Vitalism:
Some Historical and Contemporary Issues

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1. Introduction

Vitalism, in a wide sense, is the thesis that life is originated, sustained, or characterized by a force, a property or trait that is independent of physical or chemical forces. This claim has at least two strands. The first one is that this fundamental trait intrinsic to living organisms is responsible for functions and activities in these organisms, such that those functions and activities are not the results of laws or properties from physics or chemistry. The second one is that these functions and activities cannot be explained by appealing to physical and chemical processes, but only by appealing to the idea that a distinct force is responsible for producing life as a phenomenon.

Like any concept, "vitalism" is used to describe several positions in philosophy and science. In this article, we present some of the main debates involving this concept, giving special emphasis on vitalistic approaches in the history of philosophy of biology from the beginning of the 20th century to our days.

2. Vitalism from the scientific revolution to the 19th century

2.1 Vitalism in modern science

Though some affirm that vitalistic views can be traced back to ancient natural philosophy,[1] vitalism is better understood as a view that emerged in the eighteenth century, in the origins of what we call modern science (Bechtel & Richardson, 1998). As a consequence of the mechanistic picture that emerged during the period of the Scientific Revolution and that was very influential throughout the following two

[1] See, for instance, Driesch (1914, p. 11-21).

centuries, some natural philosophers proposed that life could be explained by a similar sort of mechanicism. The most famous example is René Descartes, who proposed that living organisms could be compared to machines, where the only difference between organisms and human-made mechanical devices was the degree of complexity displayed by organisms (Chene, 2015). This mechanistic picture of life was sustained by Descartes' followers and other mechanicists like Hermann Helmholtz, Ernst Brücke, and Matthias Schleiden, culminating in Julien de La Mettrie, with his argument that human beings could be compared to complex machines (De La Mettrie, 1748), but including also physiologists from the 19th century, like Carl Ludwig, Julius Sachs, and Jacques Loeb (Mayr, 2010).

In this sense, vitalism can be seen both as an attempt to explain the distinctness of living organisms *per se* and as a reaction to mechanicism. Vitalism emerged, thus, when some natural philosophers started to propose several distinct hypotheses that could be unified around the idea that life had inherent "vital properties" that differ from the sort of properties inorganic objects display.

Among vitalists from the nineteenth century, there's the French anatomist Xavier Bichat, who identified different tissues in organisms and suggested that those tissues could not be decomposed into smaller parts. He also believed that such tissues could behave in ways that are contrary to physical and chemical processes, describing properties like "sensibility" and "contractility" hand in hand with physical properties, such as gravity and elasticity (Bichat, 1801), suggesting that they were fundamentally irreducible. Another example of vitalism in biology is that of François Magendie (1855), who also rejected mechanistic explanations of biological functions and held that physiological functions were beyond what could be explained in physical terms (Bechtel & Richardson, 1998).

A remarkable source of debates on vitalism in the nineteenth century is found in discussions about the nature of fermentation. Jacob Berzelius, for example, rejected the idea that there are special vital forces in living organisms, providing chemical explanations for fermentation. He did this under the assumption that fermentation is a chemical process, and it should be explained as such, wherever it occurs – either inside organisms or in the laboratory. The renowned chemist and microbiologist Louis Pasteur, in his turn, is often labeled as a vitalist, since he claimed that fermentation was a proper "vital action" and, for this reason, it could not be reduced to a chemical process; he said this because he noticed this phenomenon occurs only in presence of living cells, and he didn't find other explanations purely based on putative chemical reactions inside of cells compelling (Hein, 1961; Bechtel & Richardson, 1998).

2.2 Bergson's vitalism

Among philosophers, Henri Bergson is one of the most important vitalists around

the end of the nineteenth century and the beginning of the twentieth century.[2] In his book *Creative evolution* (1944/1907), Bergson argues that there must be a vital impulse (the *´elan vital*) that is common to all forms of life. This vital force or impulse, Bergson held, is responsible for the creation of all species. As a consequence, both mechanistic and traditional teleological approaches were, in his view, unable to account for changing and creativity, two characteristics necessary for evolution; Bergson advocated for a distinct form of finalism, compatible with the existence of the postulated vital impulse (Lawlor & Moulard-Leonard, 2021).

Bergson's work was read by philosophers of his time, and though biologists didn't take it seriously,[3] the term "*élan vital*" appears in many works in biology and philosophy of biology in the following decades, not only referring to Bergson's original idea, but often to label some vitalistic force, agency, or property behind living organisms. Some attempts to revitalize Bergson's ideas have been made in the last decades, particularly in continental philosophy; among them, Gilles Deleuze's *Bergsonism* (1991) presents a relevant approach.[4]

2.3 Driesch's neo-vitalism

The most influential biologist to defend vitalism at the beginning of the twentieth century is the embryologist Hans Driesch. As many have recognized, he argued for vitalism when most biologists had already rejected this perspective, the reason why he is frequently labeled as a "neo-vitalist". In fact, the influence of mechanicism in the life sciences, especially in embryology, was huge at that time, particularly due to the strong influence of *Entwicklungsmechanik*, a mechanistic program in embryology of which William Roux is the foremost representative. Driesch proposed that the adaptation of the embryo cannot be conceived in purely mechanistic terms, and this proposal was one of the first to refute Roux's program in the 1890s, opening the path to nonmechanistic approaches in embryology (Maienschein, 1991, p. 48-52).

Driesch's later contributions extrapolated developmental biology, motivating his philosophical work. Based on his experiments, he proposed that, behind living organisms, there was a living force, called *entelechy*, which would explain the seemingly anti mechanistic behavior in developing embryos, when they find balance

[2] Some argue Nietzsche would be a vitalist as well; see, for instance, (Lash, 2006). However, to the best of our knowledge, his contribution to the debate of vitalism in philosophy was not as influential as Bergson's.

[3] Hans Driesch, as we will see in the following, is an exception. According to Lille, Driesch referred to Bergson as the "biological philosopher" (Lillie, 1914, p. 840).

[4] See also Lash (2006) for some insights on how Bergson's vitalism can be applied to debates on the nature of information.

with the environment. The entelechy, though, would not be present only in embryos, but in all organisms (Driesch, 1908, 1914); furthermore, it would not violate any natural laws, since the force would be nontemporal, nonspatial, and nonpsychic (Nicholson & Gawne, 2015).

Despite his efforts to show how vitalism would be preferable in contrast to mechanicism, Driesch's work was taken more seriously than Bergson's by his peers, but it was also very criticized upon its publication, not only because of the still strong influence of mechanicism but because most biologists didn't think at that time that presupposing either Driesch's entelechy or Bergson's *´elan vital* would be relevant to their methodology (Schaxel, 1913; Lillie, 1914). But Driesch's contribution, as we will see, would be relevant as opposition to mechanicism in the philosophy of biology, and would be often taken as the paradigmatic example of vitalism in philosophical debates.

3. Vitalism in the philosophy of biology of the twentieth century

As we have seen, most biologists had already rejected vitalism as a scientific hypothesis by the beginning of the twentieth century. Nevertheless, two questions were still important in the philosophy of biology. The first one was a metaphysical question: what is the fundamental trait of living beings that allows us to draw the line between them and the inanimate world? And the second one was a methodological question: if biology is a distinct science (other than physics or chemistry), what makes it distinct? Those questions, as we have seen, pervade the whole history of the tension between vitalism and mechanicism. As we will see in this section, such questions also explain the emergence of organicism as a third option that recognized the pros and cons of both positions.

It is true, on the one hand, that vitalism had already been rejected as a scientific hypothesis a century ago; as Nicholson and Gawne point out, Driesch and Bergson were, in some sense, the last advocates "of a dying creed" that had been declining in influence since the mid-nineteenth century, explaining why Driesch's work from the beginning of the twentieth century is labeled as "neo-vitalism" (Nicholson & Gawne, 2015). On the other hand, philosophers still discussed their works to some extent. Driesch's concept of "entelechy" as the distinctive feature of life was used, for example, by James Johnstone, a philosopher of biology that stated organisms, when considered as a whole, provide disproof of mechanicism. He argued that it is possible to study organisms from a purely physicochemical point of view and that reductionism to organisms to physicochemical phenomena is possible for methodological reasons (for example, when scientists isolate parts of the organisms), but such approaches leave out something since organisms should be

considered as a whole.

Johnstone said this “something out” would be the entelechy, a form of an “elemental agency” that would be responsible for the “direction and coordination of energies”. Notice, however, that Johnstone stated that postulating the entelechy is needed because mechanicism fails, so the entelechy would be the agency responsible for acting in a direction contrary to that characteristic of inorganic processes (Johnstone, 1914). Johnstone’s work is criticized by Ralph Lillie in several ways. First, he rejected the idea that the entelechy would be able to allocate energy in ways that could violate the second law of thermodynamics. Second, he argued that the entelechy would act differently in distinct organisms was evidence that there would have no singular agency pervading all organisms; and finally, Lille just pointed out that there was a strong lack of unequivocal evidence for such a mysterious agency in the way postulated by Johnstone, and thus, his entelechy hypothesis should be rejected (Lillie, 1914).

But the fact is that Johnstone’s work is just an example of how vitalism was alive in the philosophical debate on the nature of organisms and the methods of study in biology, despite being a controversial thesis. In the last decade of the nineteenth century and in the first two decades of the twentieth century, we see many discussions on the topic in science journals, involving scientists and philosophers, mostly around Driesch’s work. Among these debates, there is an interesting exchange between the biologist William Ritter, the zoologist Herbert Jennings, and the philosopher Arthur Lovejoy, discussing several aspects of the vitalism/mechanicism controversy.

Ritter argued that both vitalism and “materialism” should be recognized only as “milestones along the road of progress”; both positions, he said, are partially true, and would be overcome in the future by some synthesis. As we will see in the next section, he was, in certain sense, correct; but part of the reason why Ritter said this is because he believed both vitalism and materialism were part of a tendency to find “mystical interpretations of the world which manifests itself among primitive peoples as fetishism, animism and magic” that persisted in biology (Ritter, 1911). Lovejoy, in response, conceded that one could assume an agnostic position in this debate since a unification between the positions was not possible yet, but replied that vitalism could not be considered as mysticism, but as true science. As he affirmed, “it seems to me that any dogmatic (i. e., not merely provisiorial or agnostic) antimechanism in biology should be called vitalism”. Furthermore, Lovejoy argued that Driesch’s vitalism had experimental evidence in favor of it, and distinguished his neo-vitalism from that of Bergson, who he considered a “radical vitalist” (Lovejoy, 1911b).

Jennings, in his turn, criticized Driesch, saying that his vitalism affects the scientific method, leading to experimental indeterminism. He argued that Driesch’s

vitalism entails that, the experimenter cannot say that a given arrangement of physical components will act in a certain definite way (even after you have observed how it acts) because distinct entelechies (or entelechies in different manifestations) would act in distinct ways. However, so he argued, that violates a fundamental principle of experimentation, according to which "when two cases differ in any respect there will always be found a preceding difference to which the present difference is (experimentally) due"; and since the entelechy would violate this postulate of causal closure in experimentation, Driesch's vitalism would be problematic (Jennings, 1911). In his answer, Lovejoy (1911a, p. 78) affirmed that Jennings's interpretation of Driesch's theory was misconceived and led to no indetermination, but Jennings replied by quoting his correspondence with Driesch, who recognized that he accepted "experimental indeterminism". In Driesch's own words,

> "A complete knowledge of all physicochemical things and relations (including possible relations) of a given system at the time physicochemical things and relations (including possible relations) of a given system at the time *t* gives *not* a complete characteristic of that system in the case that it is a living system." (Jennings, 1912, p. 435).

In synthesis, Jennings argued that Lovejoy's interpretation of Driesch was misleading, given that Driesch reaffirmed his idea that the entelechy would produce effects that are not purely physical.[5]

These debates between Ritter, Lovejoy, and Jennings are relevant in several ways. First of all, notice that, despite their disagreement on what fostered vitalism, both Ritter and Lovejoy agreed that neither vitalism nor mechanicism (or, as Ritter says, "materialism") would be enough to provide an account of biological phenomena. As we will see later in this section, they were in a certain sense anticipating the same conclusion advocated some years later by the organicists, who recognized the insufficiency of both vitalism and mechanicism. In addition, Lovejoy and Jennings's debate shows how Driesch's vitalism impacted the discussion on the methods of biology. Driesch assumed a position according to which organisms would violate physical causal determinism, settling the discussion in favor of Jennings. Of course, this does not solve the question of what, then, should be the method of biology, if organisms do not obey the same experimental laws of physics (even because, as we said, Driesch's vitalism was not being taken seriously by many biologists at that time), but it opens up the possibility of finding methodological principles that could account for life in different ways than those of mechanicism.

That does not mean, though, that vitalism was supported by most

[5] But Lovejoy later affirmed Jennings' interpretation of his letter is mistaken – he argued he never meant to say in his letter that Driesch's theory leads to no experimental indetermination (Lovejoy, 1912)

philosophers. For instance, the controversy between mechanicism and vitalism was discussed years later, in the 1918 Conference of the American Philosophical Association; as part of this Conference, a special edition of the *Philosophical Review* (Vol. 27, No. 6, Nov. 1918) was dedicated to this topic. In this volume, most contributions tend to criticize vitalism to some extent. For example, Lawrence Henderson affirmed that Driesch's "proof that mechanicism was not enough [...] is not of the character of scientific proof" (1918, p. 573). Herbert Jennings repeated his criticism of Driesch's vitalism, demanding that scientific accounts should follow the sort of "experimental determinism" in the way he had argued some years before. However, Jennings's contribution shows that mechanicism was not a consensus among the authors: he remained open to the idea that this experimental determinism "does not imply or oppose the 'autonomy' of different classes of phenomena", like organisms, and at the same time, affirmed mechanistic explanations would be also insufficient to account for experimental determinism, rejecting it should be "dogmatically accepted for biology" (Jennings, 1918, p. 592, 594596).

The point here is that, though vitalism was very controversial by that time, there are important debates about this topic around the beginning of the twentieth century. On the one hand, vitalism (especially that from Driesch) was being rejected by its peers, but on the other hand, it had something to say; if it didn't, it wouldn't be a matter of discussion in important journals and conferences, both in science and philosophy. In our understanding, vitalism served was at least as a provisional counterpoint to mechanicism. It is noteworthy that, according to John Needham, most biologists were mechanicists by the mid of the 1920s, (Needham, 1925), and some years before we wouldn't expect this to be different. Therefore, contrary to some narratives, it is not as if vitalism was just a "dying creed" that didn't play any role in the debate, but it was a position that, though not very accepted, helped philosophers and biologists see that mechanicism was also problematic.

A very different picture emerged around the end of the 1910s and throughout the 1920s, when some biologists and philosophers, including John Haldane, Edward Russell, Joseph Needham, Ludwig von Bertalanffy, and Joseph Woodger, started to argue that neither vitalism nor mechanicism was plausible options, opting for a third one, that came to be called *organicism*. Due to the polarized debate at that time, and the lack of alternatives to the two main options, some of them were considered vitalists by their peers – for example, Lillie (1914, p. 840) mentioned both Johnstone and Haldane as vitalists, though the label only applied to the former. Organicists believed that organisms should be the starting point of theorizing in biology and the point of integration of its theories. Though diverging in important matters, they agreed on the central thesis that organisms should be considered as complex systems that couldn't be explained by the analysis

of their parts (but without appealing to an additional "vital force") and that each part couldn't be understood in isolation concerning the whole. Needless to say, such methodological assumptions opposed both vitalism and mechanicism.

As Nicholson and Gawne (2015) affirm, vitalism was fully rejected in the 1920s as an important option among philosophers; organicism, in its turn, took the lead and determined the discussion in biology in the next decades. Furthermore, Nicholson and Gawne oppose a common narrative according to which the philosophy of biology was born just in the 1970s, when both vitalism and mechanicism/logical positivism were dead, by arguing that the group of organicists made important contributions to the philosophy of biology since that period, and those contributions are continuous with the discussions we find in the discipline nowadays. Without any doubt, their claim is precise, but to their description, we add that, even before organicists appeared, there were important debates in the vitalism *vs* mechanicism trench that cannot be ignored, since they are also continuous with the development of organicism as a plausible option, and, as such, are also continuous with debates in the field of philosophy of biology as we know today.

4. Contemporary issues

In its traditional form, vitalism is dead. However, some contemporary discussions in biology and the philosophy of biology seem to bring again this topic. Among them, we discuss here Lovelock's Gaia hypothesis and some recent proposals in the philosophy of biology, emphasizing Walsh's methodological vitalism. To say that these approaches can be considered forms of vitalism is, in some sense, anachronistic, and do justice neither to traditional vitalism nor such views. We think, however, there are important resonances between these contemporary issues and vitalism in its original historical context.

4.1 Lovelock's Gaia hypothesis

The *Gaia hypothesis* is the hypothesis developed by the independent scientist James Lovelock, according to which the Earth should not be considered just the environment where life appeared and developed, but should be taken as a fully integrated with the dynamics of the biosphere, such that life, in a relative sense, would be fully and systematically integrated with the planet as a whole. The Gaia hypothesis appeared explicitly when Lovelock and the biologist Lynn Margulis presented evidence for the idea that, since life appeared on Earth, the atmosphere has always been in homeostasis with life, even in periods of change. Far from being the result of mere chance, they argued, this is explained by the hypothesis that, when life appeared on the planet, it take control of the environmental conditions that would favor the development of life. They concluded that the Earth's atmosphere should be considered as a component of the biosphere, instead of just the

environment that provided conditions for the development of life (J. E. Lovelock & Margulis, 1974).[6]

In the following decades, Lovelock explored the Gaia hypothesis in detail, stating that the Earth should be considered to be alive, and providing evidence for and against this idea (J. Lovelock, 1988, 2000). This hypothesis suffered criticisms and modifications over the years but is discussed even nowadays as a plausible account in ecology, atmospheric sciences, and evolutionary biology. As Lovelock himself and others have argued (J. E. Lovelock, 1990; Lenton, 2003), self-regulation of Earth doesn't imply some sort of teleology (though initial formulations of the hypothesis had left this open to interpretations) and is compatible with natural selection as we understand it nowadays. Still, the Gaia hypothesis includes the thesis that life cannot be isolated and described just by stating the biochemical conditions within organisms; instead, life should be seen as fully integrated and harmonized with external forces, dynamics, and conditions. In this sense, we think, the Gaia hypothesis resembles the form of criticism that vitalists addressed to some mechanistic accounts of life, as we addressed in the previous section.

4.2 Recent works in the philosophy of biology

When it comes to recent contributions that establish connections with classical vitalism, there is what philosopher and biologist Denis Walsh calls *methodological vitalism* (Walsh, 2018). According to Walsh, this form of vitalism differs from the sort of ontological vitalism defended by Driesch, Bergson, and others. However, he says that's not the only sort of traditional vitalism: as he argues, E.C. Broad (with his "emergent vitalism"), E.S. Russell (one of the organicists), Claude Bernard, and Erwin Schrödinger, have all espoused the idea that living organisms engender distinct methods of study.

Walsh claims that the modern synthesis is a theory about the organisms as objects, and not as agents. However, organisms constitute an ontological category distinct from ordinary objects: they are agents, and as such, they are goal-directed, using means that conduce to the attainment of their goals, and dynamically interact with affordances (conditions that promote or impede the pursuance of their goals). But since agents play a role in evolution, Walsh affirms we have reasons to endorse a methodological vitalism – "the view that evolution should be studied from the perspective of the distinctive role that agents play in enacting evolution" (Walsh, 2018, p. 182).

Of course, Walsh's approach is so far different from classical vitalism; still,

[6] Lovelock also worked for NASA, aiming at finding extraterrestrial life. One of the best ways to find signs of life, in his view, would be to study atmospheric conditions, since signs like strongly non equilibrium composition of the atmosphere would be able to reveal the existence of life (Hitchcock & Lovelock, 1967; Connes et al., 1967).

we think there are at least two ways in which both views can be compared, respecting their historical contexts. First, like methodological vitalism, classical vitalism assumed that organisms are ontologically different from inorganic entities, and, as such, they require a distinct methodology. Second, both Walsh's methodological vitalism and classical vitalism would agree that vitalistic methodologies would be more complete than their alternatives. Both views agree that methodologies that don't recognize organisms have difference-making properties or traits would be incomplete; they would be able to treat them as objects for the sake of their theorizing but would leave outside their theories important elements that a vitalistic approach wouldn't (Driesch, 1908; Johnstone, 1914; Lillie, 1914).

Indeed, recent years have brought not only some new contributions to historical and philosophical perspectives on vitalism (Normandin & Wolfe, 2013) but even what arguably would be a contemporary version of the old debate between mechanicism and vitalism/organicism. Contributions like those from Walsh (2015, 2018), Nicholson (2010), Nicholson and Dupré (2018) tend to propose organisms as distinctive in scientific inquiry, while approaches like those from Bechtel (2013) and Baedke (2019) bring new challenges to those views. Far from being completely settled, the old controversy on whether organisms can be simply treated with the same tools as we deal with objects, machines, or inorganic matter or whether they have "something else" is perennial, and in some sense, is still alive in current debates.

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