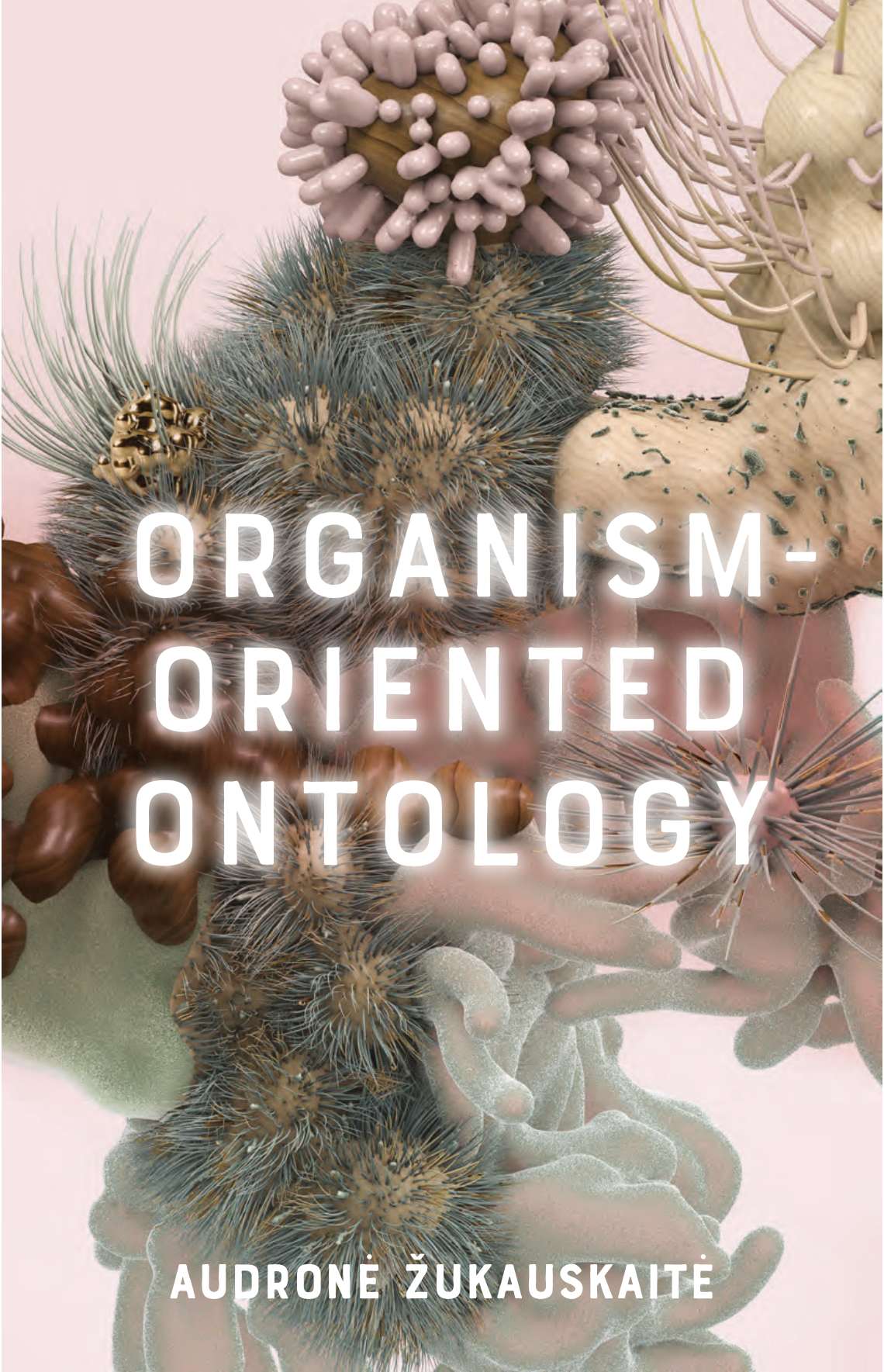

ORGANISM-ORIENTED ONTOLOGY

AUDRONĖ ŽUKAUSKAITĖ

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Autopoietic Systems

The notion of self-organisation is creatively elaborated in Humberto Maturana and Francisco Varela's theory of autopoiesis, which can be taken as a starting point to discuss different theories of biological organisation. The theory of autopoiesis examines living systems both as organisationally closed and structurally open at the same time. Maturana and Varela proposed the term 'autopoiesis' in the 1970s. *Auto* means 'self' and refers to the self-organisation of living systems, and *poiesis* means 'making' (and comes from the same root as the word 'poetry'). Thus, autopoiesis means 'self-making', or the self-organising capacity of a living being. A simple example of an autopoietic system is a unicellular organism which is capable of maintaining and recreating its organisation despite multiple chemical reactions taking place in it. Thus, the main characteristic of an autopoietic system is its self-organisation, self-maintenance, and its constant self-reproduction within a boundary. Not every self-organising structure is autopoietic; only those organisations that are self-making, i.e. autopoietic, are considered to be alive. The idea of self-making and self-organising implies that a living system is *organisationally closed*, that its order is imposed not by external forces but by the system itself. 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 within its structure. Therefore, it is said that every living system interacts with the environment through 'structural coupling'. However, even after undergoing some structural changes, the model of organisation of the system does not change. This is why autopoietic entities are said to be *closed* on the level of organisation but *open* at the level of structure.

Thus, Maturana and Varela define autopoietic systems as organisationally closed and structurally open at the same time. Such a definition might sound like a contradiction because closure and openness towards the environment move in different directions. However, what is important to understand here is that a living system needs the environment so as to obtain energy and nutrients to maintain itself and to keep its identity. As Evan Thompson points out,

> The self-transcending movement of life is none other than metabolism, and metabolism is none other than the biochemical instantiation of the autopoietic organization. That organization must remain invariant – otherwise the organism dies – but the only way autopoiesis can stay in place is through the incessant material flux of metabolism. In other words, the operational *closure* of autopoiesis demands that the organism be an *open system*. (Thompson 2009: 85)

In other words, to stay alive a system has to communicate with the environment and change, because a total closure would mean death. In this context

it is important to understand the difference between 'organisation' and 'structure': 'organisation' means the relations between the components of a system that 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 organisation. The term 'structure' means the actual relationships between physical components: a given organisation can be embodied in different physical structures (Maturana and Varela 1998: 47). In other words, living beings differ from each other in their structure, but members of the same class are alike in their organisation.

It is important to note that even if an autopoietic system is triggered by the environment, its organisation remains constant. In this sense, an autopoietic system differs from an allopoietic system, or a machine, which is dependent on external inputs and outputs. An autopoietic system 'makes' itself, and the changes within this system appear as emerging properties, in other words, properties that are not present in the parts but emerge from the interaction of these parts. Thus, in contrast to a mechanism, which defines a living being as the sum of its parts, and vitalism, which presumes that a living being is guided by some transcendent principle, the autopoietic entity is guided by its immanent cause. By referring to themselves and constantly restructuring themselves, living beings are driven by recurrent causality, or recursivity, which incorporates contingency into its functioning. In this sense, a living being does not have a final cause or teleology because it is open to change and contingency. In *Autopoiesis and Cognition* (1980), Maturana and Varela argue that teleology does not belong to autopoietic organisation: 'Living systems, as physical autopoietic machines, are purposeless systems' (Maturana and Varela 1980: 86). In later years, Varela explained that organisms do not require a transcendental cause in the Kantian sense and that organisms have their intrinsic teleology (Thompson 2009: 93, n. 52). His later revision of this theory was that organisms do not have a teleology but a sense-making, which emerges from an organism's coupling to an environment. In this regard we can argue that a living being is driven not by external causes (inputs and outputs as in the case of allopoietic systems), or by a transcendent cause (a teleology of universal reason), but by its immanent causality.

In this respect, a living system may be differentiated from a non-living system. If a non-living system, such as a cloud or a rock, is affected from the outside, it will react according to a linear model of cause and effect, whereas if a living system is affected from the outside it will react (or respond) through recurrent interaction within the system. 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 idea 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-organising 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' (Maturana and Varela 1980: 13, emphasis in original). Living systems are cognitive systems in the sense that they change their environment. For example, photosynthetic organisms create an oxygen-rich environment. Likewise, spiders and beavers, not to mention humans, create their own environments. All living beings interact with their environment in a cognitive way and create preferable conditions for their own being. This statement is valid for organisms at different levels of complexity: for example, a cell interacts with its environment by incorporating substances and making some internal changes; a nervous system interacts with its environment through perception, and every sensory perception initiates internal changes within it. Thus, an autopoietic system relates with the environment structurally; in other words, it relates through recurrent interactions that cause changes within the system (Capra and Luisi 2014: 135). This explains the difference between living and non-living systems: a non-living system will react to an external disturbance according to a linear logic of cause and effect, whereas a living system will respond according to recurrent causality which will engender changes within the system. Every change within the system influences the system's future behaviour. Therefore, Maturana and Varela assert that the interaction between a living system and the environment is structurally determined.

However, this does not imply that a living system is determined from the outside; rather, it is determined by its internal changes. The environment triggers some changes within the autopoietic system, but the system itself introduces changes into the environment. Thus, the living system and the environment are co-evolving and co-emerging. 'The emphasis and overall concern here is not to define cognition in terms of an input from the external world acting on the perceiver, but rather to explain cognition and perception in terms of the internal structure of the organism' (Capra and Luisi 2014: 141). According to Maturana and Varela, all interactions between the living being and the environment can be described as mental activity: 'The interactions of a living organism – plant, animal, or human – with its environment are cognitive interactions. Thus life and cognition are inseparably connected. Mind – or, more accurately, mental activity – is immanent in matter at all levels of life' (Capra and Luisi 2014: 254; Capra 1997: 168). The statement that living systems are cognitive systems radically changes our understanding of cognition and consciousness. Hence, the notion of cognition is applied not only to humans and animals with nervous systems and brains, but is expanded to all living beings. According to this theory,

> the brain is not necessary for mind to exist. A bacterium, or a plant, has no brain but has a mind. The simplest organisms are capable of perception and thus of cognition. They do not see, but they nevertheless

> perceive changes in their environment – differences between light and shadow, hot and cold, higher and lower concentrations of some chemicals, etc. (Capra 1997: 170)

Thus, cognition involves not only thinking, but also perception, emotion, self-awareness and 'feeling of what happens'. Cognition and mental activity are associated not only with self-reflecting subjectivity but with diverse processes of life taking place in living beings.

The idea that living systems are cognitive systems not only extends the notion of cognition to all processes of life but also changes our understanding of what human cognition is. If cognition is embodied in all processes of life, this implies that the brain is not the only organ through which cognition is expressed.

> The entire dissipative structure of the organism participates in the process of cognition, whether or not the organism has a brain and a higher nervous system. Moreover, recent research indicates strongly that in the human organism the nervous system, the immune system, and the endocrine system, which traditionally have been viewed as three separate systems, in fact form a single cognitive network. (Capra 1997: 171)

This insight allows one to conclude that human cognition and knowledge are rooted in biological existence, and that there is a certain continuity between different levels of cognitive systems, or different forms of 'self'. For example, Varela distinguishes between biological self, bodily self and cognitive self.[1] Varela's ideas are supported by Antonio Damasio's theory of consciousness, which relates conscious activity to continually changing neural mapping. These non-conscious nervous impulses form the 'proto-self', which is later encapsulated into the conscious experience of 'core self'; the 'core self', in its turn, is encapsulated into the 'autobiographical self' that is the equivalent of reflective consciousness. In other words, both Varela's and Damasio's theories reveal the continuity and discontinuity between different levels of biological, neurological and reflective self. However, the idea that cognition is rooted in living processes and that it can evade brain control – and simultaneously the grip of biopolitical manipulation – might be thought of as a potential site for resistance.

Maturana and Varela's notion of autopoiesis is a good theoretical model to start thinking about living beings and also to define their interactions with non-living beings, such as machines or the atmosphere. Maturana and Varela often describe living beings as 'autopoietic machines', thus pointing

[1] In 'Organism: A Meshwork of Selfless Selves' (1991), Varela distinguished between five levels: 1) cellular identity (biological self); 2) immunological identity (bodily self); 3) behavioural identity (cognitive self); 4) personal identity (sociolinguistic self); and 5) social identity (collective self).

out that living beings and cybernetic machines share the characteristics of self-organisation and recursivity. However, autopoietic machines literally produce 'themselves'. They are the product of their transformations, whereas allopoietic machines produce something different from themselves. Still, autopoietic systems and allopoietic systems are connected in 'structural couplings' and produce organism–machine hybrids. The notion of autopoietic system is also useful in trying to explain the interactions between living and non-living systems. For example, Gaia theory is based on the idea that plants and other organisms produce the atmospheric gases to make the Earth suitable for living. James Lovelock and Lynn Margulis recognised that planet Earth as a whole is a living-like, self-organising system. It was Varela who convinced Lovelock and Margulis that Gaia theory could be reframed from its initial cybernetic model into an autopoietic system. As Margulis and Sagan point out, 'There is little doubt that the planetary patina – including ourselves – is autopoietic' (Margulis and Sagan 1986: 66).

Thus, the notion of autopoiesis is a very useful theoretical model to explain the internal organisation of an organism, to define the interactions between organisms of different complexity, to demonstrate the interconnection between the human body and mind, or to discuss the interactions between living and non-living systems. However, the notion of autopoiesis might have its limitations, especially when trying to explain the production of change. As Mark B. N. Hansen points out, 'autopoietic closure remains insufficiently dynamic to grapple with the basic operation of change that is everywhere at work in the world' (Hansen 2009: 116). If autopoietic systems constantly reproduce themselves, how can something new emerge or happen? And in what way can one autopoietic system interact with another autopoietic system? Donna J. Haraway (2016) proposed a productive notion of sympoiesis, which accounts for the interaction between living beings of different species. Félix Guattari (1993) argued that autopoiesis can be rethought as machinic heterogenesis, which could break operational closure by coupling autopoietic systems with allopoietic machines. The tension between operational closure in autopoietic systems and the need to go beyond this closure to incorporate heterogeneous collective systems will be discussed later in this book. At this point we can agree with Hansen's idea that the notion of closure, or boundary, might depend on the scale being explored (Hansen 2009: 117). In other words, the closure and openness of autopoietic systems should be differentiated at different scales: 'whereas autonomy of the living requires organizational closure, autonomy of psychic and collective beings requires openness to alterity' (Hansen 2009: 126). A human being is composed of different levels of autopoietic systems: according to Varela (1991), it is made of a cellular autopoietic system, an immunological autopoietic system, a cognitive autopoietic system, and at the same time it belongs to social assemblages. Thus, even if the notion of autopoiesis works perfectly well in examining cellular identity, at different scales, such as that of immunological or social identity, the notion of opera-

tional closure might be insufficient and require the invention of the idea of operational openness.

Organism-Oriented Ontology

At this point I would like to ask if the biological mode of existence can be defined in ontological terms? Is an organism just a domain of life, or is it an ontological mode of existence? Here I would like to propose a new concept of an organism-oriented ontology, which encompasses different threads coming from systems theory, the notion of autopoiesis, and the philosophy of biology, and relates them to actual and 'vital' ideas circulating in contemporary philosophy. An organism-oriented ontology pursues the Kantian idea that some characteristics defining living beings – organisms – might be helpful to reconceptualise ontology. In this respect, the notion of an organism-oriented ontology engages with the controversies concerning whether the living system is closed or open, whether it follows a certain teleology and purpose, or, on the contrary, is absolutely contingent and unpredictable. An organism-oriented ontology examines the relationships of continuity and discontinuity between different levels of a living system, and also between organisms of different complexity. It problematises the relationship between organisms and technological objects and extensions, asking to what extent these technological extensions can be seen as part of the organism. Paraphrasing Cary Wolfe's essay title 'What "The Animal" Can Teach "The Anthropocene"' (2020), I would like to ask what the organism can teach contemporary philosophy, and consequently, how the notion of the organic could help to resist recent challenges, such as climate change and the Anthropocene. On the other hand, I would like to ask whether some models of self-organisation and self-determination, specific to organisms, could be useful in resisting biopolitical power.

The notion of an organism-oriented ontology prioritises three main ideas: processuality, multiplicity and potentiality (the potential for qualitative change). In contrast to ontologies based on the priority of identity and substance, organism-oriented ontology examines organisms as developing, changing and evolving. This orientation towards processes follows Alfred North Whitehead's process philosophy, the notion of morphogenesis coming from Raymond Ruyer's philosophy of biology, and also from the notion of ontogenesis formulated by Gilbert Simondon. This means that instead of being instructed by some pre-existing form (as in the case of preformationism), or by a transcendent idea (as in the case of vitalism), the living being itself is inventing its immanent principles of self-organisation, self-generation and self-maintenance. For example, Simondon questions the idea of the bounded and pre-formed individual and proposes the theory of individuation, which examines both living and non-living beings from the perspective of permanent development. Similarly, Ruyer rejects the notion of preformationism and invents a new notion – that of a living