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Sympoiesis, Autopoiesis and Immunity: How to Coexist with Nonhuman Others?

ABSTRACT

In this essay I will discuss Donna J. Haraway's notion of sympoiesis and examine different modes of cohabitation or hybridization with nonhuman others. Such concepts as sympoiesis, or holobiont, question the notion of the biological individual and also change our understanding of what it means to be human. As Richard Grusin pointed out, "we have never been human" because "the human has always coevolved, coexisted, or collaborated with the nonhuman—and that the human is characterized precisely by this indistinction from the nonhuman" (ix–x). We have never been human because we have always been dependent on other species living within or beyond our bodies. However, the question which still needs to be answered is whether all forms of coexistence are profitable and welcomed. How does one define the limit at which this co-existence is collaborative and productive ("posthuman"), and beyond which it becomes damaging and lethal (in other words, "posthumous," e.g., coming after life)? For this reason, the interrelations between different life forms should be discussed together with the concepts of contagion and immunity. The notion of immunity expresses an ambivalent character of life: on the one hand, it protects the organism against everything that is beyond its boundary; on the other hand, it helps to collaborate with other organisms and to create an ecosystem. In this sense, immunity can be thought as a field of negotiations between human and nonhuman beings.

Keywords: sympoiesis, autopoiesis, individual, holobiont, immunity, contagion.

SYMPOIESIS AS "MAKING-WITH"[1]

Donna J. Haraway's discursive interventions, from cyborgs to symbiotic creatures, deconstruct the myth of the organism as a natural wholeness. Instead, she persuasively demonstrates that every living being is a multiplicity, an assemblage, which might be arranged and rearranged in many different ways. In this respect, Haraway, without acknowledging it,[2] elaborates further Gilles Deleuze and Félix Guattari's attempts to disarticulate the idea of an organism and open it to becoming and "unnatural participations" (Deleuze and Guattari 266–67). For Deleuze and Guattari, an organism is an assemblage-like construction, the body without organs, which demonstrates the disorganization of the organism and the denaturalization of nature. Deleuze and Guattari are interested in different modes of becoming, which is defined as expansion, propagation, occupation, contagion, peopling. It is a multiplicity, which is organized not by filiation, or heredity, but through epidemic, or contagion. Haraway also insists on the contingent and undetermined mode of every multiplicity, however, she stresses symbiotic cooperation and sympoietic entanglements.

In *Staying with the Trouble* (2016), Haraway defines her notion of sympoiesis as a specific practice of "making-with," or "becoming-with." Haraway is sympathetic to Lynn Margulis's idea that life emerges through symbiosis and symbiogenesis which leads to the increasing complexity of life forms. In *Symbiotic Planet* (1998), Margulis proved that life originated from the interaction between different life forms, such as bacteria and archaea. By fusing with each other, bacteria and archaea invented a complex cell made of a nucleus and extranuclear organelles. As Haraway suggests, symbiosis is the basic law of life: "The core of Margulis's view of life was that new *kinds* of cells, tissues, organs, and species evolve primarily through the long-lasting intimacy of strangers" (*Staying with the Trouble* 60). However, Haraway questions Margulis's idea that these emerging life processes are autopoietic and argues that perhaps Margulis "would have chosen the term *sympoietic*, but the word and concept had not yet surfaced" (61). Haraway argues that nothing can really create itself, therefore, nothing is really autopoietic but needs other organisms and environments to become what it is.

Thus, Haraway asserts that organisms are never quite autonomous and "neither biology nor philosophy any longer supports the notion of independent organisms in environments. . . . Bounded (or neoliberal)

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[2] We find a harsh critique of Deleuze and Guattari's notion of becoming in the first chapter of Haraway's *When Species Meet* (3–44). However, a more positive and careful approach is missing.

individualism amended by autopoiesis is not good enough figurally or scientifically; it misleads us down deadly paths" (33). Instead, she says, we have to adopt Karen Barad's agential realism and intra-active complex systems of relations, where the elements of the system do not pre-exist the relations but are created precisely by them. Such a model of intra-active relationships is better than the model of autopoietic systems as

> [a]utopoietic systems are hugely interesting . . . 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." (33)

Haraway suggests that a living being, before being closed onto itself, is always connected to other living beings and forms with them interspecies assemblages.

In other words, Haraway does not completely reject the theory of autopoiesis but insists that autopoiesis and sympoiesis are different aspects of systemic complexity and they rather enfold than oppose each other.[3] At this point it is important to stress that Maturana and Varela, who elaborated the notion of autopoiesis in their book *Autopoiesis and Cognition: The Realization of the Living* (1980), do not assert that autopoietic systems are closed and devoid of interaction with other systems. A simple example of an autopoietic system is a unicellular organism which is capable of maintaining and recreating its organization despite the multiple chemical reactions taking place in it. Thus, the main characteristic of an autopoietic system is its self-organization, self-maintenance, and its constant self-reproduction within a boundary. However, a living being cannot survive without energy and nutrients and for this reason it is connected to the environment. The environment triggers an autopoietic system and engenders some changes in its structure. Maturana and Varela argue that every living system interacts with the environment through "structural coupling." However, even after undergoing some structural changes, the model of organization of the system does not change. This is why autopoietic entities are said to be *closed* on the level of organization but *open* at the level of structure. In this

[3] In *When Species Meet* Haraway claims that "Margulis and Sagan's symbiogenesis is not really compatible with their theory of autopoiesis" (33). In a footnote she refers to Cary Wolfe's reworking of autopoiesis, which takes into account second-order cybernetic thinkers such as Humberto Maturana and Francisco Varela. The notion of autopoiesis is reworked in such a way that it combines openness and closure, called by Wolfe "openness from closure" (317, ft. 46). I will elaborate this point later.

context "organization" means the relations between the components of a system which allow it to be a member of a specific class (e.g., a bacterium, an animal, or a human brain). All living beings of the same class have a similar organization. The term "structure" means the actual relationships between physical components: a given organization can be embodied in different physical structures.

In other words, Maturana and Varela never stated that autopoietic systems are closed or bounded; by contrast, they argue that "[a]utopoietic systems may interact with each other under conditions that result in behavioral coupling" (119–20). The interacting organisms as dynamic systems trigger each other and thus become continuously changing structures but never lose their autopoietic character. In this respect, autopoietic systems are not neglected but rather complicated and they become the source of each other's change and development. Haraway is saying the same thing when she adopts Margulis's notion of the holobiont and re-invents it in the sense that the holobiont designates not the host plus the symbionts but rather means that "all of the players are symbionts to each other, in diverse kinds of relationalities and with varying degrees of openness to attachments and assemblages with other holobionts" (*Staying with the Trouble* 60). In this sense sympoiesis is always an allopoiesis, or heteropoiesis, an attempt to deal with otherness and cope with differences.

To assert her theory of sympoiesis as a "making-with," Haraway refers to the works of biologists which give clear evidence that symbiosis has always been a dominant mode of existence. For example, in their famous article "A Symbiotic View of Life: We Have Never Been Individuals" (2012), Scott F. Gilbert, Jan Sapp, and Alfred I. Tauber argue that biological individuals are always inhabited by other forms of life, such as viruses or bacteria. After examining a biological individual according to anatomical, developmental, physiological, genetic, and immunological criteria, the authors come to the conclusion that all organisms are related to each other in an all-pervading symbiosis. Before Margulis's work, symbiosis was seen as rare or exceptional; now symbiosis "is becoming a core principle of contemporary biology, and it is replacing an essentialist conception of 'individuality' with a conception congruent with the larger systems approach now pushing the life sciences in diverse directions" (Gilbert, Sapp and Tauber 326). For example, according to anatomical criteria a biological individual is regarded as a structured whole, but if we take a look into Margulis's favorite critter *Mixotricha paradoxa*, which is "a beast with five genomes" (Margulis and Sagan 38–41), we find a chimeric individual made of host and persistent populations of symbionts.

If we examine a biological individual according to developmental criteria, we can see that development is closely related to interspecies

communication. Another famous example, researched by microbiologist Margaret McFall-Ngai, is the symbiosis between the Hawaiian bobtailed squid *Euprymna scolopes* and a bacteria called *Vibrio fischeri*. The newborn of the squid lacks a light organ, which is later developed in cooperation with the luminescent bacteria *Vibrio fischeri*, helping to camouflage the squid from predators swimming below (McFall-Ngai 61). These bacteria not only change the squid's appearance and protect it from predators but also initiate changes in the squid's gene expression, changing the development of its body and immune system. As McFall-Ngai points out, "[t]hese observations challenged what we thought we knew about organismal development, namely, that it was driven primarily by inherited genetic codes. In contrast, our research showed us that squid develop, in part, through relations with microbes, not exclusively through inherited genetic scripts" (61). These and many other examples provide evidence that animals cannot be considered individuals by anatomical, developmental, physiological, immunological, genetic, or evolutionary criteria. Their bodies must be understood as holobionts which developed through interspecies communication.

However, the notion of the holobiont not only changes our understanding of the biological individual but also the idea of what it means to be human. Seen from this perspective, the human body is not a bounded individual but a complex ecosystem, which is related to other organisms through the reciprocal process of symbiosis. For example, in defining anatomical individuality, Gilbert suggests that only about half the cells in our bodies contain a "human genome," and the other cells include about 160 different bacterial genomes (75). Thus, from the anatomical point of view, human bodies contain a plurality of bacterial ecosystems. From the genetic point of view, we are not individuals either, because while humans have about twenty-two thousand different genes, the bacteria in us provide eight million more genes. From the immunological point of view, humans are also far from individuals because our immune system allows countless microbes to become parts of our bodies. As Gilbert points out, "[w]ithout the proper microbial symbionts, important subsets of immune cells fail to form" (82). Thus, after discussing anatomical, genetic, developmental, physiological, immune, and evolutionary criteria, Gilbert comes to the conclusion that we are not individuals but holobionts: "The holobiont is powerful, in part, because it is not limited to nonhuman organisms. It also changes what it means to be a person" (75). This means that symbiosis is not a marginal or random case but an all-encompassing principle of life. "These major symbiotic webs rule the planet, and within these big symbioses are the smaller symbiotic webs of things we call organisms. . . . Symbiosis is the way of life on earth; we are all holobionts by birth" (84). But if we are all holobionts by birth, what do these modes of symbiosis and co-habitation mean for us and for other species?

Inspired by recent biological research, Haraway enthusiastically invites us to engage in interspecies communication which is understood as sympoiesis. In contrast to biological symbiosis and symbiogenesis which is simply found in the natural world, sympoiesis means an active "making-with" with other species, which is understood as a way to counter both anthropocentrism and the Anthropocene. Taking the spider *Pimoa cthulhu* as a metaphor, and making a small change in spelling, from Cthulhu to chthulu, Haraway invents a new term—the Chthulucene—that should replace the Anthropocene:

> [T]he Chthulucene is made up of ongoing multispecies stories and practices of becoming-with. . . . Unlike the dominant dramas of Anthropocene and Capitalocene discourse, human beings are not the only important actors in the Chthulucene, with all other beings able simply to react. The order is reknitted: human beings are with and of the earth, and the biotic and abiotic powers of this earth are the main story. (*Staying with the Trouble* 55)

Haraway invites us to create tentacular webs and make assemblages with other species. However, what I find problematic in this project is that these connections work only on the imaginary and speculative level, avoiding the real interaction with other species. The relationship with animal partners remains vaguely defined, and in some cases—like the poetic interaction with companions in *When Species Meet*—looks very problematic because it is still imbedded in the logic of anthropocentrism and asserts the supremacy of the human species.

How can we imagine interspecies communication beyond these beautiful speculative fictions? Even if the notion of symbiosis is now widely accepted in biology, sympoiesis, or "making-with," between human and non-human species still needs to be accounted for and explained. How are these sympoietic collaborations enacted at different levels of organization? How can we define this tension between the need to keep the boundaries and the potential for change? Do these collaborators have intentions, expectations, and purposes? And if they do, can we name these intentions as a certain kind of cognition, as defined by Maturana and Varela? Haraway quite enigmatically states that "*Symbiosis* is not a synonym for 'mutually beneficial'" (*Staying with the Trouble* 60). This implies that collaborations might also be damaging, poisoning, contagious. Having this ambivalence in mind, I suggest that the notion of sympoiesis should be discussed in relation to the question of immunity: are all connections and relations profitable to the host and its symbionts, or not? If they are, then everyone can enjoy interspecies collaboration; but if they are not, then

these connections might be deadly contagious and lead to destruction. In other words, to explain the interaction with otherness, we have to explain the functioning of the immune system.

IMMUNITY AND CONTAGION

The notion of immunity, as it was formulated in the middle of the 20th century, is based on the "self" and "nonself" dichotomy: the immune system tolerates the "self" and attacks the "other." However, what remains to be explained is what defines the "self" and why the immune system is silent in relation to its own cells and tissues. What happens when a part of the so-called "self" changes and becomes a stranger to itself? Is the biological "self" identical with philosophical and psychological notions of individuality? As Alfred I. Tauber explains, the notion of selfhood not only was imported from philosophical discourse but quickly became an idiom which was explained as if it grew within the science of immunology (42). The notion of "self," which comprises both the organismal self and the immunological self, was a very clear and recognizable model to think about our immunological identity. However, as immunology developed, some important questions had to be answered. First, the immunological "self" is never given all at once, but is developing throughout the organism's life. Second, the immunological "self" is nonreactive or silent in relation to certain cells coming from other organisms, for example, in cases of organ transplantation or pregnancy. There is clear evidence that long after delivery the foetal cells are found in maternal bodies, creating a case of microchimerism (Shildrick 95–108). The question is why doesn't the immune system attack the cells coming from other organisms? And third, why does the immunity system *react* to the organism in case of autoimmune diseases? Why does the immunity system treat the "self" as if it is the "other"? As Roberto Esposito points out, autoimmune diseases "express, by their very name, its most acute contradiction: rather than a failure, a block, or a flaw in the immune apparatus, they represent its reversal against itself" (162). Autoimmune diseases express an "overactive defense" of the body, when the body is using a defense which is disproportionate to the actual size of the intruder.

Esposito argues that the antinomies of the immune system could be interpreted not as an alleged pathology, but, on the contrary, as its normal functioning. "If the immune system works by opposing *everything* that it recognizes, this means that it has to attack even the 'self' whose recognition is the precondition of all other recognition: how could the immune system recognize the other without first knowing the self?" (164). Here we see

a certain antinomy: the immune system should recognize the "self" in order to recognize the "other"; however, this recognition is damaging because, after recognizing this, it starts to attack itself. As Esposito points out,

> what needs explaining is not the fact that in some cases the immune system attacks its own parts, but the fact that this normally does not happen. This non-aggression is well known as being due to the phenomenon called "autotolerance," or tolerance of self. What we want to draw attention to is how this leads to the reversal of a common perception: it is not autoimmunity, with all its lethal consequences, including death, that requires explanation, but rather its absence. (164)

The question to be answered here is what the primary and natural condition of the body is: is it the absence of autoimmunity (so-called "autotolerance"), or its necessary presence ("autoimmunitary attack")? As Esposito points out, "[h]ere we arrive at the key point of the argument: the destructive rebellion against the self is not a temporary dysfunction, but the natural impulse of every immune system. In countering all that it 'sees,' it is naturally led to *first* attack its own self" (165).

These philosophical reconsiderations force us to rethink the ways in which our bodies are defined, and, more importantly, make us question the assumption that our bodies are always already given and identical to ourselves. If the body is constantly changing during its life, at which point can the body be considered as "proper," and, moreover, how can we determine our immunological "self"? Commenting on recent biomedical research, Esposito comes to the conclusion that the immune system is not something definitive and identical to itself but is permanently changing and adapting to the environment. In this sense the immune system can be thought of not as a defensive mechanism but as a network of relationships, or, as Deleuze and Guattari would say, as an assemblage that creates temporal and non-hierarchical connections between heterogeneous elements. In this context the notion of immune tolerance could mean not only a lack of response but also a positive recognition of elements of the "nonself." The discovery that immune tolerance can be *induced* artificially demonstrates that the immune system can be taught to recognize the cells of the other body and respond to them positively:

> This means that tolerance is not a non-immunity, a kind of virtuous immuno-deficiency; if anything, it is a reverse immunity: that which reverses the effects within the same lexicon. But if so, if tolerance is the product of the immune system itself, it means that, far from having a single-response repertoire, that of rejecting other-than-self, it includes the other within itself, not only as its driving force but also as one of its effects. (167)

In other words, the body should be thought of as a chimeric multiplicity or as an assemblage where different molecular populations compete with each other and which never form a singular and stable "self."

All these questions signal that the notion of immunity is undergoing a conceptual shift. Rather than being understood as a defensive reaction toward an external, contagious element, immunity is now conceived as a self-referential and self-contained network which keeps the balance in the organismal self. In other words, it is not a negative reaction toward a foreign element but a normal functioning that needs to be explained. Tauber traces this approach to immunologist Niels Jerne and his network theory: "Jerne argued that antibodies comprised a system of self-regulated interactions that resulted in a self-organized grid. This model, consisting of interlocking recognizing units, posited that each component reacts with other like constituents of the system to form a self-referential network" (60). In other words, immunity works as an autopoietic system which at the same time interacts with the environment and permanently redefines its internal organization. Haraway also discusses Jerne's network theory in one of her earlier texts "The Biopolitics of Postmodern Bodies: Constitutions of Self in Immune System Discourse." Haraway supports Jerne's idea that the immune system is to be understood not as a protection of the individual "self" but as a changing network based on self-regulation and self-organization. Immunity as a network is capable of recognizing and mirroring the antigen in such a way that there is nothing external that the immune system had not already mirrored internally. "'Self' and 'other' lose their rationalistic oppositional quality and become subtle plays of partially mirrored readings and responses. The notion of the *internal image* is the key to the theory, and it entails the premise that every member of the immune system is capable of interacting with every other member" (Haraway, "The Biopolitics" 291). What is important for Haraway in this context is that the body is understood not as something given but as constantly changing: paraphrasing Simone de Beauvoir, she asserts that "one is not born an organism. Organisms are made; they are constructs of a world-changing kind" (279).

In a similar way, Tauber examines Jerne's network theory as a major shift in immunity theorizing. As Tauber explains, Jerne proposes that the immune system is made of interlocking recognizing units so that each component reacts with the other within the system to form a self-referential network. In this model the antibody has two roles, active and passive:

> So in addition to the active binding of antigen, Jerne suggested that antibody could also act as the target of another antibody by presenting

> itself as an antigen through its so-called *idiotypic* domains. On this view, immunoglobulin behaves as both antibody (as originally regarded) and antigen to a corresponding antibody that reacts with its unique *idiotope*. (Tauber 60)

The immune system reacts to the external antigens only to the extent that these elements are recognized in the internal "library" of antibodies. "In other words, Jerne postulated that the amino acid sequences of immunoglobulins share structural homologies with all antigens to which the organism might respond—that is, 'internal images' represent that external universe" (60). The immune system performs a dialogue between antibodies which play two roles, as the "recognizer" and the "recognized," but neither of them has any essential characteristics of "self" or "nonself." Rather they are signifiers referring to other signifiers, and, in this sense, immunity can be understood as a self-referential structure of language. The "other" is something that simply disturbs that structure and activates a response.

Seen from this perspective, the immune system cannot be explained by "self" and "nonself" distinctions, because, strictly speaking, the immune network can recognize only itself. Every element is always already within the system, and what is external or "other" is either invisible or appears as "nonsense." The distinction between "self" and "other" can be conceptualized only from the observer's point of view, whereas the immune network is always immanent to itself and cannot reflect its outside. As Tauber points out, "Jerne's network conception built on *self-recognition*, which then reconfigured "autoimmunity" (self-recognition) from aberrancy to the normative organizational rule of immune function" (62). Immune tolerance or silence does not need a special explanation because the immune system knows only itself. The originality of Jerne's model lies in the fact that it denies the subject-object structure, which implies the observer's perspective, and suggests that immunity is an immanent self-referential structure based on self-survey.

In other words, immunity as an information processing system can be theorized as a certain kind of cognition characteristic of autopoietic systems. Such cognition is not associated exclusively with human cognition but can be extended to other living beings. Thus Jerne's network theory replaced the understanding that there is a certain agent (the "self") processing information with an understanding of cognition without agency (59). As Tauber observes, "Jerne's innovation offered a model of immune function independent of agency, and with that move, he highlighted the difference between the observer's perspective and the network's" (65). In this sense any living system—from cells and organisms

to ecosystems—functions as a self-organizing and self-referring cognitive network. Varela and Anspach compare immunity to an ecological system: "[T]he body is like Earth, a textured environment for diverse and highly interactive populations of individuals. The individuals in this case are the white blood cells or lymphocytes which constitute the immune system" (69). The lymphocytes are generating different molecular populations within the body, similar to living species which generate diversity within an ecosystem. Thus, the organism is a self-referential cognitive system functioning both on a molecular and planetary scale.

HYBRIDS AND CHIMERAS

The idea that immunity functions as an ecosystem, and also the fact that immunity can be induced artificially makes it conceptually isomorphic to the practices of bioart. In this respect, bioart, by creating and constructing sympoietic modes of existence, such as hybridization, microchimerism, or co-habitation, opens new fields of knowledge. By examining various artworks, we can distinguish between different forms of sympoietic existence: for example, hybridization, which rests on the binary logic of two individuals, which merge together, or microchimerism, which works on the molecular level and dissolves the remnants of bounded individuality. Vinciane Despret distinguishes between hybrids and chimeras, or between what she calls "combinations" and "compositions":

> [H]ybridization remains a matter of a "combination," thus of the reproduction of certain characteristics of the two "parent" species. Thinking in terms of hybridization forces the rest to give and to impose a binary system. . . . Metamorphoses, conversely, retranslate "combinations" into a system of "compositions," a system that remains open to surprise and to the event: "other things" can arise that profoundly modify beings and their relations. (190)

In this respect "compositions" create aberrant chimeras which do not have official parents and a clearly defined line of descent. They are open to metamorphic events which can modify individuals and their relations. Despret refers to Margulis and Sagan's research of bacteria which, they say, never stop trafficking their genes but never form a fully defined individual. Thus every organism is the result of symbiosis: "Co-optation, contagion, infections, incorporations, digestions, reciprocal inductions, becomings-with: the nature of human being, Haraway says, is at its most profound, at its most concrete, at its most biological, an interspecific relation—a process of co-opting strangers" (191). In this sense, ecological immunity could

reflect the ways in which human animals create new modes of hybridization by reshaping their immunological reactions.

Artistic practices could be seen as another attempt to think along the lines of ecological immunology. At this point, I would like to discuss some artistic examples which examine the interaction between human and nonhuman animals not in a speculative but in an actual physical way. The first example is the project "May the Horse Live in Me" (2011), created by Marion Laval-Jeantet and Benoît Mangin (Art Orienté Objet). The project started as a biomedical self-experiment which consisted of several procedures. Over the course of several months the artist allowed herself to be injected with horse immunoglobulins and thus progressively developed a tolerance to this foreign animal body. To achieve this, she had to exclude some most cytotoxic red blood cells, as well as lymphocytes and macrophages; however, she saved for transfusion all other cells, including immunoglobulin, which transfers information within the body (Hirszfeld 174–80). Having built up her immune tolerance, the artist Marion Laval-Jeantet was able to be injected with horse blood plasma during a ritualized performance at Galerija Kapelica in Ljubljana on February 2011.

The intention of this performance was that the horse immunoglobulins would by-pass the defensive mechanisms of the human immune system, enter the artist's blood stream and interact with it. As I have argued elsewhere (Žukauskaitė 22–37), the performed horse blood plasma transfusion became the place of negotiations with otherness: on the one hand, the injected blood plasma was recognized by the artist's immunity system; on the other hand, some new reactions and affections emerged in the artist's body. As the artist herself points out, the first response to the transfusion was fever, which was going up and down, then sleep disorder, a very strong appetite, and panic attacks (Hirszfeld 174–80). Afterwards her blood sample was extracted, which became completely clotted in ten minutes, thus showing a symptom of strong inflammation. The blood sample, which was freeze-dried, can be seen as a synecdoche part of the performance, as a document of a new form of "becoming-with," or the becoming-horse of the performer.

This immunological experiment was followed by other performative attempts to overcome bodily boundaries. As Laval-Jeantet points out, "[a]fter experiencing immune otherness through horse blood injection, we have become interested in eco-systemic otherness, including human and non-human animal microbiota as a new milieu within which to perform" (158). This interest in an eco-systemic exchange led to two new artistic projects which involved microscopic living matter as performance "actors": "May the Rain Forest Live in Me" (or "May the Pygmy Live in Me") and "Holy Coli, the Mice in Odor of Sanctity." The first project "May the

Rain Forest Live in Me" (starting from 2015) was inspired by the scientific discovery that Yanomami people from a Brazilian rainforest have the richest and most diverse microbiota in the world, and, consequently, the most exceptional immune system. The artist decided to approach another tribe, Pygmy, known from her previous journeys, and imagined that after grafting the same microbiota as a Pygmy, she will experience fascinating changes in her mental states: "[C]ould I, in turn, also learn to feel the forest environment as my Pygmy friend does, thanks to the transplant of his internal ecosystem?" (Laval-Jeantet 159). As it turned out, the experience was quite exceptional: "It was followed by brutal colic, a violent eviction of this Indigenous world by my European internal ecosystem" (159). It seems that microbiotic multiplicity is not always a good thing and it might lead to lethal contagion; moreover, it might be one of the reasons why people in this geographical place die young.

However, in the second project "Holy Coli, The Mice in Odor of Sanctity" the transformation of the microbiota was more favorable for the host. The project aimed to transform the microbiota of a mouse with genetically modified *E. coli* that makes mouse faeces smell of violet. In this way the figure of the mouse is elevated to a certain holiness because it is an animal which is most often used in laboratory research to save humans. It was Haraway who noticed this sacred dimension of experimentation when describing the special case of the Oncomouse, a genetically modified mouse, which carries an activated oncogene and which was intentionally created to research breast cancer. In Haraway's interpretation, the Oncomouse is both a scapegoat and a secular Christian figure which will be sacrificed to find a cure for breast cancer and possibly save many women—other mammal beings (Haraway, *Modest_Witness* 79). "Holy Coli," then, suggests that the smell of violet potentially changes the status of the laboratory animal and restores it to its own existence. The project also suggests that in some medical or biological situations human bodies and animal bodies are interchangeable, transgressing the boundaries of the insular biological individual.

Thus, both performances imply a certain "logic of contamination," to use Jacques Derrida's term, by establishing new experimental conditions. The performance "May the Horse Live in Me" and "May the Rain Forest Live in Me" created conditions in which the artist's body and her immune system became the place of negotiations with other species. The artist was trying to induce a certain tolerance to the other species, or to other ethnic groups into her own body and in this sense invented a new level of immune (re)cognition. In a similar manner, the performance "Holy Coli" invented an experimental space where human and animal bodies become interchangeable. In both cases the immunity system is not a defensive

mechanism protecting the "self" from the contagious "other" but an ecological network expressing the relationships between the organism and the environment. Tauber argues that in the future biology should create a model of ecological immunity examining the ways in which human and nonhuman animals shape and create their environment. As Tauber points out,

> [o]lder understandings of immune identity based on autonomous, insular animals in competition with others omit the crucial mechanisms of tolerance and that allow organisms to live as a holobiont. And to study such aggregates, eco-immunology shifts from the individual-based conceptions that have dominated the life sciences to considerations of the dialectical relationships that require tolerant mechanisms to mediate beneficial exchanges. (221)

Understood in this way, the notion of immunity takes its place within ecological sciences. Any organism—human or nonhuman—is an assemblage which is constantly changing according to its environment. Moreover, it can manipulate its environment in such a way as to create most profitable conditions.

CONCLUSION: BACK TO AUTOPOIESIS

Thus, the immune system works both in internal circuits (creating and maintaining the holobiont) and in external circuits (negotiating with the environment). In this respect, as Cary Wolfe observes, there is an isomorphism between the immunological paradigm and the theory of self-referential autopoietic systems (108). Contrary to the understanding that autopoietic systems are closed and solipsistic, as Haraway claims, autopoietic systems work in two different directions: on the one hand, they are closed on the level of organization and seek to maintain their integrity; on the other hand, they are connected to the environment which triggers some changes in their structure. Thus, autopoietic systems are organizationally closed but structurally open at the same time. As Evan Thompson points out: "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*" (85). The idea that a living being responds to the environment and can even affect it in a certain way, led to the conclusion that a living being is interrelated to its environment through a "structural coupling." This insight challenges Darwin's theory of adaptation because the organism is not simply adapting to the environment

but is also actively manipulating it. The idea that living beings can manipulate and change their environment allows Maturana and Varela to argue that self-organizing activity, expressed at different levels of life, is a mental activity: "Living systems are cognitive systems, and living as a process is a process of cognition. This statement is valid for all organisms, with and without a nervous system" (13). Living systems are cognitive systems in the sense that they change their environment. All living beings interact with their environment in a cognitive way and create preferable conditions for their own being.

This twofold functioning of the autopoietic system is similar to the functioning of the immune system: on the one hand, the immune system has to keep the organism's "identity," its internal organization; on the other hand, to remain what it is, it has to constantly negotiate its boundaries and connect to its environment. In this sense immunity necessarily involves a certain immune-knowledge, the investigation and cognition of other beings. However, to know these other beings, the immune system has to incorporate them, to introduce them in the form of an antigen which is recognized by a specific antibody. In this sense immunity is an open and changing network, incorporating and negotiating otherness. The fact that immunity can be induced artificially makes it conceptually isomorphic to the practices of bioart: bioart creates unique conditions which help to establish "structural couplings" with other species and in this way induces them into our environment. Thus, the artistic practices discussed above work in a similar way to the practices of vaccination: they introduce a certain part of a foreign element and force the performer to cope with it, to accept it as a part of its autopoietic system. Instead of explaining this interaction in terms of symbiosis we can interpret them as the interaction between different autopoietic systems, which maintain their integrity but are simultaneously open to structural changes.

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