantees that there can be no true evolution, no genesis or symbiogenesis at all. This is a generalizable problem of scientific thought, which must posit the end as a possibility present from the beginning in order for a cause to be knowable.

<sup>16</sup> Lovelock's Gaia hypothesis has recently received well-deserved criticism for its rejection of the environmentalist thinking and activism that was nascent at the time of its formation. Lovelock used the idea of a metabolic planet to argue that Earth could maintain its equilibrium much better than environmentalists such as Rachel Carson suggested. This research was a direct result of funding Lovelock received from the Royal Dutch Shell corporation, and was used to give scientific sanction to polluters and their enablers in government (Aronowsky 2021). Margulis's work on the Gaia hypothesis repeats the same criticisms of environmentalist thought (Margulis and Sagan 1997, 129; Cf. Margulis 1996, 140).

<sup>17</sup> Nothing about symbiosis is immune or opposed to mathematical modeling. In fact, there can be scientific knowledge and knowledge at all only where a certain formalizability that will always be mathematically expressible holds sway. For an example of an attempt to treat "holobiont" evolution mathematically, see Roughgarden et al.

nothing about this source of novelty in the course of evolution (unless one invoked the convenient hypothesis that a genetic mutation caused this choice of symbiotic lifestyle). Without recourse to an innate repository programming the future of life, it would be necessary to turn to history to decipher the contingency of an event without law.<sup>18</sup> This is the logic of Margulis's project, and however compelling it may be as an apparent antidote to the stifling project of Modern Synthesis genetics, it depends on principles that are not straightforwardly opposed or opposable to their supposed opposites. The "same" force that, in its population genetic guise, stifled and excluded life, this very same force *gives* life to every symbiotic union. The mathematical models of the population geneticist missed life entirely, according to Margulis, because they programmatically preserved isolated reproductive lineages that could never capture the apparently spontaneous irruption of the contingency of symbiotic union, the breath of life. But it can always be demonstrated that spontaneity or freedom only exists where some calculation fails—it depends just as much on the program that it appears to outstrip. So, wherever the unprogrammability of life appears to manifest itself by means of symbiosis, it is *a priori* given that this crossing of borders *depends on the very borders it places in question*. If one truly abandoned all thinking in terms of genetic lineages, one would lose the sym- along with the auto-. The very chance and hope of life is only there where that which corrupts it in principle, the mechanical and programmatic, the stifling or dead, accompanies and cultivates it. Life and death are symbiotic.<sup>19</sup> Though no *word* could capture this duplicitous movement, if word implies the unity of a meaning, conceptual content, or essence, I would propose to let this non-self-identity inhabit, with a sort of parasitic alterity, the term *symbioautothanatosis*.

I deploy this term, symbioautothanatosis, to trouble the sense of union or reunion that accompanies the thought of symbiosis. Something that cannot be identical with life, because it is not identical to itself, a contingent and

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<sup>18</sup> Margulis does not articulate the opposition between mathematicism and history as clearly as Stephen Jay Gould will, for instance. For her, the outside of mathematics is, somewhat confusingly, the dynamic modelling of autopoiesis. Still, turning from the computer screen to "nature" is part of her project: "Neo-Darwinists, closet neo-Darwinists, and non-neo-Darwinists argue among themselves about 'who selects' and 'what is selected.' [...] Dover (1988), for example, attempts to extricate us from some of these evolutionary tangles when he writes: "The study of evolution should be removed from teleological computer simulations, thought experiments and wrong-headed juggling of probabilities, and put back into the laboratory and the field" (Margulis and Sagan 1997, 271).

<sup>19</sup> One could just as well write: *life death is symbiotic*. "Life death" is the term introduced in Derrida's recently published 1975-76 seminar to describe life as neither opposed nor identical to death (Derrida 2020, 1-24; Vitale 2018).

revisable definition or self-definition of the essence and form (the life and species) of the living, is the precondition of what it makes impossible, the origin of life. For the scientist (who cannot simply exclude themselves from the domain to be defined, the domain of the living), this means that the possibility of symbiotic union, and any other form of horizontal involution in the tree of life, fictionalizes the concept of the isolated reproductive lineage that grounds the thought of species. Nonetheless, without these impossible and impossibly pure reproductive filiations, the very phenomenon of horizontality or symbiosis could not appear. The overcoming of living (natural, original) boundaries implied by the sym-bio- *derives from* the artificial (instituted, non-natural) positing of fictional divisions, from auto-thanatos. Moreover, this non-oppositional heteronomy cannot be restricted to the “epistemological” failings of a supposedly unique being who has eaten from the *arbor scientiae*. The specular alterity that makes scientificity possible and impossible *is life itself, if there is any*; life has always defended and cultivated and defined itself through acts of recognition and reproduction that necessarily depend on the reading, writing, and re-inscription of traces that are symbioautothanatotic, neither living nor dead, neither self nor other.

### 3. BACTERIA: AUTOS REGAINED

The necessity of symbioautothanatos makes itself explicit in Margulis’s work. The dependence of her theory of symbiogenesis on conventional and instituted notions of taxonomy, and thus on the formalism of *mathesis*, is just as legible in her theory as it is in the work of those geneticists she disparages:

The life-centered alternatives to mechanistic neo-Darwinism recognize that, of all the organisms on Earth today, only prokaryotes (bacteria) are individuals. All other live beings (“organisms”—such as animals, plants, and fungi) are metabolically complex communities of a multitude of tightly organized beings. That is, what we generally accept as an individual animal, such as a cow, is recognizable as a collection of various numbers and kinds of autopoietic entities that, functioning together, form an emergent entity—the cow. “Individuals” are all diversities of coevolving associates. Said succinctly, all organisms larger than bacteria are intrinsically communities. (Margulis and Sagan 1997, 273)

That is, in order to preserve the “life-centered” communalism of symbiosis, it is necessary to insist, just a single rung down in the vital ladder, on the

“individuality” of bacteria. Thus, symbiosis has a cause which is perhaps internal to its communitarian body, “endosymbiotic,” but nevertheless external and efficient or mechanical in the sense that its source resides in the encounter of originally exclusive bodies or agencies (nothing but an inner will and purpose would transcend efficient causality, which means that nothing but mechanism ever presents itself to scientific knowledge); moreover, it is formal-mathematical in the sense that the unity of these units is defined by a deconstructible model of life and its heredity, not to be confused with life “itself,” if there is any. It retains the mark or stain of what Margulis denounced when it appeared in the corpus of population genetics: 1) mechanism and 2) formalism, mathematicism.

Even if Margulis’s discourse would not be recognizable to a mathematician as part of their field, that does not guarantee that it is free of all mathematicity. Without pretending that this term could be defined, without pretending that it sheltered anything like an essence, we can at least ask if the defects it has been accused of by Margulis do not return in her own discourse. If the autopoietic living individual is the uniquely productive bacterium, this can easily be indicated by an  $X$ , and the formula for a minimal symbiosis could be written as  $X + X$ . Whether or not it is written as an algebraic formalism, every concept that allows for effects of scientific or theoretical unity must admit of something like a logic that can be abstracted from and re-deployed within the varying contexts of its application. The difference from nature “itself” that Margulis decried in the form of population genetical formalism necessarily reappears in any discourse that purports to do more than marvel before an unspeakable singularity. If one speaks the word “bacterium,” or lets any other term or germ insinuate itself into discourse or consciousness, one is already working with iterable and operationalizable traces. It is not the case that these traces simply repress or falsify the true and vital world of singular things; rather, there is no world without them. *There is nothing without the at once repressive-productive trace.* The trace allows for every effect of formalizability and de-contextuality, precisely by “producing” the residue of a situated and material or singular world. If a technology like the term *bacterium* allows for the heterogeneity both outside and *within* each “individual” to be dissimulated or dissolved in a family resemblance, it is nonetheless only on the basis of such an iterable and abstractable formalization that the singular and its corruptibility or contamination can first appear.

The same analysis or deconstruction that turned the eukaryotic cell and everything based on it (fungus, plant, animal) into a consortium of bacteria can be turned on the “bacterium” itself. If it is possible to observe some

unity here, and even to claim that this unity is autopoietic or self-made, that is only the case where it is constantly threatened and even constitutively compromised by forces that can no longer simply be attributed to the bacterium itself, if this is to name anything like a positive entity. I would attempt to draw this partitioning back before the classical topos of philosophical thought that identifies life where parts operate or cooperate in the service of the internal purposes of a whole (as opposed to the external purpose of a machine). Certainly, a bacterium is decomposable, intellectually or materially, into constituents whose unity has the character of a temporary *détente*. These parts, just in order to count as parts and parts of the whole, are necessarily riven by the trace that places the “whole” in question. Some may prove extrinsic and dispensable to the formation, or some more necessary than others, and each may have a different or differing history, age, and origin, if not quite a history of their own. Ultimately, this deconstruction of the “autopoietic cell” can only demonstrate dis-unity by feigning the unity of parts, attributing them identities and something like a life that can then be given or shared symbiotically. I insist on it not to pretend that those parts are the true unities underlying everything else, but to recognize the necessary transition or translatability of frames that inaugurates the legibility of these possibilities while also harboring their dissolution.

A trace that is neither natural nor artificial functions as the hidden border that interminably re-frames, re-writes and re-reads the dispensation of vitality. It is on the basis of this non-present and non-self-identical trace that “bacteria” and the distinction of separate bacterial lineages can function both as the name for the self-originating source of life and all symbiosis, and as an artificially imposed term that has been repeatedly displaced and deconstructed in the past decades.<sup>20</sup> One figure for this disruption of the integrity and conceptual stability of life is the virus. Despite its apparent exteriority to its hosts, it can reveal a re-apportioning of the boundaries of the living that is no more internal than external. It draws boundaries within the distribution of species as they have been known, parasitizing some while benignly occupying others—though these mutualisms may be just as violent, creating a marked lineage that brings death to its former kin. In any case, the mark or trace of species-identity is revealed to be a non-present vulnerability to what arrives long after birth or the origin. As such, it is not simply the case that the virus, as a positive entity with its own identity, befalls the cell, but that its possibility reveals something like a *virality* that sets in motion every apparently living unity, animating something like the circulation of its

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<sup>20</sup> The most influential displacement of the category of bacteria has come from Carl Woese’s invention or discovery of the domain Archaea (Sapp 2009, 162–313).

economy or membrane. This virality is the non-unity of everything, and yet is the condition of all unity present and to come. The borders of a cell or its species are haunted by a non-apparent vulnerability to something like an infection that can arise from within or without and re-partition the lines or lineages of life by means of an a-filiation without reproduction—a *sans-biosis*. Every appearance of individual- or species-identity harbors the threat or promise of a subversion that could not simply be attributed to another life, present and self-made.

Perhaps for this reason, Margulis struggles to fit the virus within her theory of autopoiesis and symbiosis. It does not count, in her estimation, as autopoietic or even as living (Margulis and Sagan 2002, 39–40). Nonetheless, she acknowledges that it can be the donor of acquired genes or genomes, and thus of heritable traits and even speciation (Margulis and Sagan 2002, 73–75). The virus is part of the *origin* of species or evolutionary novelty that she seeks, without itself being part of life.

#### 4. REPRO-TRADUCTIONS: NATURAL MODELS

The symbiotic theorist, both when identifying her own theoretical act, and when identifying its object, symbiotic union, is guilty of a certain misrecognition. Margulis does not see that her own theory, like the population genetics she criticizes, necessarily has the status of a model or metaphor, something that cannot simply be identified with the “nature” it makes accessible. Yet, like a symbiont that is both foreign to itself and a family relation of even the most unrecognizable other, model-metaphors are not simply external to and imposed on what they describe. “Nature” is nothing at all without its model, or at least the designation of the outside-the-model is itself part of any logic, system, science, or model of thought. This referral or *renvoi* beyond itself is a line that runs *within* every term or observable in one’s system—one never simply arrives at this outside only because one is always there already.<sup>21</sup>

The desire for nature itself manifests in Margulis’s thought as a search for the origin of nature’s pure productivity. She points out that Darwin’s *Origin of Species* lacked a theory of precisely that—the *origin* of speciation (Margulis and Sagan 2002, 3). Darwin theorized that a variable population inheriting certain traits from its parents with differential survival and reproduction would undergo natural selection, but gave no theory of the *source* of

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<sup>21</sup> On the *renvoi*, see Derrida 1976, 46–49; Senatore 2017.

variability. The Modern Synthesis attempted to fill this gap by placing random genetic mutation as the driver of variation, but this leaves something to be desired. Margulis only points out that random genetic mutation is typically deleterious—rather than leading to new species, it tends toward debilitation and death (Margulis and Sagan 2002, 10–11). One could carry this critique a step further, however. Genetic study must begin from relatively intuitive, observed differences among the living, at which point the genetic difference correlated with that variation can be sought out. The most one ever arrives at by this method (whose limitation applies to any search for causes) is a knowledge of *difference*, rather than origin. In other words, it is never a positive term, this “gene” here, to which causality can be attributed, but a difference whose positive faces are interminably deconstructible. It will always remain possible to find that an organism which develops at a different temperature, or with more or less nutrition, or with the internal presence of another “gene,” or the external presence of a new symbiont, no longer expresses the same phenotypic difference, and thus that this “gene,” as a supposedly positive entity, was never a pure origin or causal source. Even the most univocal geneticists acknowledge the primacy of difference (Huxley 2010, 18–19; Dawkins 2006, 281; Schwartz 2000). It is not true that “gene A causes trait B,” but that an unknown network whose inaccessible contours may be broader than the world allows something to operate as a “gene,” while always harboring the threat or promise of taking back what it has given.

This difference- or difference-at-the-origin certainly necessitates that genetics will remain a deconstructible science. An “epigenetic inheritance system,” or even an external feature of the biotic or abiotic “environment” can function as a “gene” or decisive difference just as well as the organism’s “genetic” endowment. However, this “same” deconstructibility, even if it places every “genetics” in question, can never be overcome by another science, under another heading, model, or metaphor. Symbiogenesis (and epigenetics, niche construction theory, developmental systems theory, eco-evo-devo, or any other participant in the “Extended Evolutionary Synthesis”) will necessarily remain just as deconstructible in their representations or reconstructions of causality. One can supplant a model-metaphor, but only with another model-metaphor. Thus, we can read with a certain suspicion everything in Margulis’s discourse that aspires for a return to the pure productivity of nature, that is, to nature itself without intermediary. Symbiosis is posited as the “source” of evolutionary variation and “novelty,” the *origin* of species or speciation that Darwin missed (Margulis and Sagan 2002, 11–12). Though it is attributed to individuals that are already living,

they are purely “productive,” “autopoietic” or self-making bacteria, offering the gift of nature itself.

“Bacterium” is just as revisable and revolutionizable a category as any model or metaphor. It is perhaps to avoid facing this artificiality of nature, and of the bacteria in which she had entrusted nature “itself,” that Margulis fought against Carl Woese’s widely accepted division of “prokaryotes” into the two domains Bacteria and Archaea (Sapp 2009, 198).<sup>22</sup> One symptom of this desire to return to a pure and simple origin in and as nature appears in Margulis and Sagan’s framing of a deceptively *simple* inquiry: “where new species come from” (Margulis and Sagan 2002, 3). Phrasing the question in this way leads the reader (and the authors) toward only one side of the Janus-faced answer. Margulis will argue: new species come from symbiosis, from acquiring genomes. What this answer leaves out is that “new” species, symbiogeneses, necessarily depend as well on a prior, revisable, revolutionizable, or deconstructible model-metaphor of species. Someone must decide what “species” means or where to draw its lines. “New” species arise where someone or something, often a scientist, deploys a species-concept or species-decision and achieves some degree of communal consensus around their decision or discussion. The source or “origin” of nature is divided; “nature” is born from this supplement of artificiality, from symbioautothanatosis.

Anton de Bary’s definition of symbiosis, which Margulis frequently invokes, makes this supplementary structure explicit. Symbiosis is “the living together of *unlike named* organisms” (qtd. in Sapp 1994, 7).<sup>23</sup> Without the nomination that creates the apparent family resemblance or effects of conceptual unity of a species, no crossing of borders or symbiogenesis could be possible. Where do new species come from? From the scientist, who is at once the most fertile and sterile of creatures.

The dependence on a prior, deconstructible inscription is legible in Margulis’s very “definition” of species (which, given this circularity, cannot hope to name a simple concept). The “symbiogenetic definition of species”

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<sup>22</sup> Margulis advocated for a five-kingdom taxonomy, which combined all prokaryotes in kingdom Monera. She advocated for this taxonomy in a work coauthored with Karlene Schwartz (1988), *Five Kingdoms*, and it formed the organizing principle of another work she co-authored with Dorion Sagan (1995), *What Is Life?* In “Big Trouble in Biology,” when Margulis contrasts scientific terms that in her estimation are nothing more than groupthink with those she claimed were “independent of language and culture” and represented “universal science,” she placed “Archaeobacteria” and other terms related to Woese’s research in the disparaged category (Margulis and Sagan 1997, 276).

<sup>23</sup> “The long-term symbiosis that led to species origin by symbiogenesis requires integration of at least two differently named organisms” (Margulis and Sagan 2002, 7).

groups together those organisms “composed of the same set of integrated genomes” (Margulis and Sagan 2002, 6). What is a genome but the idealized genetic endowment of a species?<sup>24</sup>

## 5. ALL TOO HUMAN SCIENCES

Margulis repeats the gesture of accusing the other of a fault or gift they share in common when she describes the concepts of population genetics as “anthropocentric:”

Symbiosis, merger, body fusion, and the like cannot be reduced to replacing “competition” as a major motive force in evolution with “cooperation.” Ultimately, an anthropocentric term like “competition” has no obvious place in the scientific dialogue[...].Vogue terms like “competition,” cooperation,” “mutualism,” “mutual benefit,” “energy costs,” and “competitive advantage” have been borrowed from human enterprises and forced on science from politics, business, and social thought. (Margulis and Sagan 2002, 15–16)

We have returned to the debate with which we started, over whether symbiosis should be thought as a mutually beneficial association, or a neutral one that perhaps exists beyond the reaches of economic calculation.<sup>25</sup> Everything I have said thus far, however, should lead us to question whether any concept, whatever its name and position relative to this economy, could truly remain pure of all “anthropocentrism.” If every concept retains some mark of artificiality, then it will always appear detachable from its “natural” context, received from a relatively naïve and extrinsic intuition (even when it originates “within” the sciences), and thus as bearing the stain of its contingent dependence on the apparently human investigator. At the same time, this very contingency is what allows or constrains the “human” to duplicitously reach beyond itself. Nature “itself” is only ever the after-effect of this conceptuality or this re-contextualization of relatively “anthropocentric”

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<sup>24</sup> If one took “genome” in this definition to simply mean whatever DNA sequences were present in a single organism, then only genetic clones would belong to the same species. The examples Margulis gives make clear that this is not how she intends her definition to be taken.

<sup>25</sup> I hoped to consider the work of Donna Haraway and Zakiyyah Iman Jackson as part of this essay, but constraints of length require that I devote a separate text to these ethico-political reflections on symbiosis. Both authors waver between descriptions of symbiosis that recognize it as irreducibly ethically fraught, and those which treat it as the good itself. In this, their projects are the ethical mirror of those debates between symbiosis as mutualism and symbiosis as beyond economy that have plagued every author who takes up the subject.

concepts—if anything at all will appear to us as beyond our limits and definitions, arriving to us as a pure gift of the other, it could only be as a non-present restlessness within the circulation of these economic concepts.<sup>26</sup>

Margulis may be sensing a deeper risk in the idea of “cooperation,” given its circumscription by the “reciprocal altruism” of population genetics and gene-selection discourse. This theory of reciprocity attempts to explain every apparently “altruistic” behavior among the living within the confines of population genetics, and thus of individualistic struggle (Trivers 1971; Dawkins 2006, 166–88). Everywhere that apparent selflessness can be observed, the organism that risks or sacrifices its own benefit must *either* expect some good deed in return, *or* be acting for the sake of organisms with which it shares some genes. This conclusion absolves itself of its cynicism with a simple calculation—any behavior that was truly self-sacrificial, in terms of reproductive potential, would be drowned out by those who looked out for their own advantage (this depends on the idea that all behavior is determined through vertical inheritance). In other words, if we define self-interest as reproductive success, it is more or less tautologous to conclude that a behavior that sacrifices reproduction will cease to exist, while any behavior that augments it will become more prevalent. A system organized to mechanically act out of self-interest could arrive at these apparent performances of “altruism.”<sup>27</sup>

Thus, if one interprets symbiosis as mutual benefit (“cooperation”), one has not in fact challenged the principle of neo-Darwinian thinking, which is Margulis’s ultimate goal—to return to a life whose pure generosity is not yet circumscribed within an economy of differential survival. Can such a thing be the subject of scientific knowledge? It would require, according to Margulis and Sagan, a novelty that only the symbiosis of disciplines could provide:

Such evolution requires new thought processes. New metaphors to reflect on permanent associations are needed[...]we would propose a new search in the social sciences for terms to replace the old, tired

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<sup>26</sup> On the interdependence of anthropocentrism and its excess, see Derrida’s (1982) “The Ends of Man.” On the suppression of this interdependence (and of deconstruction) in contemporary materialist and realist thought, see my (2018) “Misreading Generalised Writing.”

<sup>27</sup> That is not to say that these are the only possible interpretations of “altruism.” The undecidability of its concept or figure demands the search for an interpretation that can never quite satisfy the impetus setting it in motion. One could compare, for instance, Sober and Wilson’s (1999) *Unto Others*, which does not attempt to reduce altruism to individualistic competition, but nonetheless does not take the radical departure from adaptationism that Margulis is proposing.

social Darwinist metaphors. If survival is owed to symbiosis, rather than overemphasized intraspecific competitive struggles, what then are the consequences for nonbiologists interested in evolution? (Margulis and Sagan 2002, 15)

There is more than an appearance of contradiction in this reasoning which sees “politics, business, and social thought” as anthropocentric but “social sciences” as a potential source for the influx of life itself. This impasse is symptomatic of the desire to exceed anthropocentrism while remaining scientific.

Myra J. Hird, whose project in *The Origins of Sociable Life* is largely inspired by Margulis’s work, seems to discover such a concept from a perhaps unlikely source. She takes the idea of a gift beyond economy not only from anthropologists such as Marcel Mauss (who could be the sort of “social scientist” Margulis envisioned) but from the work of Jacques Derrida as well (Hird 2009, 77–90).<sup>28</sup> For Hird, the gift offers a figure, necessary for biological as well as social thought, of a relationship with the other that would take place outside of economic exchange:

It is this excess of the gift—a compromising of the self—that interests me. [...] I argue that there is much in gifting that circumvents descriptions of the ‘self’/‘nonself’ dichotomy in terms of a closed economy in which resources are exchanged without excess or remainder. [...]

My interest is to bring together these two literatures, the former concerned with the philosophical and the latter with the biological. This bringing together attempts an analogy between the biological and the economical self. To do this, I will suggest that the models of self produced by each discipline have developed in directions that suggest an appreciation of the self’s excess produced through interaction. I argue this excess (especially in terms of its unpredictability and unintended consequences) may be usefully illustrated by the bioevolutionary phenomenon of symbiogenesis. (Hird 2009, 77–78)

The figure of the gift, as it circulates in Hird’s text, largely follows the contours of Margulis’s argument regarding symbiosis: the symbiotic gift is extracted from economic relations of either benefit or detriment, but at the same time is figured as the good itself. One could say that an enormous *credit* is extended to the symbiotic gift. The problem with letting the gift circulate

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<sup>28</sup> Joost van Loon’s “Epidemic Space” also turns to Derrida’s work on the gift in the context of a discussion of symbiotic phenomena (2005, 41).

in discourse in this way is that the gift is neither a simple “thought process” nor a “metaphor” (which is what Margulis hoped the social sciences would provide us with). It has no essence and no figure, but loses itself in the “same” gesture that grants it, as Hird’s syntax demonstrates with an uncanny insistence: “Corporeal generosity escapes neoliberal notions of a closed economy, and reminds us that, whatever cultural notions of autonomy and free will to which we might aspire, we are all corporeally inter-dependent” (2009, 88). Can one escape “closed economy” (and with it neoliberalism as well as what Hird elsewhere calls “Western” thought and society) by recognizing an *inter-dependence*? That is, by acknowledging one’s place in a system of indebtedness? The gift depends on the relations of self and other that it nonetheless places in question, and thus undoes itself in the same breath that offers it. This gesture that declares its freedom from the circularity of identity only by trapping itself within the circle is structurally identical to the claim: “Symbionts all the way down means that we are, ancestrally, made up of bacteria” (Hird 2009, 84).

If the gift depends on what it is not—economy—then it will never be a present entity or process (bacteria, corporeal inter-dependence), nor even a theoretical ideality. Derrida’s intervention in anthropological studies of the gift is to demonstrate that everywhere the anthropologist speaks of and celebrates the gift they locate it within economy—that a doctrine of knowledge or positive science of the gift is an impossible project. Thus, he cannot simply be arrayed with Mauss as yet another theorist, scientist, or philosopher of the gift. The problem is not that the gift simply *isn’t* these economic manifestations or circulations. That would leave open the possibility that a gift *was* something or somewhere else. Rather, gift and economy depend on each other while making each other impossible. They have neither a relation of simple exteriority nor identity. One can give no content to the idea of a gift in any recognizable logic or grammar unless *someone gives something to someone else*, yet these are precisely the conditions that undermine the gift (Derrida 1992, 11). If a recipient recognizes that they have received a “gift,” then they are immediately indebted or obligated in an at least symbolic economy that might require from them gratitude and other recompense. Even if a giver knows (consciously or unconsciously) that they have given in secret, this recognition is enough to annul the generosity of the gift, to bring it within an economy of self-congratulation. The conditions of possibility of the gift are its conditions of impossibility.

Still, if we were to say that there could be gift only under the cloak of an absolute unconsciousness (more radical, Derrida specifies, than that

Freudian or Lacanian unconscious that forgets nothing and whose letter always arrives), we would have to admit that what was lost was the possibility of a knowledge or science of the gift. We would never know when a gift had been given, how or by whom, nor could we ever exclude the possibility. And yet, if the gift is the good itself, the only chance of a good beyond economy, it would follow that ethics as such would be the science of the gift, would consist in the commandment that one give and know how to give, and know how to give thanks when a gift has been received. It is *imperative* that we know, precisely where knowledge makes its own *order* impossible (its field and its command).

The objective of my or Derrida's texts are not to deny the gift, nor to insist on a unity and saturation of economy that would be just as illusory. As I tried to show above, there could be no life or evolution at all without a gift that is nonetheless impossible as a positive presence. Only by insisting on the most extreme and exacerbated non-self-identity of gift and economy can one give the gift the only chance or risk it will ever have. Otherwise, if one is willing to describe economy while calling it gift, with a self-satisfied credulity, what hope is there? In a word, gift cannot be captured within that economy of knowledge we call *science*, at least not any science worthy of the name. Life or "evolution" cannot be the gift that "bacteria" give to each other or their hosts in a symbiotic union—not if we hope to pretend that we know anything at all by these names. If one knows what one means and what one says by naming them, can point them out with surety and agree on observations among a community of scientists, can provide logically consistent discourses in which these names circulate, and if one believes or acts as if these terms indicated ideal and self-identical unities, then they will never be gifts or givers. They can circulate in a (mechanistic, mathematical) economy, they can exchange credit and debit, but they cannot *give*.

As I attempted to show above, it was not where "bacteria" or "sympio-genesis" was invoked as the self-originating origin of life that the gift shone through in Margulis's texts. Rather, it was where a certain arbitrariness marked the deconstructibility of these terms, without offering anything like a secure foothold for alterity, that something like an impossible gift infected their economy. Margulis's text, like Derrida's and I hope my own, is written *on the gift*, in every sense of the phrase—which certainly does not mean that we can purely thematize and objectify it, but rather that we are already part of and engaged in its sending, before we can even hope to speak its name. Such texts cannot simply belong to the category of "science," though they cannot be *opposed* to science, placed under another heading, either:

For finally, if the gift is another name of the impossible, we still think it, we name it, we desire it. We intend it. And this *even if* or *because* or *to the extent that* we never encounter it, we never know it, we never verify it, we never experience it in its present existence or in its phenomenon. The gift *itself*—we dare not say the gift *in itself*—will never be confused with the presence of its phenomenon. Perhaps there is nomination, language, thought, desire, or intention only there where there is this movement still for thinking, desiring, naming that which gives itself neither to be known, experienced, nor lived—in the sense in which presence, existence, determination regulate the economy of knowing, experiencing, and living. In this sense one can think, desire, and say only the impossible, according to the measureless measure of the impossible. If one wants to recapture the proper element of thinking, naming, desiring, it is perhaps according to the measureless measure of this limit that it is possible, possible as relation *without* relation to the impossible. One can desire, name, think in the proper sense of these words, if there is one, *only* to the *immeasuring* extent [*dans la mesure démesurante*] that one desires, names, thinks *still* or *already*, that one still lets announce itself what nevertheless cannot *present itself* as such to experience, to knowing: in short, here *a gift that cannot make itself (a) present* [un don qui ne peut pas se faire présent]. This gap between, on the one hand, thought, language, and desire and, on the other hand, knowledge, philosophy, science, and the order of presence is also a gap between gift and economy. This gap is not present anywhere [...]. (Derrida 1992, 29)

“Living” and “science,” which are here at least grammatically arranged on the side of “presence” or the “order of presence,” are not simply opposable to the thought, language, or desire that exceeds the economy of presence. It is not that life or science must or even could be given up in the name of the gift. Rather, only the movement of risking and re-appropriating science and life holds open the hope and the faith that the most unanticipatable monstrosity could emerge from the economy of nature such as it has been known thus far.

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