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Article

Why Is Biological Teleology Non-constitutive (Merely Regulative) for Kant?

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Abstract:

There is no doubt that Kant assigns a merely regulative function to biological teleology. But the reasons for Kant's doing so are less clear. For some Kant scholars, Kant does so because, for him, the concept of natural purpose amounts at best to a subjective maxim of certain heuristic values. Appealing as it is, this view runs into difficulties when other Kant scholars note that Kant takes biological teleology to be indispensable and uses the natural purpose concept to identify biological organisms (or, more precisely speaking, formative powers). In this article, I argue that Kant treats biological teleology as non-constitutive (i.e., merely regulative), because the concept of natural purpose is not associated with any supporting laws (biological organisms as instances or *particulars* of the concept of natural purpose are given, but the concept itself as a *universal* is only assumed). Based on this new reading, I do four more things: first, I offer a revised interpretation of Kant's view of biological teleology; second, I clarify a Kantian stance on the concept of life; third, I solve a puzzle about the relationship between Kant, *Naturphilosophie* and the history of biology; fourth, I sketch some of its implications for three contemporary issues, vitalism, the mathematical approach to life, and the nature of life. For all these, I conclude that, despite tremendous achievements in biology, regarding the provision of a proper logical treatment of the concept of life, we still have much to learn from Kant.

Keywords: Kant; biological teleology; the regulative/constitutive distinction; life; vitalism

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Introduction

Kant's philosophy of biology has received much attention, and one central issue concerns his view of biological teleology. Kant deals with teleology, both biological and non-biological, in numerous writings. In the second half of *the Critique of the Power of Judgment* (2000), for instance, Kant submits biological teleology to a thorough examination. While Kant's discussion in the third *Critique* is notoriously complex, and Kant scholars are still debating over details, most of them have agreed on the following claim: For Kant, teleological judgments in biology are merely regulative rather than constitutive. Further, regarding the

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reasons why Kant does so, Kant scholars are often committed to the view that, because Kant takes teleological judgments in biology to be merely subjective (non-objective) maxims of only a heuristic (non-explanatory) or reflective (non-determinative) function. Admittedly, it is easy to find textual support for this view. In the third *Critique* Kant remarks several times that teleological principles in biology are merely "subjective" (e.g., 2000, 257, 5: 385-6), "heuristic" (e.g., 280, 5: 411-2) and belong only to the "reflecting… power of judgment" (e.g., 234, 5: 360-1).

Yet, in what sense is biological teleology heuristic and merely subjective for Kant? This character of Kant's biological teleology can be best illustrated through his concept of natural purpose. Indeed, while it is true that Kant attributes a heuristic function to natural purpose, through which he imposes a certain unity to the realm of biological organisms (organized beings in material nature, in Kant's terms), it is also essential to understand that, for Kant, natural purpose leads necessarily to a self-contradiction from the conceptual point of view. As has often been pointed out, Kant adopts strictly an intentional view of teleology and purpose, and he is also deeply committed to its analytical consequence that purposes cannot exist in (material, not mental) nature.[2] Hence for Kant, teleological judgments in biology are at best analogical to those genuine teleological judgments in the mental realm; as a result, the concept of natural purpose must be merely subjective, and natural purposes, as they are often called, cannot have objective existence in nature.

To put it more explicitly, the claim that Kant intends biological teleology to be regulative rather than constitutive consists of two sub-claims: for Kant, (1) biological teleology is regulative; (2) biological teleology is *non-constitutive* (in other words, *merely* regulative). In current Kant scholarship, the heuristic function of natural purpose is used to elucidate its regulative status; and speaking of the reasons for which biological teleology is non-constitutive, the focus is often on the supposedly non-objective (to speak differently, *merely* subjective) character of natural purpose. However, a recent interpretation adds some complexities to this widely received view. According to this interpretation, teleological judgments in biology are also indispensable for Kant, because Kant intends natural purpose to also serve an identificatory function, through which it helps pick up biological organisms, determine the subject matter of biological sciences, and constitute therefore the domain of biology. In consequence, continues this interpretation, natural purpose for Kant must be objective in the following sense: It refers to real objects in nature, that is, biological organisms.[3]

This interpretation can also find support from Kant's text, not only in several places where Kant mentions "objective and material purposiveness" (e.g., 2000, 239, 5: 366-7), but especially when he remarks that "organized beings… provide objective reality for the concept of an end that is not a practical end but an end of nature" (247, 5: 375-6). However, while this interpretation does touch upon subtleties within Kant's view of biological teleology (e.g., different senses of objectivity), it raises no fundamental challenge to the received view that Kant intends teleological judgments in biology to be merely subjective. To elaborate, for proponents of this interpretation, although Kant does allow the use of natural purpose to identify biological organisms, which are certainly objective, he denies that the concept of natural purpose can be used to objectively describe certain feature of biological

[2] In the preface of his *Metaphysical Foundations of Natural Sciences*, Kant makes it clear that "nature… has two principal parts, in accordance with the principal division of our senses, where the one contains the objects of the *outer* sense, the other the object of *inner* sense… where the first considers *extended* nature, the second *thinking* nature" (2002, 183, 4: 468).

[3] Recent scholars who support this interpretation include Quarfood (2004, 2006) and Van den Berg (2014, 2018). There are others who can be read as endorsing this interpretation (McFarland 1970, 114; McLaughlin 1990, 156-61; Steigerwald 2006; Cohen 2007; Zuckert 2007, 89-169; Breitenbach 2014; Huneman 2014; Nassar 2016).

organisms. To put it briefly, what concerns Kant is not the objectivity of biological organisms, but that of *biological organisms as natural purposes*. Therefore, although the new interpretation rightly emphasizes the identificatory function of Kant's biological teleology, the received view appears intact: Kant finds no objective counterparts for the concept of natural purpose in nature, so he attributes a non-constitutive status to biological teleology.[4]

However, does natural purpose, for Kant, really lack objective counterparts in nature (as I have explained, biological organisms do not count)? Anyone familiar with Kant's third *Critique* will not miss his intriguing concept of formative power: "The organized being possesses in itself a formative power, and indeed one that it communicates to the matter, which does not have it (it organizes the latter)" (2000, 246, 5: 375).[5] Then, given Kant's explicit assignment of non-mechanistic, formative powers to biological organisms, are these formative powers qualified to act as objective counterparts for natural purpose?[6] As a matter of fact, if a positive answer to this question is plausible, it will be impossible to maintain a non-constitutive status for biological teleology, by simply referring to its allegedly non-objective character.[7] However, to our disappointment, Kant scholars appear to avoid this question and continue labelling even the concept of formative power as merely regulative-understood as merely subjective-for Kant; but clearly, unlike that of natural purpose, formative powers are intended by Kant to have objective existence.[8]

Thus, in Kant's philosophy of biology, the non-constitutive status of biological teleology cannot be properly understood, by simply treating it as merely subjective and lacking objective counterparts; formative powers possessed by biological organisms are indeed plausible candidates. Now given Kant's insistence on assigning a merely regulative function to natural purpose, it is likely that the regulative/constitutive distinction has a

[4] This can be seen in the case of Quarfood (2006). At the start, he appears too radical in the eyes of Kant scholars when he starts by claiming that Kant "seems to treat teleology as constitutive condition for biology", at least "on the object level of biological science" (735). But this radical position is only apparent, because later in the same article Quarfood admits that his interpretation of Kant is "somewhat reconstructive" (736), and that, more importantly, his use of the notion of constitutivity "deviate(s) from Kant's usage" (744). In my view, Quarfood is better read as suggesting a new definition for constitutivity *in the name of Kant*: being a constitutive principle = possessing an identificatory function. Despite this, he is still committed to the view that, at least for Kant himself, biological teleology is still non-constitutive, for its lack of objective counterparts in nature. Quarfood's decision to distance Kant's (regulative) biological teleology from (constitutive) vitalism (743) aligns with the commonly accepted perspective, attesting further to his rather non-radical commitment.

[5] In a later passage when commenting on Blumenbach's theory of epigenesis, Kant follows Blumenbach's terminology and opts for the phrase "formative drive" to name this distinctive character of organisms, in contrast to "merely mechanical formative power" (2000, 292-3, 5: 424-5).

[6] It should be noted here that Kant also has a different concept to treat this issue, given his explicit remark that "only then and on that account can such a product, as an organized and self-organizing being, be called a natural end" (2000, 235, 5: 374-5). Clearly, biological organisms are organized beings; now as they can be further judged through the concept of natural purpose, it is plausible that the self-organizing aspect of them (self-organizing beings) can also be treated as the objective counterpart of natural purpose. Note that instruments of art (like a watch) are also organized beings, but they are not natural purposes exactly because they are not self-organized beings because they are organized from outside by intentional agents. Finally, it should also be warned that Kant in most parts of the third *Critique* simply equates "biological organisms" with "organized beings", but what he means is that biological organisms are identical to organized beings *in material nature*.

[7] Some scholars have acutely grasped this tendency of Kant towards what they call (constitutive) vitalism (Zumbach 1984, 79-86; Ginsborg 2004).

[8] Most scholars focus on natural purpose, but some do discuss formative power. The latter include Zammito (2006, 2012, 2018), Richards (2000, 2002) and Van den Berg (2014, 122-7). Two contradictory claims from Van den Berg are particularly revealing: he first claims that "ontological appeal to vital forces [formative powers] is largely absent in the writings of Kant" (122); but subsequently he claims that "Kant… accepts its [vital force's] existence" (127).

difference sense for him, in the context of biological teleology. The goal of this present article, then, is to make this sense clear. Regarding the question why biological teleology is non-constitutive for Kant, my answer appeals primarily to its non-explanatory (or *merely* heuristic) or non-determinative (or *merely* reflective) status. Some might find nothing new in my reading; yet I claim that my reading relies on a hitherto little noticed sense of being non-constitutive for Kant, that is, being non-constitutive due to the lack of supporting laws.[9] Under this reading, the concept of natural purpose and that of formative power could be treated as equally regulative, and they turn out to be even synonymous for Kant.

More specifically, the main thesis of this article is that Kant treats biological teleology as non-constitutive, because the concept of natural purpose is not associated with any supporting laws (section "Being non-constitutive due to the lack of supporting laws"). Meanwhile, after highlighting the significance of supporting laws in making constitutive principles, the present article aims to do four more things: First, it offers a revised interpretation of Kant's view of biological teleology (section "Kant's view of biological teleology: a revised interpretation"); second, it clarifies a Kantian stance on the concept of life (section "A Kantian stance on the concept of life"); third, it suggests a new solution to a controversy related to Kant, *Naturphilosophie*, and the history of biology (section "Kant, *Naturphilosophie*, and the history of biology"); fourth, it sketches some implications of my new reading of Kant for three contemporary issues, vitalism, the mathematical approach to life, and the nature of life (section "Some implications for contemporary issues"). This article concludes by addressing in general the contemporary relevance of Kant's view of biological teleology.

Being Non-constitutive Due to the Lack of Supporting Laws

As pointed out above, for Kant, biological teleology has an identificatory function. This function of identifying biological organisms is in a way fundamental because it helps determine the subject matter of biological sciences and constitute thereafter the domain of biology. Yet, Kant himself still declines to assign biological teleology a constitutive function. The reason, as this section will argue, is that Kant (correctly) understands that the concept of natural purpose is not associated with supporting laws and lacks therefore explanatory power.

To start, it is useful to revisit a distinction made by Kant for two types of judgments. In the third *Critique*, in several places Kant contrast explicitly reflective (heuristic) judgments against determinative (explanatory) ones. Here are two examples:

> The power of judgment in general is the faculty for thinking of the particular as contained under the universal. If the universal (the rule, the principle, the law) is given, then the power of judgment, which subsumes the particular under it (even when, as a transcendental power of judgment, it provides the conditions *a priori* in accordance with which along anything can be subsumed under that universal), is determining. If, however, only the particular is given, for which the universal is to be found, then the power of judgment is merely reflecting. (2000, 66-7, 5: 180)
>
> The determining power of judgment by itself has no principles that ground concepts of objects. It is no autonomy, for it merely subsumes under given laws or concepts as principles… But the reflecting power of judgment is supposed to subsume under a law that is not yet given and which is in fact only a principle for reflection on objects for which we are objectively entirely lacking a law or a concept of the object that would be adequate as a principle for the cases that come before us. (2000, 257, 5: 386)

[9] This reading can find some hints in Van den Berg (2014), who is aware of Kant's acceptance of vital force [formative power] and rightly comments that "the concept of a vital force does not have a significant function in the third *Critique*" (127).

These two passages show clearly that one decisive difference between reflective and determinative judgments is that, in the latter, universals that are to subsume particulars through laws are already *given*, while in the former, they are merely *assumed*.[10]

Moreover, it is also well known that Kant writes in several passages that biological teleology only serves reflective rather than determinative functions. Here are some examples:

> It is self-evident that this [the concept of natural purpose] is not a principle for the determining but only for the reflecting power of judgment, that it is regulative and not constitutive… (2000, 250, 5: 380)
> …this [fundamental principle of teleology] is only a maxim of reflecting, not of the determining power of judgment, and hence is valid only subjectively for us, not objectively for the possibility of this sort of thing itself… (2000, 282, 5: 414)

These two passages show convincingly that Kant does relate the reflective/determinative distinction, hence also the heuristic/explanatory distinction, to the regulative/constitutive distinction, and finally the subjective/objective distinction, and I will consider in detail the complex relations between these distinctions in next section. Now it suffices to note that, for Kant, teleological judgments in biology are non-determinative. Further, as the decisive difference between reflective and determinative judgments concerns the availability of universals and laws, the concept of natural purpose, although identifying biological organisms as particulars, must be a problematic universal. The chief reason is that natural purpose possesses no supporting laws, without which the determination of particulars through universals simply cannot start.

The above elucidation is a bit abstract, but it can be better understood through a more concrete example, namely, Kant's analogy between natural purpose and intentional purpose. As a matter of fact, as several scholars have noted (Breitenbach 2014; Van den Berg 2018; Nassar 2016), Kant provides an essentially analogical reflection of biological teleology, by referring to intentional teleology. Here what is of particular interest to us is that Kant also develops an example to illustrate the reflective/determinative distinction based on this analogy. Kant states that intentional purpose, which is outside material nature, yields determinative judgments. On this he writes:

> For the thing itself is an end, and is thus comprehended under a concept or an idea that must determine a priori everything that is to be contained in it. But insofar as a thing is conceived of as possible only in this way it is merely a work of art, i.e., the product of a rational cause distinct from the matter (the parts), the causality of which (in the production and combination of the parts) is determined through its idea of a whole that is thereby possible (thus not through nature outside of it). (2000, 245, 5: 374)

For Kant, intentional purpose can be understood as associated with a set of supporting laws, which state the consequences (products of art) of rational/psychological causes (ideas). In this case, the idea of an art product is the universal, from which there come out particular art products. Thus, according to Kant, intentional purpose does give rise to "a constitutive

[10] In point of fact, the two types of judgments correspond to two uses of reason: determinative judgments are reminiscent of "the 'apodictic' use of reason", in which "the universal is in itself certain and given, and only judgment is required for subsuming, and the particular is necessarily determined through it"; reflective judgments take us to "the 'hypothetical' use of reason", in which "the universal is assumed only problematically… the particular being certain while the universality of the rule for this consequent is still a problem" (1998, 592, A647/B675).

principle for the derivation of its products from their causes" (2000, 234, 5: 361).[11] In contrast, natural purpose does not achieve any of these. Although the idea of natural purpose is borrowed from that of intentional purpose through an analogy, it is restricted to nature and lacks supporting laws associated with the latter. As a result, natural purpose serves only a reflective function: While it does help judge biological organisms as natural purposes, it lacks supporting laws stating the reasons for which biological organisms are natural purposes. For this reason, indeed, Kant even goes further to declare that natural purpose is "inexplicable" and "a dogmatic [determinative] treatment" of it is impossible (2000, 266-8, 5: 395-8).

Perhaps an even more illuminating illustration can be found in an example that has not been mentioned by Kant in the third *Critique*. This example concerns Kant's concept of attractive force, which is an essential constitute of his dynamic concept of matter and whose determination relies fundamentally on, according to Kant, the law of universal gravitation. While it is impossible to present any details here, it suffices to note that the concept of attractive force, as a universal, does support determinative judgments made in respect to particular material substances through the law of universal gravitation. For this supporting law, Kant takes the concept of attractive force as well as the dynamic concept of matter to be playing constitutive roles (Friedman 1992a, b, 2013).

It is fundamental to understand that the law of universal gravitation is an empirical law of nature: It does not come solely from principles of understanding or reason, but is partly inferred from data of experience in empirical research. Here reflective judgments also come into play. To put it briefly, in early empirical research (by natural philosophers before Newton), reflective judgments start from particulars (planetary motions), and connect such particulars, although only hypothetically, to certain universals (the concept of attractive force and the dynamic concept of matter). But as empirical research makes progress, subsequent results show that these universals can be precisely demonstrated through supporting laws (the law of universal gravitation). With these laws, in consequence, the concept of attractive force as well as the dynamic concept of matter are capable of supporting determinative judgments regarding material substances in general.

Finally, it should be noted that in the history of science the concept of attractive force can also be understood as borrowed from the concept of intentional purpose through an analogy. Evidence shows that Newton was not entirely free from the influence of this analogy, when he wrote in *General Scholium* (2009) that "a certain most subtle Spirit...pervades and lies hid in all gross bodies" (more generally, see Yolton 1984). However, thanks to the efforts of Newton and other natural philosophers, attractive force-understood as gravity-moved beyond its analogical status and became a precise concept useful to study the motion of planetary objects. This conceptual evolution was clearly driven by the formulation of the law of universal gravitation. Applying Kant's regulative/constitutive distinction, we might claim that attractive force evolved from a regulative idea to a constitutive principle.

I hope these comparisons are illuminating. In the cases of intentional purpose and attractive force, supporting laws, although empirical in nature, can be treated as given, at least in Kant's time; as a result, they serve explanatory functions through determinative judgments, and yield therefore constitutive principles for Kant. By contrast, natural purpose is simply incapable of yielding supporting laws, here, in relation to biological organisms; in consequence, even though natural purpose helps identify biological organisms reflectively, it has no genuine explanatory power, so Kant assigns it a merely regulative function. In a revealing contrast to attractive force, in Kant's time the concept of natural purpose failed to move beyond its analogical status (and still has not done so, even in our time).

[11] According to Allison (1992), this is a "psychological explanation, in which the causes are non-material and 'internal'" (26); however, it still "falls within the scope of mechanism in the extended sense [which] is equivalent to the transcendental principle of causality…" (27).

In summary, while Kant is of course aware of the identificatory function of biological teleology, he is also and perhaps more concerned with its explanatory role in science. In this respect, the concept of natural purpose falls short than those of attractive force and intentional purpose, due to the lack of supporting laws. I believe that this is the reason why Kant puts the following passage in the third *Critique*:

> Strictly speaking, positing ends of nature in its products, insofar as it constitutes a system in accordance with teleological concepts, belongs only to the description of nature, which is composed in accordance with a particular guideline, in which reason certainly plays a role that is magnificently instructive and purposive in many respects, but in which it provides no information at all about the origination and the inner possibility of these forms, although it is that with which theoretical natural science is properly concerned. (2000, 286, 5: 417)

Kant's View of Biological Teleology: A Revised Interpretation

The previous section highlights the significance of supporting laws for making constitutive principles. The lack of supporting laws is perhaps one of the most important reasons for Kant's not granting biological teleology a constitutive status. Further, the reflective/determinative and heuristic/explanatory distinctions seem to be in a better place to ground the regulative/constitutive distinction. However, as mentioned above, Kant also relates the subjective/objective distinction to previous distinctions; then, what roles does the subjective/objective distinction play for Kant? As mentioned above, there are different levels of objectivity, and now this can be articulated in my revised interpretation of Kant's view of biological teleology.

> This interpretation can be conveyed through the interpretive spectrum presented in Figure 1. In this spectrum there are three basic units. On the right end lie purely explanatory concepts (like attractive force and intentional purpose), which, as elucidated above, are capable of yielding determinative judgments through supporting laws. In contrast to this unit, the other two contain non-explanatory concepts (including natural purpose), which can only support reflective judgments as heuristic tools. Through this contrast, indeed, the reflective/determinative, heuristic/explanatory, and finally regulative/constitutive distinctions can be drawn in a clear way.

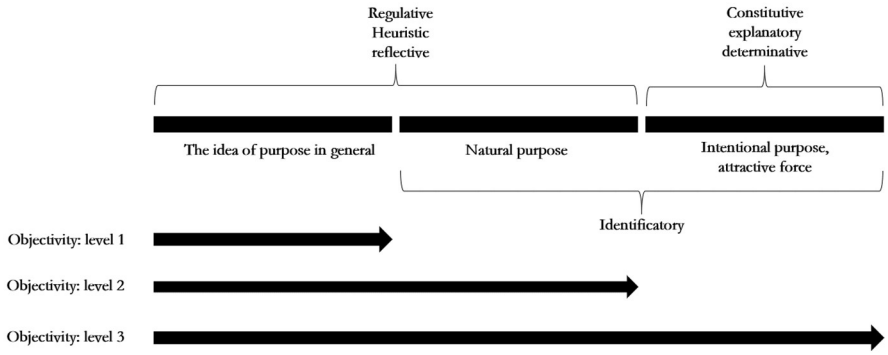

Figure 1

The specificity of biological teleology is also relevant to the difference between the left unit and the other two on the right. In this spectrum the concept of natural purpose is placed in the central unit; by contrast, for instance, the idea of purpose applicable to all objects in nature and finally nature as a whole belongs to the left unit. As is well known in Kant scholarship, this idea of purpose in general, along with other similar ideas of reason (the unity and systematicity of nature, God, etc.) is often treated as purely regulative, only for reflective and heuristic uses; at best, reason only uses them to indicate certain unity and systematicity for nature, which can never be empirically realized and lacks objective counterparts in nature. Now, through the two different types of teleology, the essential distinction between the left and the central units can be clearly seen, in relation to, as a matter of fact, the identificatory function of biological teleology: Although both of them are for reflective and heuristic uses, the concept of natural purpose identifies a set of specific objects in nature, that is, biological organisms; whereas the idea of purpose in general simply fails to do so. Kant himself is clearly aware of this difference when he writes:

> They concern ideas for which no appropriate objects can be given in experience, and which could therefore serve only as regulative principles in the pursuit of experience. It is the same with the concept of a natural end, as far as the cause of the possibility of such a predicate is concerned, which can only lie in the idea; but the consequence that answers to it (the product) is still given in nature, and the concept of a causality of the latter, as a being acting in accordance with ends, seems to make the idea of a natural end into a constitutive principle of nature; and in this it differs from all other ideas. (2000, 274-5, 5: 405-6)[12]

Why is natural purpose different from other ideas of reason for Kant? Exactly for its identificatory function: "the consequence that answers to it (the product) is still given in nature".[13]

In summary, through this three-fold interpretative spectrum, the specificity of biological teleology can be better grasped. The concept of natural purpose lies in the central unit: compared to attractive force and intentional purpose on the right, it is not constitutive,

[12] This passage actually has rich interpretative implications. For instance, when Kant claims that "the idea of natural end" seems to be made "into a constitutive principle of nature", he appears generous enough to call the identificatory function of biological teleology "constitutive", as a contrast to "other [purely regulative] ideas" of reason. So, Quarfood (2006) appears to make a reasonable suggestion that sometimes "Kant seems to treat teleology as a constitutive condition for biology" (735), although he does not really argue for it with textual evidence. Yet, even if Kant grants a constitutive-understood as identificatory-role to biological teleology, this does not affect the main thesis of this article: for Kant, natural purpose is merely regulative due to its lack of supporting laws. In other words, there might be two different senses of constitutivity for Kant. Then, it is not surprising at all that Kant accepts a principle as both regulative and constitutive (for different reasons). as Friedman (1992a, b) shows convincingly, for Kant (1998, 602, A664/B692), while categories of understanding are undoubtedly constitutive with respect to experience, they are also regulative with respect to intuition, since, unlike mathematical principles (which are constitutive with respect to intuition), they are not directly demonstratable. For a similar complication regarding the practical use of reason, see Makkreel (1991) and Kant (2000, 322, 5: 457-8).

[13] On this, McFarland (1970) remarks that "although the principle that everything in nature is good for something or other is simply heuristic or regulative for Kant, its regulative status is different from that of the principle that we must estimate everything in an organism to have a purpose. For he has already told us that we *must* estimate organisms in this way, since, if we do not, we will miss what is essential about their organic nature" (113). McLaughlin (1990) similarly notes that "such teleological principles [in general] occasion no further difficulties since they are merely pragmatic maxims without any compulsory or binding character. Only the concept of natural purpose, only the intrinsic purposiveness is not purely voluntary and must necessarily be assumed" (52).

because it possesses no explanatory power due to the lack of supporting laws; but compared to those equally regulative ideas on the left, which refers to nothing particular in nature, it uniquely identifies a set of specific objects.[14]

> Finally, this interpretative spectrum is also useful to make sense of the subjective/objective distinction. To start, ideas and concepts and principles in the three units, compared to purely subjective fantasies, are all objective in the following sense: they are all related to nature (although by different means). Those in the right unit, like intentional purpose and attractive force, are objective in the strongest sense (level 3), because they not only identify specific objects in nature, but do this through determinative judgments supported by laws. On the other extreme, those in the left unit, like the idea of purpose applied to all objects in nature and nature as a whole, are objective in the weakest sense (level 1), for that they do not even identify specific objects and suggest at best a goal (unity and systematicity) for our knowledge about nature to achieve. In comparison, those in the central unit, natural purpose as a representative, possess a sense of objectivity that stands in-between: it helps identify specific objects, but only through reflective judgments due to the lack of supporting laws (level 2).

A Kantian Stance on the Concept of Life

In previous two sections I have presented a hitherto little noticed sense of being non-constitutive for Kant, and I have shown that, through this sense, Kant rightly detects the difference between the concept of natural purpose on the one hand, and the concepts of attractive force and intentional purpose on the other. Indeed, partly due to the lack of supporting laws, natural purpose is deemed by Kant to be inexplicable. In the third *Critique*, interestingly, Kant also considers two related concepts, that is, formative power and original organization, to be "inscrutable". As will become clear, Kant's formative power, natural purpose and original organization are best understood as the same thing, that is, what we call by life today.[15] Now, this section clarifies a Kantian stance on life, with comparisons to both matter and mind.

To start, again, as pointed out above, Kant treats natural purpose as analogical to intentional purpose; meanwhile, in the late eighteenth century, Newtonian analogies that refer to attractive force were popular in treating biological organisms (Wolfe 2014). However, in the third *Critique* Kant not only rejects such Newtonian analogies, but also finds even intentional analogies unsatisfying. He maintains that natural purposes are "thinkable and explicable", neither "in accordance with any analogy to any physical, i.e., natural capacity that is known to us", nor "through an exact analogy with human art" (2000, 247, 5: 376). So,

[14] When interpreting Kant's view of biological teleology, scholars also claim that teleological judgments in biology are descriptive, and they often simply equate "descriptive" with "heuristic" (Zammito 2006; Kant 2000, 286, 5: 417). Now given the identificatory function which distinguishes biological teleology from other equally heuristic ideas of reason, it seems better to distance the descriptive role of natural purpose from its heuristic role, as the former must be related to ("describe") existent objects in nature.

[15] Apparently, Kant takes formative power to be mere "analogue of life", not life itself. But in my view, this is only a verbal difference. The standard definition for life can be found in *Metaphysical Foundations of Natural Sciences*: "life is the faculty of a substance to determine itself to act from an internal principle… desiring… thinking… willing" (2002, 251-2, 4: 544-5; also see *Critique of Practical Reason*, 1996, 144, 5: 9-10). Clearly, this definition of life applies more to animals rather than plants. However, in *Opus Postumum* Kant also uses the concept of life in a way similar to ours, "all organic beings… are beings in which there is life" (1993, 197, 22: 99-100). Discussions of Kant's conception of life are available in Ingensiep (2006), Molina (2010) and Van den Berg (2014, 236-9).

it turns out that Kant dismisses both mechanistic and intentional routes as inadequate in conveying a proper understanding of natural purpose. On this Kant writes:

> An organized being is… not a mere machine, for that has only a motive power, while the organized being possesses in itself a formative power, and indeed one that it communicates to the matter, which does not have it (it organizes the latter): thus it has a self-propagating formative power, which cannot be explained through the capacity for movement alone (that is, mechanism).
> One says far too little about nature and its capacity in organized products if one calls this an analogue of art: for in that case one conceives of the artist (a rational being) outside of it. Rather, it organizes itself, and in every species of its organized products, of course in accordance with some examples in the whole, but also with appropriate deviations, which are required in the circumstances for self-preservation. (2000, 246, 5: 375)

Clearly, Kant terms this property, which is neither mechanistic nor mentalistic, "self-propagating formative power", which belongs uniquely to biological organisms. Here follows that, for Kant, the concept of formative power can be used to describe certain character possessed by biological organisms. As a result, such powers can be treated as objective counterparts of the concept of natural purpose. Indeed, formative power is not unlike attractive force, especially when the latter was not associated with supporting law of universal gravitation before Newton.

However, little difference is made by suggesting objective counterparts of natural purpose. On this point Kant writes:

> Perhaps one comes closer to this inscrutable property [formative power] if one calls it an analogue of life: but then one must either endow matter as mere matter with a property (hylozoism) that contradicts its essence, or else associate with it an alien principle standing in communion with it (a soul), in which case, however, if such a product is to be a product of nature, organized matter as an instrument of that soul is already presupposed, and thus makes that product not the least more comprehensible, or else the soul is made into an artificer of this structure, and the product must be withdrawn from (corporeal) nature. Strictly speaking, the organization of nature is therefore not analogous with any causality that we know. (2000, 246, 5: 375)

In this passage, Kant elaborates the contradictions of treating formative power as either a material (leading to hylozoism[16]) or a mental property (withdrawn from corporeal nature), and he finds this concept ultimately "inscrutable": "Strictly speaking, the organization of nature is therefore not analogous with any causality that we know". Recall that Kant also remarks on "the inexplicability" (266-8, 5: 395-8) of natural purpose, due to its lack of similar laws associated with intentional purpose; here I claim that the "inscrutable" nature of formative power can be understood in the same way, but perhaps better by referring to attractive force. Attractive force has left its analogical status and grown to be a constitutive

[16] Kant's famous denial of hylozoism, i.e., the possibility of living matter, is often misunderstood. By this, Kant is not suggesting that objects conventionally treated material (like biological organisms) cannot be alive; rather, objects can be material and alive at the same time, but the two aspects (matter and life) need to be strictly separated, from the conceptual point of view. On this Kant writes in a note, "that matter is lifeless is a rational and not an empirical judgment, because although one perceives much life in matter, one distinguishes this from material properties" (2005, 96, 17: 348-9). For a further articulation of Kant's denial of hylozoism, refer later to Niels Bohr's discussion of life.

principle, but formative power has not done so. To put it more explicitly, both natural purpose and formative power lack supporting laws and are thus similarly non-constitutive. It is partly for this reason that, I believe, Kant deems them to be "inexplicable" or "inscrutable".

Even more interestingly, in addition to formative power, Kant also advances another "inscrutable principle of an original organization" (2000, 292, 5: 424-5), which "uses that mechanism itself in order to produce other organized forms or to develop its own into new configurations" (287, 5: 418-9). Clearly Kant relates the concept of original organization more to what we call biological evolution today. Yet, since this original organization "purposively aimed at all these creatures" (288, 5: 419-20), it only makes Kant even more perplexed, for that now he has to deal with all forms of biological organisms rather than a single one form! In summary, to treat (certain aspect of) biological organisms, Kant has many conceptual tools, like natural purpose, formative power, original organization, but ultimately, he finds all of them inexplicable and inscrutable. Their inexplicability and inscrutability, in my view, only take us to what we call the mystery of life today.

In the late eighteenth century Kant was familiar with popular evolutionary speculations in his time. Indeed, Kant himself offers his own version in the third *Critique*, by placing material, living and mental beings in a single (logical, perhaps not actual) evolutionary scheme:

> This analogy of forms, insofar as in spite of all the differences it seems to have been generated in accordance with a common prototype, strengthens the suspicion of a real kinship among them in their generation from a common proto-mother, through the gradual approach of one animal genus to the other, from that in which the principle of ends seems best confirmed, namely human beings, down to polyps, and from this even further to mosses and lichens, and finally to the lowest level of nature that we can observe, that of raw matter: from which, and from its forces governed by mechanical laws (like those which are at work in its production of crystals), the entire technique of nature, which is so incomprehensible to us in organized beings that we believe ourselves compelled to conceive of another [teleological] principle for them, seems to derive. (2000, 287, 5: 419)

In this passage, Kant notes that mechanistic principles operate for the material realm and teleological principles are best confirmed in the mental realm (namely, human beings), and these two types of constitutive principles are uncontroversial. Then he also notes that living beings (polyps, mosses and lichens) lie somewhere in between: maybe "higher" forms of matter (even "higher" than crystals), or "lower" forms of mind (not as purposive as human beings)? But for Kant, these speculations only strengthen the mystery of life: Even though life apparently stands between matter and mind, neither mechanism nor (intentional) teleology is able to make full sense of it. As a result, regarding biological organisms which are instances or particulars of life, Kant can only request that mechanistic explanations must be pursued as far as one can, yet the remaining aspect, that is, the living aspect, can only be judged through teleological principles in analogy to mind.

> Finally, it must be noted that, although Kant is puzzled by the mystery of life, he does not question its objectivity (recall the identificatory function of natural purpose). For Kant, life is still more objective than, for instance, the notion of God (as the ultimate purpose of all things in nature and nature as a whole), because in the very least it helps identify biological organisms. Yet, due to a lack of supporting laws as constitutive principles, the concept of life cannot attain the level of objective reality possessed by matter and mind. In summary, perhaps we can speak for Kant that, concerning life, (1) its existence is well confirmed since some objects in nature are unquestionably alive, (2) but little knowledge has been attained about it, due to the lack of supporting laws.

As a result, other than being puzzled by the mystery of life, what Kant can do is merely to coin new terms for it in different heuristic agendas: Natural purpose as analogous to, but still different from intentional purpose, formative power only to be distinguished from mechanistic power (attractive force, for instance), and original organization to treat all forms of biological organisms.

Kant, *Naturphilosophie*, and the History of Biology

Historians and philosophers of biology have long been debating over Kant's influence on the history of biology, especially in comparison to that of later *Naturphilosophie*. A representative issue in this debate concerns the relationship between Kant and Johann Friedrich Blumenbach, a great physiologist and anthropologist contemporary to Kant. On these there are two conflicting standpoints. The first is articulated by Timothy Lenoir (1982), who argues that the German history of biology after Kant largely followed his "teleomechanism" research program. In particular, Lenoir takes Blumenbach to be perhaps the most important among first-generation biologists who followed the teaching of Kant. But Robert Richards (2002), Gambarotto (2018) and John Zammito (2018) strongly disagree with Lenoir. For them, it is subsequent philosophers of nature such as Schelling, rather than Kant, that decisively shaped the science of biology from the philosophical perspective, and Kant's philosophy of biology acted more like an obstacle to the development of biology. Their contention relies on a particular interpretation of Kant's view of biological teleology. For them, Kant's mistake lied in his treating natural purpose as merely regulative (understood as lacking objective counterparts) and finally inexplicable; in doing this, Kant simply denied the objectivity of biological organisms and therefore also the possibility of a science of biology. In sharp contrast, these scholars continue, subsequent philosophers of nature correctly endorsed biological teleology as a constitutive principle, confirmed thereby the objectivity of organisms, and finally rendered a science of organisms possible. Accordingly, Blumenbach is interpreted by them as more influenced by *Naturphilosophie* rather than Kant. For evidence they refer to Blumenbach's physiological text, in which he clearly treated vital force as constitutive. For all these, Lenoir is blamed for his mistaking Kant's regulative treatment of biological teleology as a constitutive one.

Yet, if my revised interpretation of Kant's view of biological teleology is correct, this debate suffers from its failure in distinguishing different levels of objectivity. To me Van den Berg (2014)'s attempt to solve this debate represent an important advancement, in his use of the identificatory function assigned by Kant to biological teleology. In fact, Van den Berg strikes a balance between the two conflicting standpoints, although in more favor of Lenoir's. For Van den Berg, given Kant's acknowledgment of the identificatory function of biological teleology, obviously he cannot deny the objectivity of biological organisms. Moreover, Van den Berg tries to do justice to Kant and he notes that, by the inexplicability of natural purpose, Kant does not maintain that organisms are in general inexplicable; rather, he is puzzled by the applicability of natural purpose to living organisms. According to Van den Berg, for Kant, most aspects of biological organisms are-and can only be assumed-mechanically explicable, and the correct method of doing biology is to submit mechanism to teleology. Van den berg is largely in agreement with Lenoir, although the latter, for Van den Berg, pays insufficient attention to the difference between Kant's regulative treatment of biological teleology and the latter's essentially constitutive reception by later philosophers and biologists.

I believe that Van den Berg's solution is correct in general. On the one hand, he does justice to Richards and Zammito, by confirming that subsequent philosophers and biologists, who, unlike Kant, intended a constitutive status for biological teleology; on the other hand, he reads Lenoir sympathetically and recognizes Kant's contribution to the emergence of a

new science of biology, despite Kant's regulative treatment of biological teleology. However, if my revised interpretation presented above is correct, Van den Berg, like many others, appears to misunderstand the scientific reason behind Kant's insistence on a merely regulative treatment, that is, the concept of natural purpose lacks supporting laws.

Further, I would even claim that biologists after Kant, like Blumenbach, despite their empirical achievements, would be simply mistaken in treating biological teleology as constitutive, if Kant's criterion of having supporting laws were presupposed. Let us make a closer comparison between Kant and Blumenbach. When Kant mentioned his vital force (formative power), he did relate it to typical biological phenomena like development ("an organ that produces the other parts", 2000, 245, 5: 374-5), reproduction ("one… produce(s) another", 246, 5: 374-5) and regeneration ("replace parts that have been taken from it", 246, 5: 374-5). However, he did not think that this concept helps explain these phenomena; at best, the relationship between vital force and these phenomena is regulative, and it has not reached a constitutive status. In contrast, Blumenbach envisaged an ambitious function for vital force (or formative drive) and he intended a unified theory of life through it ("one of the first causes of all generation, nutrition, and reproduction", Blumenbach 1781, quoted from Richards 2000, 18). For this, Richards, Zammito and Van den Berg have rightly maintained that Blumenbach wanted a constitutive vitalism.

Yet, for Kant, Blumenbach would be simply wrong in claiming a constitutive vitalism. To see this, Blumenbach's appeal to attractive force in the material realm is particularly illuminating. He wrote:

> I hope it will be superfluous to remind most readers that the word *Bildungstrieb*, like the words attraction, gravity, etc. should serve, no more and no less, to signify a power whose constant effect is recognized from experience… (Blumenbach 1789, quoted from Richards 2000, 24)

But the problem is that, unlike attraction and gravity, vital force yields no constant effect at all! And this is because, according to Kant, whereas attractive force is supported by the law of universal gravitation, vital force has no similar supporting laws. As a result, Kant would think that Blumenbach failed in providing a constitutive vitalism, precisely for that, vital force is not supported by laws and possess thus no explanatory power.[17]

Some Implications for Contemporary Issues

In the previous four sections I start with a new reading of Kant's regulative/constitutive distinction; Then, based on this new reading, I offer a revised interpretation of Kant's view of biological teleology, clarify a Kantian stance on life, and solve a puzzle concerning the relation between Kant, *Naturphilosophie* and the history of biology. All these rely on a hitherto little noticed sense of being non-constitutive maintained by Kant, that is, a lack of supporting laws. Meanwhile, I also claim that Kant finds natural purpose, formative power, and original organization inexplicable or inscrutable for this reason, at least partly. Nevertheless, all these are possible, admittedly, only by ignoring a significant portion of Kant's text, especially where in the third *Critique* he relates the inexplicability of natural purpose and others to the so-

[17] This view applies similarly to Herder's vital force. Kant found Herder's ideas "monstrous", because he thought that one cannot "explain what one does not comprehend from what one comprehends even less [vital force]" (Kant 2007, 132, 8: 54-5). Meanwhile, some might accuse my assessments of Blumenbach and Herder of being anachronical. But this is not true. For instance, Friedrich Hildebrandt, a professor of medicine contemporary to Kant, asserted that "to conceive of something under the name of vital force that is distinct from the matter of living bodies is not only unnecessary, but in no way explains the secret of life" (Hildebrandt 1799, quoted from Kant 1993, 273)

called supersensible, intelligent cause, and God. Indeed, this must be counted as another reason for which Kant is rather convinced that "a dogmatic [determinative] treatment" (2000, 266-8, 5: 395-8) of natural purpose is impossible. However, in my defense, my focus is exclusively on the scientific Kant, who appears more agnostic and places his emphasis on the insufficiency of scientific knowledge: "Strictly speaking, the organization of nature is therefore not analogous with any causality that we know" (246, 5: 375). Perhaps, the scientific side of Kant would even take issues with his theological side: Inexplicability and inscrutability result simply from insufficient scientific knowledge, and they give us no reason to appeal to God;[18] and to dispense such inexplicability and inscrutability, one needs to provide constitutive principles as supporting laws. Now, in relation to attempts (although unsuccessful, and often unconscious) to provide such constitutive principles in biology, this section sketches a few implications of my interpretation of (the scientific) Kant for three contemporary issues, vitalism, the mathematical approach to life, and the nature of life.

First on vitalism. Philosophers of biology often treat vitalism with abhor. When they think of vitalism, they simply dismiss it as unscientific for its positing some immaterial vital forces, like Hans Driesch's entelechies. Yet, as we have seen, philosophers with historical interest and historians of biology, such as Richards, Zammito, Gambarotto and Lenoir, are more generous towards vitalism, as they understand that certain forms of vitalism, like that of Blumenbach's, helped establish biology as a science in the early nineteenth century. The difference between philosophers and historians is fully reflected in their readings of Kant. While philosophers celebrate Kant's rejection of a scientific heresy, historians regret about Kant's failure of becoming a vitalist in his declining a constitutive treatment of biological teleology. However, if my interpretation of Kant makes sense, so far Kant's relation to vitalism has not received a proper treatment. In my view, Kant must be a vitalist in the sense that he offers the concept of non-material formative power; but Kant also finds vitalism troublesome, not because it endorses any non-material vital force, but for its lack of supporting laws.

As a matter of fact, as Chen (2018) has shown, the real problem facing Driesch's concept of the entelechy is also the absence of vital laws. This point was thoroughly analysed by contemporary logical empiricists. Importantly, as Philipp Frank pointed out, Driesch's vitalistic proposal was driven by the insufficiency of mechanistic explanations and it was certainly a legitimate hypothesis. On this Frank said:

> The introduction of the magnitude E [entelechy], in accord with Driesch, certainly means going beyond the frame of physical laws, but in no way an abandonment of the ground of empirical science, nor an introduction of anthropomorphic, soul-like elements. (Frank 1998, 111)

[18] Kant's text contains admittedly many possibilities. The famous Newton passage shows Kant's equivocation between theology and science: "It is quite certain that we can never adequately come to know the organized beings and their internal possibility in accordance with merely mechanical principles of nature, let alone explain them; and indeed this is so certain that we can boldly say that it would be absurd for humans even to make such an attempt or to hope that there may yet arise a Newton who could make comprehensible even the generation of a blade of grass according to natural laws that no intention has ordered; rather, we must absolutely deny this insight to human beings. But for us to judge in turn that even if we could penetrate to the principle of nature in the specification of its universal laws known to us there could lie hidden no ground sufficient for the possibility of organized beings without the assumption of an intention underlying their generation would be presumptuous: for how could we know that? Probabilities count for nothing here, where judgments of pure reason are at stake" (2000, 270-1, 5: 400-401). Yet maybe we can speak for Kant that in science it is absolutely forbidden to refer to God, thus the probability left for theology in science is zero; yet the probability of future vital laws is not zero and constitutive principles for life remain possible (because nothing contradicts the existence of vital laws, abstractly speaking).

However, legitimate as it is, the entelechy falls short for its lack of supporting vital laws, without which possible effects and consequences of entelechies cannot be known. On this Rudolf Carnap summarized:

> Driesch did not give laws. He did not specify how the entelechy of an oak tree differs from the entelechy of a goat or giraffe. He did classify his entelechies. He merely classified organisms and said that each organism had its own entelechy. He did not formulate laws that state under what conditions an entelechy is strengthened or weakened… the notion of an entelechy does not give us new laws, it does not explain more than the general laws already available. It does not help us in the least in making new predictions. (Carnap 1966, 15–6)

Indeed, regarding vitalism, logical empiricists fully developed the scientific side of Kant and became entirely free from theological concerns. Like Kant, logical empiricists rightly understood mechanistic (physico-chemical) explanations to be insufficient and were also aware of an alternative vitalist option; but unlike Kant, who dismissed this option as hopeless to give genuine explanations and made thereafter even a limited move to God, logical empiricists treated vitalism as a promising move but requested supporting laws for them. And, since there were no such laws, logical empiricists judged vitalism to be unsatisfying.[19]

As a matter of fact, Driesch was only one of many biologists and philosophers after Kant who aimed to solve the mystery of life, by offering a variety of vitalistic concepts (natural purpose, formative power, original organization, formative drive, entelechy, élan vital, etc). Even a brief look at the history of these concepts is already revealing: They are borrowed from somewhere (analogies from the realms of matter and mind), become popular for a while, but finally fall out of favor. This history has been summarized acutely by the editors of *Nature* as "chronic vitalism" (anonymous 2007). Indeed, the essential defect of all these vitalistic concepts (life as one of them) is the same, that is, the lack of supporting laws.

A reference to the history of physics makes this point even more revealing. In the history of physics, some physicists were rather interested in making a case for biological vitalism through these so-called "vitalistic" concepts in physics. These concepts include gravity, electricity, magnetism, energy, field, and even quantum conceptions of matter (Chen 2019, 101-42). Admittedly, these now valid "vitalistic" concepts in physics once faced a similar logical situation like vitalistic concepts in biology: In both biology and physics there are numerous phenomena that cannot be explained by concepts and principles available, and appeals must be made to new concepts. However, as can be anticipated in our previous comparison between formative power and attractive force, the essential difference between biological vitalism and physical "vitalism" is that candidates for the latter were subsequently associated with laws in physics, but members of the former are still not adequately supported by vital laws.[20]

[19] Meanwhile, logical empiricists judged mechanistic concepts with the same criterion. For instance, Frank once warned about "every trick that one might invent in the fiction of hidden combinations of inorganic state variables" (1941, 26-27).

[20] A question can be raised about whether physical concepts and theories mentioned above should be called doctrines of "vitalism" in physics. Overall, this is a matter of definition. It is a historical fact that these concepts and theories, when proposed in the nineteenth century, were often used to support biological vitalism and even a vitalist philosophy of Nature (*Naturphilosophie*); so maybe from the historical point of view, it is not too problematic to call them doctrines of "vitalism" in physics and some scholars have done this (e.g., Jennings 1913); further, to term them as such helps us appreciate important vitalistic analogies in the history of physics. However, now it should be clear that these so-called "vitalistic" doctrines in physics are different from those in biology. Even though they were

As noted above, Newton was incautious in extending the idea of attractive force to the realms of life and even mind, and the situation did not change much when it came to Niels Bohr's famous lecture on "light and life":

> The existence of life must be considered as an elementary fact that cannot be explained, but must be taken as a starting point in biology, in a similar way as the quantum of action, the existence of life must be considered as an elementary fact that cannot be explained, but must be taken as a starting point in biology, in a similar way as the quantum of action, which appears as an irrational element from the point of view of classical mechanical physics, taken together with the existence of elementary particles, forms the foundation of atomic physics. (Bohr 1933, 458)

Bohr was more cautious than Newton, because he only used the quantum conception of matter to offer a helpful analogy to illustrate the peculiarity of life; however, unlike Kant and logical empiricists, he did not proceed to stress that, the quantum conception of matter is supported by new laws from physics, but laws of life are simply unavailable.[21] Ultimately, from the historical point of view, it is also possible to claim that both physical "vitalism" and biological vitalism have partly anthropomorphic origins in intentional analogies. Yet, the essential difference that distances the physical from the biological is that, as Frank nicely summarizes, in "the history of physics and chemistry", "progress always goes hand in hand with the replacement of teleological, anthropomorphic notions by mathematical laws" (1998, 84).

The next issue we want to briefly consider concerns the mathematical approach to life. Given previous discussions, very naturally, one could envisage that in the history of biology some biologists might want to imitate physics and endorse therefore a mathematical approach to life. In doing this, they hope to characterize possible effects and consequences brought by being alive (and synonymous vitalistic concepts): An object is alive if and only if it is governed by the same (group of) supporting laws written in complex mathematics. In this tradition one can find biologists as early as Lorenz Oken, who lived after Kant and was influenced by *Naturphilosophie*, and as late as contemporaries like Stuart Kauffman and Brian Goodwin. While there is no space to articulate these in detail, it is sufficient to note that Oken envisaged a new *universal mathesis* (Reill 2005, 203); Kauffman came up with the proposal of the fourth law of thermodynamics for life (2000); and Goodwin requested for a biological field theory for all possible biological objects (1982).[22] Any one of these proposals, if realized in the future, would be able to provide constitutive principles for the concept of life, and it must necessarily become a unified theory of life.

historically connected, the validity of (some of) the former, from the logical point of view, cannot at all legislate the latter. Given these concerns, it is therefore potentially misleading to ask the question whether these concepts are vitalistic or physical. I believe that a better history of vitalism should be presented as follows: in the history there was a differentiation of meanings of vitalistic concepts. Historically, they all once sat in a common vitalistic framework of Nature (*Naturphilosophie*), some later gave rise to valid physical concepts, but others failed in biology.

[21] In a way Bohr can also be read as denying hylozoism, i.e., the possibility of living matter from the conceptual point of view. For Bohr, life is distinct from (lifeless) matter, just like that the quantum conception of matter is distinct from the classical (continuous) conception of matter.

[22] Goodwin's "biological field theory" approach is extremely illuminating to illustrate the reason why Kant finds the concept of original organization inscrutable. According to Goodwin, a genuine theory of life must resemble the periodic theory of chemical elements and contain all possible biological organizations in the same system. Thus, Goodwin's system of all biological organizations is what Kant wants for his concept of original organization. To emphasize, here Kant is concerned with the logical rather than historical sense of original organization, as it "purposively aimed at all these creatures" (Kant 2000, 288, 5: 419-20).

To emphasize, these theoretical proposals are fundamentally different from conventional biological research. To give a unified theory of life, it is not enough to give a laundry list of conventional biological phenomena, such as inheritance, metabolism, and reproduction; one must show effects and consequences of being alive in a more precise way. This is considerably more difficult, as it concerns all conventional phenomena branded as "biological" as a whole. In point of fact, we still characterize these phenomena as biological in current biology, only for that they are vaguely connected to living beings (regulative); however, as Kant has already noted, since mechanistic explanations are often available (or at least promising in most circumstances) to explain these biological phenomena and make them realizable in the material realm, it has not been shown at all that these phenomena indicate the specificity of life (constitutive). By contrast, a unified theory of life, which precisely states the effects and consequences of being alive, is able to do so.[23]

However, it should also be noted that relevant ambitious proposals from theoretical biologists remain at a rather speculative stage, and they have little influence on mainstream biological research. It is even legitimate to claim that neither of these proposals comes even close to providing genuine constitutive principles for life. Of course, part of the reason is that such endeavors are extremely difficult since they deal with no particular biological object, but all biological objects as a whole in their being *purely* biological aspect. Yet, for this difficulty and the fact that little has been achieved, Kant appears still reasonable to cast doubt over their possibility. However, this possibility can never be denied (and for this, Kant would have no reason to appeal to God); after all, endeavors in the history of physics (e.g., attractive force) have demonstrated this possibility with successful examples.

The third and final issue we might want to consider concerns an extreme position within the nature of life debate, that is, eliminativism. In brief, eliminativists deny the existence of life for its being too elusive and vague. But other philosophers disagree, and they rightly argue that life plays certain cognitive roles in several biological disciplines. In my view, the basic situation clarified by Kant remains unchanged: For the lack of supporting laws to demonstrate effects and consequences of being alive in a precise way, life fails to give constitutive principles and appears therefore elusive and vague; yet it plays an undeniable (Kant calls regulative) role, since it delimits biological objects for the science of biology.

> For this reason, Cleland (2012) argues for a wait-and-see attitude, by appealing to the history of water and H_2O: water was a once vague concept in the eighteenth century, but along with further development from molecular physics, it became a precise concept after being connected to H_2O. By this, Cleland makes a case for the possibility of a unified theory of life in the future. In addition, the history of physical "vitalism" can be even more revealing. As we have seen above, several physical concepts, despite their partially vitalistic and anthropomorphic origins, have played serious explanatory roles after being associated with supporting laws. By contrast, biological vitalism-and hence life-remains still a (rather difficult) problem to solve.

[23] It is essential to distinguish the pure concept of life (and synonymous vitalistic concepts, like, formative power, entelechy, etc.) from living objects. From the logical point of view, the concept of life is the intension, whereas living objects constitute its extension, i.e., objects for which the concept of life can act as a predicate. Given this distinction, conventional biological knowledge (inheritance, metabolism, reproduction, etc.) is only about living objects, rather than life itself. It is much more difficult to obtain knowledge about the pure concept of life. On this point, see Cleland (2013; 2019, 105-131) and Ben-Naim (manuscript).

Conclusion

This article starts with a hitherto little noticed sense of being non-constitutive employed by Kant, that is, the lack of supporting laws. Taking seriously the non-constitutive status of vitalistic concepts, Kant appears superior to philosophers and biologists both contemporary to and after him, in his recognizing that vitalism lacks supporting laws. As long as such laws are unavailable, the history of vitalism is necessarily chronic and supplies at best new vitalistic terms. In their essence, all vitalistic concepts are synonymous to that of life. While chronic vitalism does show that life continues functioning as a regulative idea, no genuine scientific progress regarding life itself has been achieved due to the lack of constitutive principles.

Although Kant might be overly pessimistic over the future possibility of vital laws (perhaps out of his theological concerns), his assessment of the concept of life and other vitalistic concepts does not seem outdated: It identifies biological objects, it regulates research practice, but even till today it has remained essentially non-constitutive, for that there has never been any unified theory of life offering constitutive principles. More than two hundred years have passed since Kant, empirical achievements in biology are tremendous and are often made under the guide of the regulative idea of life; at the same time, although vitalistic proposals have been advanced chronically, no constitutive principles have ever been available. Then, to achieve a proper logical treatment of life, it seems that we still have much to learn from Kant.[24]

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[24] The intent of this claim is absolutely not to dismiss the importance of achievements in biology, but *place them in a proper logical perspective*: These achievements only employ the concept of life in a Kantian regulative sense; they might also be helpful in formulating a unified theory of life in the future, but such a theory, offering constitutive principles, is nonexistent today.

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