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Nurturing the Ecosoma

Immune System and Impersonal (Dis)Cognition

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Abstract

The article reexamines the immune system as a cognitive entity within an enactivism framework and the 4EA approach, emphasizing embodied, embedded, extended, enactive, and affective cognition. Based on a comparative and conceptual-analytic method, this text contests the mainstream implications of immunology. Challenging the conventional linear immunity model, which simplifies antigens as inputs and antibodies as outputs, the paper proposes a hypothesis where the immune

system, through eigenbehavior, creates virtual selves and endogenous "molecular worlds" influenced by environmental factors. This perspective shifts the view of immunity from a reactive, militaristic model to a more nuanced, "peace-loving" system engaged in adaptive interactions with its environment. The study culminates in analyzing multiple chemical sensitivities as instances of discognition, demonstrating how an organism-centric view of immunology highlights the deep interdependence between humans and their surroundings.

Keywords: immunity, enactivism, eigenbehavior, inhuman cognition, multiple chemical sensitivity.

Kultiviranje ekosome. Imunski sistem in neosebna (dis)kognicija

Povzetek

Članek presprašuje imunski sistem kot kognitivno entiteto znotraj okvira enaktivizma in pristopa 4EA, ki poudarja utelešeno, vpeto, razširjeno, udejanjeno in afektivno kognicijo. Na temelju primerjalne in konceptualno-analitske metode prispevek spodbija utečene implikacije imunologije. S tem ko spodbija konvencionalni linearni model imunosti, ki poenostavlja antigen v dražljaj (*input*) in antitelo v učinek (*output*), želi razprava predstaviti hipotezo, v skladu s katero imunski sistem, s pomočjo lastnega načina vedênja (*eigenbehavior*), pod vplivom okoljskih dejavnikov ustvarja virtualna sebstva in endogene »molekularne svetove«. Takšna perspektiva pogled na imunost preobrne od reaktivnega, militarističnega modela k bolj niansiranemu, »miroljubnemu« sistemu, ki se s svojim okoljem spoprijema s prilagodljivo interakcijo. Študija se zaključi z analiziranjem multiple kemične senzibilnosti kot primera diskognicije, kakršen kažejo, da imunološki pogled, osrediščen na organizem, poudarja globoko medsebojno soodvisnost med ljudmi in njihovo okolico.

Ključne besede: imunost, enaktivizem, *eigenbehavior*, nečloveška kognicija, multipla kemična senzibilnost.

Following the COVID-19 pandemic, the perception of our world shifted, appearing more fragile and vulnerable than previously believed. After 2020, the prevailing sentiment questioned the stability of the established biopolitical order. Consequently, discussions surrounding collective immunization—encapsulating themes like lockdown measures, public hygiene, and mass vaccination—dominated the discourse on securing an increasingly atomized society.

This renewed emphasis on immunity necessitates a reconceptualization within contemporary philosophical and cultural dialogues. Eminent thinkers like Peter Sloterdijk, Alfred Tauber, Donna Haraway, and Roberto Esposito[1] have already begun this process, interpreting immunity as a biomedical phenomenon and a heuristic metaphor. For them, immunity offers an alternative lens for viewing human and non-human community interactions, the organic body's boundaries, and the metaphysical subject's delocalization.

In this paper, I aim to explore immunity as a cognitive system wherein the body discerns its boundaries and gains self-awareness. I draw upon enactivism and the 4EA approach, which encompasses cognition's embodied, embedded, extended, enactive, and affective facets.[2] Rooted in the close interplay between cognition and the sensorimotor structure of the body, this perspective understands cognition as an embodied action within a given context. The method employed in this paper is comparative and conceptual-analytic, shifting the perspectives from classical

1 See: Esposito 2011; Haraway 1991; Sloterdijk 2020; Tauber 1994. One can also mention Niklas Luhmann's cybernetic arguments about social immunity represented by the legislative system: such immunity "corrects" social "deviations," reproducing the prevailing regime.

2 This abbreviation is a generalized model that combines a highly diverse and only sometimes coherent set of projects unsatisfied with the current state of brain sciences and cognition studies. See the attempts at systematization in: Cappuccino and Froese 2014; Di Paolo, Buhrmann, and Barandiaran 2017; Stewart, Gapenne, and Di Paolo 2010.

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transcendental phenomenology to more flesh-oriented, pre-conscious processes comprehended in immunology (and biomedicine in general), cybernetics, and inhuman thinking. The phenomenological interpretation of these processes discloses the recursive nature of pre-individualized processes, which can modify our understanding of cognitions, in general, and somatic cognition, in particular. Hence, immune cognition operates at a subconscious and somatic level, devoid of sentient consciousness and defined by its unique recursive structure. In cybernetics, this self-referential structure is termed *eigenform*, its inherent, self-generating activity is known as *eigenbehavior*.

Building on this, I hypothesize that the immune system, through its eigenbehavior, fosters the creation of endogenous "molecular worlds." The phenomenological manifestation of these worlds is influenced by their surroundings' exogenous, ecological attributes. Immune cognition, inherently non-representational, gives rise to a distinct model of embodied cognition. I suggest that this can best be understood through a lens of non-intentional or material phenomenology of pathic immediate experience. In doing so, the role of immunity underscores the blurred lines defining individuality, emphasizing processes of individuation, concorporeality, and interpenetration instead.

In conclusion, I will delve into an under-recognized illness—multiple chemical sensitivity—as an instance of immune discognition. This examination aims to illuminate how an organism-focused approach to immunology elucidates the ties binding humans and their environments.

The non-linear body and organic thinking

The body's discernment of its boundaries, distinguishing where it ends and the external begins, is a marvel of biological evolution. The immune system embodies this discernment, incorporating a diverse array of components. These include protective barriers like mucous membranes and skin, inhabited by symbiotic bacteria; the mucous-coated linings of our digestive and respiratory tracts armed with antibacterial agents; and the lymphatic and circulatory systems that deploy phagocytes to inflammation sites. Furthermore, the bone marrow, thymus gland, tonsils, appendix, and other anatomical entities play vital roles, interlinking with the body's metabolic and homeostatic processes.

This understanding casts immunity as a protective shield, a predetermined boundary, safeguarding the living system against foreign intrusions. From this, emerges the classical view of immunity as the body's defense mechanism for recognizing and preserving its boundaries. Anything unrecognized by the immune system is deemed foreign and slated for elimination. This paints the body as a sovereign entity, perpetually at risk from external threats, necessitating vigilance against foreign invasions. However, a puzzling paradox arises: Why does the immune system not turn against its host as an organism's cellular molecular composition evolves? How does it refrain from self-annihilation?

The concept of "horror autotoxinus," introduced in early 20th-century immunology, explains it. It highlights the immune system's innate neutrality and tolerance towards its components, epitomizing its capacity to discern the "self" from the "other." Pioneers like Frank Macfarlane Burnet and Élie Metchnikoff have expounded on this. Burnet's clonal selection theory postulates that during late embryonic development, the immune system learns to distinguish "self" from "non-self," initiating appropriate responses. Metchnikoff, historically before Burnet, believed that immunity ensures the body's internal harmony. While Metchnikoff envisioned a harmonious role for immunity, Burnet proposed a more aggressive stance, suggesting that the immune system ruthlessly eliminates perceived threats, even if they resemble the host (Crist and Tauber 2000).

Drawing from cybernetic language, Burnet's model is *linear*, viewing antigens as input and the resulting antibodies as output. It portrays the immune system as a relentless recognizer and eliminator of threats. Therefore, while immunity preserves the organism's sanctity and boundary integrity, it operates fundamentally as a cybernetic input/output mechanism.

Niels Jerne revolutionized our understanding of immunity. He described the immune system as a network of intercommunicating cells, primarily lymphocytes, which possess the ability to learn. He leaned on cybernetic notions of network and information to draw parallels between the immune system and artificial neural networks regarding function and capability.

This perspective posits that alien entities are "perceived" by the immune system through "internal images." Given the vast array of antibodies produced during somatic mutations, which are associated with specific antigenic

molecular forms, the immune system is, in essence, primed to recognize a comprehensive spectrum of possible immunological variations. This includes those that have never been encountered during biological evolution and even those synthetically composed by humans.

In this context, the immune system functions as an external information processor. It differentiates signals from noise, a process intrinsically linked to the immune system's endogenous activity. This idea resonates with Gregory Bateson's definition of information: "a difference that makes a difference." Additionally, such information plays a dual role: it shapes the immune system's activity, while delineating the environment. This is particularly evident in the context of non-specific immunity. Drawing from Evan Thompson's perspectives, this type of information is not purely inherited; instead, it is dynamically constructed during an organism's developmental stages (Thompson 2007, 57).

So, what implications does endogeneity have on the immune system's cybernetic operations? At its core, it implies the immune system's inherent cognitive capabilities, assisting the body in defining its identity amidst environmental influences. This notion echoes the tenets of enactivism. The immune system's cognitive domain is not just an elementary input/output machine, but is capable of creating imagery.[3] It conjures images that determine its environmental interactions, crafting these images based on what does not oppose the organism. Hence, the "alien" image is typically neutral, only turning hostile in exceptional circumstances.

Enactivists emphasize the immune system's cognitive ability in molecular form recognition, learning, and memory. These attributes align with what might be termed "zero-degree cognition." A system does not necessitate conscious experience or self-reflection for cognition; cognition can be inferred

3 This thesis, which has not yet found full articulation in enactivism and related areas, has remained somewhat of a provocative hypothesis regarding the representational abilities of systems. Meanwhile, the figurative representation of antigens can be revealed interestingly as a "molecular" refraction of the classical problem of the image in the light of chemical, cybernetic, and quantum-mechanical variations of some modern philosophical and cultural theories. See, for example, the "micro-ontology of the image" in Emmanuel Coccia (2016) or the "embryology of the visible" in Mark Hansen (2005).

from a conjunction of perception and action, the system's operational closure,[4] and feedback loops, involving the environment and system activity (Varela 1994, 34). This concept, central to the 4EA approach, underscores the need to identify cognition, autonomy, adaptability, and teleology in various life forms. The overarching objective of cognition is preserving a system's identity and function amidst disruptions and perturbations (Di Paolo 2005).

This can be regarded as a postulation that cognition hinges on a system's sensorimotor structure. The system's form influences perception, and cognitive structures evolve from recurring sensorimotor patterns.[5] The dichotomy of "inside" and "outside" emerges from the intersection of the system and its environment. Such an understanding propels us to differentiate between autonomous (self-governed) and heteronomous (externally driven) systems. This raises the intriguing question: Can the immune system be reduced to a mere heteronomous or *trivial* machine? A trivial machine is defined as an invariant relation between input (stimulus) and output (reaction). This relationship is deterministic: the same stimulus always causes the same reaction. Hence, a trivial machine is predictable. In a nontrivial machine, the input depends on its previous inputs and outputs, because the same stimulus can provoke different, unpredictable reactions at different times. Hence, it is concluded that a trivial machine "lives" the same state "from within" its "subjective" perspective, and a non-trivial one—a set of fleeing elusive states (von Foerster 2003, 208 and 311).

Enactivism and the 4EA approach emphasize that the body's autonomous cognition is closely linked to its metabolic functions. As anthropologists

4 Operational or organizational closure can be defined as a self-referential (cyclic and recursive) network of relations that define the system as a singular unity and are capable of dynamic reproduction (Thompson 2007, 45). The network unites interdependent modules and mediates invariants of sensorimotor correlations between sensory and effector surfaces, giving rise to the autonomous behavior of the system (Varela 1997).

5 In the theory of autopoiesis—a prerequisite of enactivism—, this connection between the recurrence and sensorimotor structures and the shape of perceptual words is defined as the structural coupling. Structural coupling is defined in two ways: the mutual consistency of the system and the environment and the history of their relationship. Natalie Depraz recreates this connection by transferring it to the affective relationship of two living systems and endowing their meeting with phenomenological connotations taken from the terms *acoplamiento* and *Paarung* (Depraz 2008, 239–240).

Annemarie Mol and John Law emphasize, observation is not the paramount activity of the body-in-action. Through metabolism, the body continually incorporates (eating, drinking, breathing) and excorporates (defecating, urinating, sweating) (Mol and Law 2004, 53–54). This continuous exchange blurs the boundaries between the inside and the outside, posing questions about what constitutes the "self": Are "urine, feces, saliva, blood, hair, nails, skin, and seminal fluids" still part of the body (Grosz 1994, 81)?

Such questions are further heightened when considering the immune system's function. Its role is not just about defense, but also distinguishing and integrating—functions performed endogenously. As systems oscillate between stability and instability, or what some scholars term metastability, they exhibit behavioral invariants or consistent behavior patterns driven by intrinsic attractors. These are not merely reactions to external stimuli, but are set within the system.

In cybernetics, immunity is a testament to autonomous systems capable of nonlinear behaviors. Such perspectives have been enhanced by thinkers like Francisco Varela, whose interdisciplinary work during in the period 70s–90s aligned with the neocybernetic, i.e., recursive and self-referential understanding of biological processes (Eichmann 2008). Collaborating with Nelson Vaz, Antonio Coutinho, and John Stewart, Varela and his enactivist/neocybernetic contemporaries expanded the scope of immunology beyond its traditional confines (Vaz and Varela 1978; Varela, Coutinho, Dupire, and Vaz 1988; Stewart and Varela 1989; Stewart, Varela, and Coutinho 1989; Varela, Andersson, Dietrich, Sunblad, Holmberg, Kazatchkine, and Coutinho 1991; Varela and Anspach 1994). The modern understanding, shaped by these thinkers, posits that immunity is not just a linear defense mechanism. Instead, it is a somatic subjectivity that "negotiates" and seeks "compromises" with the molecular entities it encounters.[6] From a cybernetic lens, immunity

6 Referring to the philosophy of Emmanuel Levinas, Irina Aristarkhova notes that hospitality precedes all hostility; therefore, immunity, entering into negotiations and alliances, strives for peaceful ecological coexistence: the environment constitutes organisms, and they transform it by supporting self-awareness and tolerance, which Burnet also tended to, using the language of cybernetics and information theory (Aristarkhova 2017, 136). This idea is consonant with some ideas of developmental

demonstrates *eigenbehavior*—a term introduced by Heinz von Foerster. It indicates a system's ability to function based on its intrinsic teleology beyond the predictive capacities of external observers.

With its vast repertoire of recognizing even the previously unencountered molecular forms, the immune system operates as a non-trivial machine, challenging and enriching our understanding of body autonomy and identity. An *eigenform* operates as a recursive description-construction (x), where a system can describe and construct itself: $x = f(x)$. The true core of this form arises within a cognizing system, especially within its unique operator. This operator produces contents representing "its own" (eigen) forms: $k = f(k)$. An eigenform can generate meanings that define its existence, its fundamental laws. Simultaneously, some forms defy the construction of a meta-position due to their encompassing nature. Von Foerster and Louis Kauffman labeled such forms as eigenforms. Let us assume that a human observer is part of the world, and the same physical laws govern their body as elsewhere in the cosmos. In such a case, the observer is intrinsically linked to both the external world and their observable bodily parts; the observer essentially becomes the universe they observe. Philosophically, this answers why the world aligns with our knowledge and how vast abstractions function within it. The concept can be summarized as: "The world is signified." Conversely, it can be interpreted as: "The signified world is our reality." It is the only world we recognize as meaningful and genuinely real.

The immune system operates as a dynamic entity, perpetually adapting to its internal and external environment. Its state of stability is transient and is constantly redefined through its interactions, thereby generating its own unique "world" or ensemble of eigenforms influenced by its eigenbehavior.[7]

psychology, where the formation of a child's individuality is co-dependent on the presence of an "evoked Other," in interaction with which a psychological self arises and grows. The example, with which Aristarkhova illustrates her reasoning, is the hematoplacental barrier during pregnancy, which does not allow the blood of the fetus and the mother to mix. The placenta prevents some (but not all) immune reactions of the mother's body to fetal components.

7 Humberto Maturana, speaking about the autopoietic organization of life as a knowledge that supports life, emphasizes the circular causality of self-organized life that constitutes a complete cosmology (Maturana and Varela 1980, XVIII). Life

The interplay of cellular interactions sculpts this worldview, all orchestrated with a sense of coherency and identity rooted in the thymus and lymph nodes.

The concept of autopoiesis underscores the self-producing and self-maintaining nature of living systems (Maturana and Varela 1980, 78–79). This recursive and cyclical functionality is paramount for the immune system's operation. It is not just about reacting to external threats, but also about asserting and re-establishing its identity. This projection into the future, likened to phenomenological anticipation, is analogous to metabolism's role in driving life forward (Jonas 2001, 80).

Learning and differentiation are crucial aspects of the immune system's operation. It does not innately differentiate between self and non-self, but learns to do so over time. When faced with an antigen, the immune system references past interactions, fine-tuning its response based on historical encounters. Elements that fail to trigger a learning response in the system are deemed to be irrelevant or are considered as "noise."

The immune system's "cognitiveness" is relational. It arises at the interface of its components and the molecular forms it encounters. This act of recognition is enactive, with the immune system playing a participatory role in defining what is known. The convergence of subject and object in the immune system's functions reinforces its self-directed nature. It brings forth a paradoxical realization: the immune system's responses are essentially autoimmune.[8] Its quest to define and protect the self constantly navigates the boundary of self and other, thereby continuously redefining its identity.

description is always a "from within" external cosmology of the observing system (ibid., 8). For a more detailed overview of eigenforms and eigenbehavior, see: Füllsack and Riegler 2017; Kauffman 2017.

8 This does not mean identifying the work of immunity with autoimmune pathology, but an indication of self-assertion and self-recognition as the fundamental principles of the immune system's eigenbehavior as autopoietic. Autoimmunity supports the homeostasis of the immune system and destroys dead cells (Huetz, Jacquemart, Pena Rossi, Varela, and Coutinho 1988).

The immune system's processual identity

The identity of a system is better understood as a dynamic process rather than a static entity.[9] Immunologists' familiar distinction between "self" and "not-self" can potentially be misleading. One might feel compelled to equate the immune "self" of an organism with the biopsychosocial "self" of an individual. However, possessing autonomy does not necessarily denote an "ego-centered" worldview.[10] With its narrative and discursive nature, the psychosocial self could be an illusion, even if evolutionarily significant. Furthermore, the presumption that cognition mandates neurons or neuromimetic automata is not universally applicable.

According to Varela, the most basic level of cognition aligns with "primitive" actions within an ecological niche. In terms of immunity, he terms this "ecosomatics" (Varela 1991, 182; Varela, Coutinho, and Stewart 1993, 219). Simply put, we cannot say anything about the immune system in isolation from the rest of the body's work, the ecosoma. Its autonomy is coordinated with a meshwork of organic processes, establishing an ecology

9 Hence, it is a subject to epigenetic transformations. Epigenesis, in this case, can be specified through productive relationships between genotype and phenotype, hereditary information and its interpretation under the influence of environmental parameters, and, more broadly, between invariants and their variation in various forms of life, for example, during the development of the embryo and the accompanying differentiation of cells, tissues, and body parts, in the pluripotency of stem cells or neuroplasticity (Malabou 2016). Epigenetic development is contingent, not subject to the necessary, predetermined trajectory of development, and this turns out to be similar to cybernetic eigenforms. See the study of epigenetic immune networks in connection with the problems of oral tolerance, reducing the body's ability to form antibodies against food proteins (Vaz and Andrade 2017).

10 Moreover, even the idea of the self as a "command center" is doubtful. Not only enactivists (Varela, Thompson, and Rosch 1991, 59–63), but also inhumanist philosophers develop various projects of "subjectivism without selfhood," where the system's ability to act, speak, and socialize is objectified and does not refer to the phenomenological subject's "interiority," but instead is based on an evolutionarily inherited ability to build cognitive categories (Brassier 2011). The difference to enactivism is that the phenomenological dimension, although derived from pre-intentional, impersonal processes, is conceivable only as a given for this derivative of subjectivity, which develops ideas about eigenbehavior and its dynamics in "neuropsychoevolutionary" phenomenology (Varela 1996).

of relationships (Coutinho 2003, 19). By emphasizing the symbiosis between the immune system and its somatic environment, Varela illustrates that the inhabitants influence the environment, which, in turn, provides feedback (Varela, Coutinho, Dupire, and Vaz 1988, 364–365). The body serves as a dynamic locus of leukocytes, its "subject" and "object" are identical.[11] Their delicate network, comprising mutations, the production of new anti-idiotypic antibodies, and various cells in bodily fluids, maintains the immune system's stability and coherence.

Systems equipped with a nervous system use sensorimotor movements to navigate their environment. Contrastingly, the immune system maneuvers through an abstract "shape space," reminiscent of a phase space (Varela, Coutinho, and Stewart 1993, 223–225: Stewart 2014, 111–114). This abstract realm encompasses all potential states and profiles of the system, defined by both attractors (elements it is drawn to) and repellers (elements it avoids). While such systems also exhibit physical mobility, their primary movements are molecular and formative. A system's complexity defines its movement type: while a rudimentary autopoietic system leans towards phase/morphological dynamics, a multifaceted system exhibits spatial movements. Notably, the latter's physical movements are predicated on its morphological movements.[12]

11 Reflecting on the autonomy of living systems, back in 1980, Varela wrote: "Yet, if what I have said so far has any consistency at all, it should now be clear that the first cut, the most elementary distinction we can make, may be the intuitively satisfactory cut between oneself qua experiencing subject on the one side, and one's experience on the other. But this cut can under no circumstances be a cut between oneself and an independently existing world of objective objects. Our 'knowledge,' whatever rational meaning we give that term, must begin with experience, and with cuts within our experience—such as, for instance, the cut we make between the part of our experience that we come to call 'ourself' and all the rest of our experience, which we then call our 'world.' Hence, this world of ours, no matter how we structure it, no matter how well we manage to keep it stable with permanent objects and recurrent interactions, is by definition a world codependent with our experience, and not the ontological reality of which philosophers and scientists alike have dreamed." (Varela 1980, 275.)

12 Interestingly, some authors build a consistent analogy between the movement of a system in phase space and the immanent orientation of consciousness towards a subject in phenomenology. "External" events for the system make sense only in the perspective of its eigenbehavior; the system is directed to the attractor, which itself is

Consider the amoeba, which discerns fundamental distinctions in its milieu. It navigates aquatic terrains, propelling pseudopods forward and pursuing bacteria, algae, and other minuscule prey. Upon sensing threats, it retreats. This path embodies its inhuman ontogenetic development, devoid of a psychological self or rudimentary self-awareness. Such rudimentary life forms already possess a foundational cognitive self—a closed loop ensuring functional. This "self" is devoid of personalization or human-centric narration. It results from a myriad of simple components, each incapable of independent cognition, but collectively enabling perception and movement. This interconnectedness of simultaneous processes, crafted from situational elements, aims for system preservation. As such, "selves" are fluid constructs intertwined with their generative processes. Over time, certain behaviors solidify, leading to predictable reactions and priming the system for future interactions (Vaz 2011, 701).

The system's eigenbehavior demarcates its unique operational style. It distinguishes itself in physical space through its actions, yet remains intertwined with its surrounding environment. Local operations yield global outcomes, which conversely impact local conditions, illustrating their interdependency. Autopoiesis thrives on the dialectics of local and global, part and whole, foreground and background. Immune reactions are intrinsically tied to an organism's interconnected states, self-defined by its historical context. Having survived a liver transplant, Varela wrote:

> The boundaries of the self undulate, extend and contract, and reach sometimes far into the environment, into the presence of multiple others, sharing a self-defining boundary with bacteria and parasites. Such fluid boundaries are a constitutive habit we share with all forms of life: microorganisms exchange body parts so often and so fast that trying to establish body boundaries is not only absurd, but runs counter to the very phenomenon of that form of life. (Varela 2001, 263.)

the product of its activity (Dupuy 2009, 104–105); the world is disclosed to the subject due to their own activity (Thompson 2007, 27). Of course, such a movement is not value-neutral; it has an affective valence in the range from "allure" to "disgust" (Depraz 2008, 241–242).

> It is not the body-technology that introduces the alterity in my lived body as a radical innovation. That technology widens and slips into what is always already there. The alien and the foreign of the transplantation gesture is not a sharp boundary marker for how my body holds its place as the locus of intimacy. (Ibid., 266.)

Thus, for enactivism, the immune system is an alternative, non-neuromimetic realization of the cognitive ability. It is characterized by recognition, learning, memory, differentiation of self/non-self, and other forms of complex behavior based on an architecture only superficially analogous to the nervous system and its artificial models.

In understanding the identity and operation of systems, particularly the immune system, embracing the fluidity and dynamism inherent in their structure and function is critical. The traditionally held distinctions, such as "self" and "non-self," while informative, may not grasp the full significance of these systems. The immune system's role transcends mere physical defense; it offers insights into cognition, movement, and minimal self-recognition—qualities previously reserved for more complex systems with a nervous computational framework. Varela's concept of ecosomatics and the complex dance between local and global processes stresses that cognition is not solely the domain of neural systems. With its capacity for recognition, learning, and memory, the immune system emerges as a poignant testament to the diverse architectures, through which cognitive abilities can manifest, challenging our preconceptions about cognition's functioning (Varela 1991, 174).

Although the enactivist understanding of immunity is profound, questions about immune system dysfunctions from biomedical and biopsychosocial perspectives persist. We should envision a continuum within the epigenetic model where autoimmunity and immunodeficiency represent opposing extremes. Some phenomenologists, such as Henri Maldiney or Maxine Sheets-Johnstone, suggest that an organism's behavior and its *Umwelt* form an alternative standpoint (Maldiney 2007). It is essential to consider that even the most primitive animation of single-celled organisms carries inherent cognitive or mindful qualities. It is evident when evaluating the environment's profitable and destructive aspects. For example, the cognitive dimensions of a bacterium's animation are not merely symbolic or representational. For

Sheets-Johnstone, proprioception and, more specifically, kinesthesia point to a knowledgeable subject, recognizing its bodily boundaries. At its most basic, this subject recognizes its motion or lack thereof (Sheets-Johnstone 1998, 273). The same applies to the elements of the immune system. Affects resonate more with dynamic, kinetic descriptions than distinct emotional occurrences, given their roots in the tactile-kinesthetic body. From this angle, the affect could be interlinked with the complexity of movement. If this is true, the affect's evolution might be better understood through the lens of the tactile-kinesthetic body's richness and variability rather than solely from a social anthropocentric perspective. Life is outward-focused, achievable only through its internal activities. Hans Jonas termed this "needful freedom." Phenomenology supplements this with the notion that organic life undergoes discontinuities, interspersed with stability and instability.

Phenomenologically speaking, immunity's foundation emerges from the embodied system's *auto-affection*, constituting the primary event of self-knowledge experience. A harmonized cooperation of various virtual selves is essential for the reflexive self and its antecedents—including minimal cellular unity, bodily self, and the cognitive perceptual-motor self. The immune system inherently differentiates between itself and its environment. Nevertheless, the immune self, like the virtual poles of individuation, cannot view itself externally/objectively, "from nowhere and nowhen" or the system-environment boundary.

We cannot disentangle ourselves from our world to perceive ourselves as systems within an environment. Our world's perception relies on our experience of it. Hence, the immune system's behavior exemplifies auto-affection and epistemic closure, which can be likened to a recursive demarcation of the system's boundaries by its intrinsic activity. This is reminiscent of Husserl's and Merleau-Ponty's illustration, where one hand touches the other. By touching my body, I concurrently perceive and am perceived, with both facets of the interaction being chiasmatically co-constitutive. Neither exists without the other; the world's existence is intertwined with the actions that shape it.

Pathos, or suffering, correlates with affectivity, which should not be equated with emotions. For Catherine Malabou, affect denotes any alteration introducing dynamism and transformation to the system's life (Malabou

2009, 113). In phenomenological terms, affect encompasses aspects, where "activity" and "passivity" blur, revealing the subject's innate vulnerability, which paradoxically manifests its existence. If we extend this activity/passivity dynamic—deemed *pathic* by some scholars—to the body's metabolic and visceral processes, the system's openness becomes evident. Such openness, on the one hand, manifests in the system's eigenbehavior, and, on the other, it facilitates its non-linear, non-trivial behavioral repertoire and evolution. The system's uniqueness and autonomy emerge in interaction, or intra-action, with its environment, which comprises environmental events and other systems. Thus, immunity's individuality is not purely forged through aggressive actions against perceived threats. Enactivism, in essence, demobilizes the immune system.[13]

The cybernetic notion of eigenbehavior advocates a similar perspective, emphasizing life's capacity to generate values congruent with survival conditions. Eigenbehavior is intrinsically internal; it resists external predetermination. Everything perceived or influencing the ecosomatic self is innately integral to it. In the phenomenology of life, a living system interacts with its environment while preserving autonomy.

Thus, self-affection represents a unique passivity preceding external object-focused intentionality. Immunity encapsulates the phenomenology of the pathic, encountering the affects and contingencies beyond the subject's control. Passivity does not negate activity, but alludes to receptiveness towards alterity. Such receptiveness is a precondition for discerning oneself distinct from a "neutral" environment. Immunity embodies hospitality, accepting and learning from encounters, only exhibiting hostility under threats to its integrity. Everything the immune system discerns comprises its self-constructed forms and images, facilitating self-regulation and preservation:

> The molecular world we inhabit, thus, is not pre-given, and then inhabited *post facto* by our immune systems through some optimal adaptation. It is rather laid down as we walk in it, it is a world brought forth. (Varela, Coutinho, Dupire, and Vaz 1988, 373.)

13 I borrowed the demobilization metaphor from Joel 2012.

Discognizing the pathic

We need a comprehensive picture of the immune system's functionalities, including its seemingly "pathological" states. With this, we risk going beyond the traditional biomedical view of the body. However, this approach connects the atomistic, isolationist picture of the body, which is compromised by the holistic attunement between the preconscious recursive body and constituted environment replete with embodied meaning—as specified in the 4EA and enactivist proposal. At first glance, the presented vision paints an unrealistic image of unhindered cognition. However, I aim to emphasize examples, when this cognitive framework fails. Enactivism and cybernetics typically only address successful implementations of autopoiesis and cognition. Yet, it is evident that life only sometimes progresses seamlessly; it often faces disruptions, injuries, and breakdowns. S. Kay Toombs, a phenomenologist specializing in medicine and chronic diseases, posits that while healthy individuals view their bodies as self-evident, illness disrupts this perceived normality (Toombs 1996, 12).[14] Once anonymous and transparently functioning body becomes acutely present and problematic for the afflicted individual. Patients with compromised autopoietic systems navigate worlds characterized by disintegration, blurred boundaries, and both de-subjectification and objectification.[15] Anthropologist Myra

14 Thus, the objectification of the diseased body is made, which is transformed into an inanimate object, consisting of organs, tissues, and cells that make up a set of interchangeable parts. The illness as a pathic experience shows the negative side of auto-affection and the inverse side of autopoiesis; the subject happens to be sick, but this experience is destructive and exposes their fragility and vulnerability—autopoiesis can be interrupted not only by a momentary cessation of metabolism, but also during the gradual extinction of vital functions. It is a possible discrepancy between the enactivist vision of immunity and its pathologies and the idea of destructive plasticity in Malabou: the destructive transformation of the system, its apoptosis/necrosis, and transformation into an appendage to the disease can be stretched over time, and does not necessarily have a momentary event character.

15 The life of the autopoietic system, the ability to maintain its organization and regulatory processes, has a graduated nature: health, illness, stress, and exhaustion characterize its perception of the environment and interaction with it (Thompson and Stapleton 2009, 25). At the same time, a "healthy" and "sick" body can present itself to the subject in different ways: it can either retreat to the background of perception/action ("dis-appearing," to use Drew Leder's vocabulary), becoming an invisible

Bluebond-Langner's 1970s research on terminally ill children in U.S. cancer departments highlighted that each patient and their immediate environment constructs a unique world. Each participant contributes significantly to forming the "world of a dying child," which has distinct subjectivity, agency, and experience (Bluebond-Langner, 1978).

Last century's medical domain identified an "autoimmune rheumatoid personality type." Predominantly diagnosed in women, these individuals were perceived, within a biomedical context, as having unconscious tendencies, such as rebellion against men, bisexuality, rejection of "traditional" female roles, and even masochism and voyeurism (Martin 1994, 49–63; Neocleous 2022). Consequently, specific personality and gender attributes were linked to propensities for autoimmune diseases in this sexist and ableist discourse. This "autoimmune autoaggression" intersected inhuman cognition, ecosomatics, and psychiatry, making some patients especially vulnerable to cruel medical interventions. Patients with rheumatoid arthritis were stigmatized, viewed as aggressive, and deemed incapable of fulfilling societal roles. More broadly, medicine has affirmed, and continues to affirm, connections between personality traits and non-infectious diseases, including oncology and cardiovascular diseases. However, when it comes to immune-related disorders, unique existence modes with distinct spatial and temporal qualities are seen rather than fixed "pathological" personality types.

Historian and philosopher of science Ludwik Fleck observed that infectious diseases were conceptualized alongside the idea of organisms as isolated systems, with the disease-causing agent being an external threat (Fleck 1979). However, no empirical evidence strictly supports this body image. Even today, this viewpoint persists. The notions of infectious pathogens and immune responses evolved concomitantly with the idea of an organism as an isolated fortress-like entity, fending off an intrusive environment. This concept of a

intermediary between consciousness and the world, or, on the contrary, "block" the world with its "incorrect" functioning ("dys-appearance"). The body can give pleasure, feel healthy, strong, and attractive (Zeiler 2010), but this does not always happen. There are pathological cases of deafferentation, leading to a complete loss of proprioception and motor control over body movements. With the progression of an incurable disease, patients begin to feel like outside observers of their decay (Charmaz 1983).

closed, atomized body marked the inception of medicine as a discipline centered on individuals,[16] echoing Michel Foucault's observations (Foucault 2003).

Contrary to mainstream theories, enactivist perspectives regarding immunity emphasize symbiosis and ecological exchange. In the 19th century, American medicine predominantly viewed the body as a permeable system, emphasizing the fluidity of borders and the importance of physico-chemical exchange. Today, the once-prevalent network metaphor is considered archaic. Just as past eras likened the brain to a telephone network, viewing the immune system as a communications network, modern technological advancements bring their metaphors, shaped by the cybernetic view of humans as enclosed and feedback systems.

However, the "outdated" analogy of a porous body still has relevance, particularly when examining a commonly overlooked condition known by various terms: "multiple chemical sensitivity" (MCS), "environmental illness," and others.[17] Its etiology remains unclear, affecting between 4% and 30% of Americans. It is occasionally linked with conditions like fibromyalgia and chronic fatigue syndrome, but its recognition in the medical community is tenuous. Many argue that MCS has yet to conclusively manifest in evidence-based medicine as a distinct illness, fitting within existing medical classifications.

Following exposure to various substances—from household chemicals to electromagnetic radiation—, affected individuals develop a range of debilitating symptoms, impacting multiple body systems and subsystems (Gibson, Placek, Lane, Ostroff Brohimer, and Earehart Lovelavce 2005). From a biomedical psychiatric standpoint, these symptoms mirror classical hysteria or hystero-hypochondria and are considered treatable with specific psychoactive drugs,

16 Individuality is discovered here as a clinical case, a carrier of the disease; the doctor's task is to uncover the disease hidden in the patient and not to assess the patient's experience. Therefore, it requires the exposure of the pathological dimension given through this particular body, but not directly dependent on how this body lives and what it feels. The prerequisites for a biomedical objectivist vision of the patient and diseases also lie here.

17 For an overview of the history of this disease's concept, demography, etiology, diagnosis and therapy, see Zucco and Dot 2021.

such as selective serotonin reuptake inhibitors (SSRIs). The condition often objectifies patients, making them nearly indistinguishable from their allergic and immune responses. Some might argue that the condition combines genuine allergic reactions with aspects of mental health disorders, like obsessive-compulsive disorder.

The crux of MCS's challenge is not just its physiological or psychiatric manifestation. These patients' mental well-being is inextricably linked to environmental factors—urban development, industrialization, and pollution. Their immune health is intertwined with external processes, which reciprocally influence the immune system's perception and reaction. The boundaries of selfhood blur as these individuals' bodies react adversely to their environments. Their innate defense mechanisms attempt to resist external intrusions, but often fail. This reactive behavior inhibits the body's adaptability to changing conditions. The posthumanist feminist researcher Stacy Alaimo states:

> Metaphorically "weighed down" by toxins, the bodies of the chemically reactive […] have more in common with the permeable corporealities of nineteenth-century medicine than they do with the "modern bodies" of twentieth-century allopathic medicine. […] And yet, environmental illness is a particularly twentieth- and twenty-first-century phenomenon, in part because of the avalanche of xenobiotic chemicals produced and disseminated in recent years. Moreover, the treatment for environmental illness thrusts the patient into the onto-epistemological terrain of contemporary risk society, where the ordinary citizen must assess a multitude of potential dangers—confronting vertiginous sources of information, colliding with objects and substances that seem to morph from benign to malignant. (Alaimo 2010, 114.)[18]

18 Similar motives can be found in Rachel Carson's acclaimed book *Silent Spring*, which sheds light on the destructive effects of pesticides and insecticides on the environment, its flora, and fauna. Meanwhile, the definition of environmental health proposed by the World Health Organization (WHO) covers all physical, chemical, and biological factors external to human and all related factors affecting behavior. It includes the assessment and control of those environmental factors that can potentially affect

The biomedical perspective either outright denies the existence of multiple chemical sensitivity (MCS) or divides it into somatic immunopathology and psychological conditions. These divisions struggle to coexist within the traditional conceptualization of the human body. This approach's ontological commitments—essentially, the responsibilities and assumptions placed upon science—often contradict the prevailing evidence-based paradigm.

To truly understand conditions like MCS, we must acknowledge the fluid and "porous" boundaries between individuals and their environments. The example of multiple chemical sensitivity shows the immune system's *discognition* (Shaviro 2016), the inability to recognize the boundaries of the ecosoma, and mixing self and others in a series of unpredictable and nonspecific idiosyncrasies.

Instead of starting our analysis from the premise of a distinct, autonomous subject, we should consider the dynamic processes that shape our bodies and their interactions with the world around them. This perspective requires emphasizing the bodies' continual evolution and individuation, rather than fixating on structural and functional pathologies alone. Recognizing personal and societal contexts of suffering becomes essential. The enactivist notion of immunity as a system that allows the body to understand itself offers a promising framework. Through this lens, environmental diseases like MCS can be seen as disruptions in the body's innate behaviors, manifesting at the molecular level and influencing our overall sense of self.

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health, the prevention of diseases, and the creation of a healthy environment. Whether the framework of such an image of the body, its relationship with the environment, health, and disease, is applicable to the issue of multiple chemical sensitivity, WHO does not specify. Alaimo mentions the statement of biologist Sandra Steingraber that the best way to measure the load of harmful substances on the body is to take samples of every fluid and tissue: blood, urine, breast milk, exhaled air, fat, semen, hair, nails, sweat, and tears (Alaimo 2010, 97).

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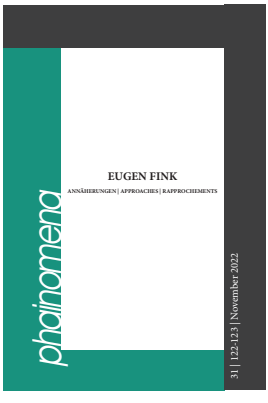

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