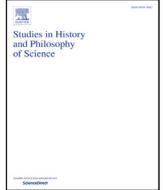




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Analogical reflection as a source for the science of life: Kant and the possibility of the biological sciences[☆]

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ABSTRACT

In contrast to the previously widespread view that Kant's work was largely in dialogue with the physical sciences, recent scholarship has highlighted Kant's interest in and contributions to the life sciences. Scholars are now investigating the extent to which Kant appealed to and incorporated insights from the life sciences and considering the ways he may have contributed to a new conception of living beings. The scholarship remains, however, divided in its interest: historians of science are concerned with the content of Kant's claims, and the ways in which they may or may not have contributed to the emerging science of life, while historians of philosophy focus on the systematic justifications for Kant's claims, e.g., the methodological and theoretical underpinnings of Kant's statement that living beings are mechanically inexplicable. My aim in this paper is to bring together these two strands of scholarship into dialogue by showing how Kant's methodological concerns (specifically, his notion of reflective judgment) contributed to his conception of living beings and to the ontological concern with life as a distinctive object of study. I argue that although Kant's explicit statement was that biology could not be a science, his implicit and more fundamental claim was that the study of living beings necessitates a distinctive mode of thought, a mode that is essentially analogical. I consider the implications of this view, and argue that it is by developing a new methodology for grasping organized beings that Kant makes his most important contribution to the new science of life.

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Although Kant's relation to the sciences has been largely focused on his interest in the physical sciences, recent scholarship has highlighted Kant's engagement the emerging science of life.¹ Whether it is by investigating his exchange with Blumenbach,

exploring his interest in the debates on generation and race, or systematically reconstructing his conception of organisms, studies in both the history of science and the history of philosophy have shown that Kant must be regarded as a contributor to the late 18th century debates on the ontological status and epistemological significance of organized beings.² While historians of science have sought to determine the roots of Kant's conception of teleology, or demonstrate its contributions (or lack thereof) to various scientific programs of its time, philosophers have generally focused on the systematic significance of the *Critique of Judgment*, with the aim of understanding the ways in which Kant's final critical work expands upon his understanding of systematic and scientific unity.³

[☆] All references to Kant will be made to the Akademie-Ausgabe edition, with the exception of the A/B pagination of the *Critique of Pure Reason*. English translations used are indicated under References.

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¹ The recent rise of interest in Kant's "biology" is evident both in historical and philosophical studies of the *Critique of Judgment*. However, the fact that these studies emerge out of different fields (history of science and history of philosophy) means that their approaches do not always converge. Thus there are numerous studies of Kant's contributions to biology that are not concerned with, for instance, the systematic coherence of his project; and, in turn, there are studies of Kant's conception of organic unity that are not concerned with the historical roots of his conception or his contribution to the scientific programs of his time. There are, of course, important exceptions to this rule, such as [McLaughlin \(1990\)](#). Edited collections also offer important exceptions, given that they often include essays by both historians of science and historians of philosophy. See for instance [Goy and Watkins \(2014\)](#) and [Huneman \(2007\)](#).

² [Lenoir \(1982\)](#) is a classic from this perspective.

³ This is the case in [Zuckert's \(2007\)](#) excellent book, which seeks to account for the systematic unity of the *Critique of Judgment* and understand its contributions to the critical project in general. Other systematic accounts can be found in [Ginsborg \(1997\)](#).

However, although these varying investigations have revealed Kant's serious interest in the life sciences, Kant's highly ambiguous claims regarding the status of a science of life leave us with an important methodological question: how are we to understand his apparent injunctions against the very notion of a science of life? In other words, how are we to account for his claim that there can be no Newton for a blade of grass and his distinctively narrow conception of "proper science" as mathematical physics?⁴ Should we ignore Kant's injunction, and instead focus on his actual (historical) contributions?⁵ Or should we accept Kant's view on philosophical grounds, but reject it on pragmatic ones? Or, finally, should we read Kant *against* Kant, that is to say, see in Kant's philosophical project an implicit but key move to the development of a science of life?

Although these questions are largely implicit in the differing approaches to Kant's relation to the science of life, the first two map on to the interpretive paths I mentioned above. By regarding Kant from a historical perspective, the first question prioritizes the reality of his contributions to the life sciences and emphasizes his connections to various scientists of the time, and thus exemplifies the position that historians of science have taken on the issue. The second question, by contrast, exemplifies the position of more philosophical approaches, where the underlying issue is whether Kant's views on organic unity and mechanical inexplicability cohere with his larger systematic aims, and the extent to which his solution to the antinomy of teleological judgment successfully offers a solution to the dichotomy between a purposive conception of nature and a mechanical one.⁶

The third question will be the strategy adopted in this paper. It aims to bring together these two concerns—the historical and the philosophical—by focusing on Kant's methodology.⁷ My claim is that Kant, despite himself, leaves us with a critical insight regarding the methodology of a science of life, a methodology based on analogical reflection. More specifically, I argue that it is in Kant's explication of the analogical character of teleological judgment, and his related claim that analogical reflection is essential for understanding living beings, that we can resolve the conflict that underlies the antinomy of teleological judgment and that concerns the scientific study of teleology. For it is precisely in Kant's notion of analogical reflection that, I contend, we find a positive contribution to the study of living beings.⁸ In contrast to the majority of studies that regard Kant's characterization of teleological judgment in

negative terms, i.e., in terms of what it must *not* or *cannot* achieve, or in terms of its *as if* status, I locate a fundamentally positive moment in teleological judgment, focusing on what it *can* achieve, and the kind of scientific research program it engenders.⁹

An investigation of Kant's account of scientific methodology will require an explication of the apparent tension between his notion of "proper science," as elaborated in the *Metaphysical Foundations of Natural Science*, and his attempt to develop an "empirical science" in the *Critique of Judgment*. Thus, I will begin with an examination of this tension, and its attempted solution in the antinomy of teleological judgment. I will then proceed to consider Kant's account of teleological judgment, highlighting what Kant distinguishes as its "problematic" character. I argue that it is problematic insofar as it cannot offer what Kant calls "explanation," a point that has been largely overlooked in the literature. Following a negative account of teleological judgment, i.e., an account of what it *cannot* achieve, I go on to provide a positive account, which is fundamentally based on its analogical character. It is this positive contribution of teleological judgment as a form of analogical reflection that, I contend, provides the basis for Kant's understanding of the study of living beings or the science of life.

1. "Proper Science," empirical science and the antinomy of teleological judgment

Kant's infamous statement that it would be absurd to hope that "there may yet arise a Newton who could make comprehensible even the generation of a blade grass according to natural laws" has been taken to imply that for Kant the science of biology is simply impossible.¹⁰ While this statement follows from Kant's views of nature as mechanism, and closely resembles earlier claims he makes on the knowability of living beings,¹¹ it does not sit well with the overarching aims of the *Critique of Judgment*.

The goal of the third *Critique* is to make intelligible those beings that are, from the perspective of mechanism, inexplicable. Importantly, this intelligibility implies the development of a scientific research program. After all, Kant describes teleology as "indispensable" for scientific research, writing that "it is in fact indispensable for us to subject nature to the concept of an intention if we would even merely conduct research among its organized products by means of continued observation..."¹² In other words, Kant introduces teleological judgment precisely because it can contribute to scientific investigation. But in what sense and to what extent can teleological judgment contribute to science?

These, I think, are the key questions that Kant is posing and attempting to answer in the antinomy of teleological judgment, which aims to resolve the conflict between two scientific modes of

⁴ Kant (1790), AA 5, 400 and Kant (1786), AA 4, 468.

⁵ Or lack thereof. The debate regarding Kant's significance for the development of biology (and his understanding or misunderstanding of key thinkers at the time, especially Blumenbach) can be found in Richards (2000, 2002) as well as Zammito (2012).

⁶ See for instance Allison (1992); Breitenbach (2006); Watkins (2009).

⁷ Huneman (2006) takes a similar approach, locating in Kant the origins of the two main paths that biology undertook in the 19th century. While Huneman focuses on Kant's conception of purposiveness, however, I focus on Kant's methodology and his introduction of analogical reflection in teleological consideration, both of which I regard to be his most significant contribution.

⁸ Another recent account of Kant's positive contribution to the life sciences can be found in van den Berg (2013). In concert with the approach that I take here, van den Berg's aim is to show that Kant, despite himself, offered important tools for the development of the science of life, in contrast to both theology (Wolffian teleology) and (French) materialism. While I think van den Berg rightly situates Kant in this context and thereby illuminates Kant's differences from both approaches, he does not properly explain why the materialist approach could not, on its own, have offered a science of life, nor does he explain how Kant's specific contribution (i.e., his non-theological teleology) provided much needed tools. Furthermore, van den Berg does not properly consider Kant's narrow conception of science, and thus does not reflect on the limitations that Kant himself places on the possibility of a science of life. Nonetheless, and in agreement with van den Berg, my aim here is to show that Kant did offer significant tools for the science of life, but these were, above all, methodological tools, i.e., new ways by which to look at or regard the world.

⁹ By way of conclusion to a recent article titled "Biological Purposiveness and Analogical Reflection," Angela Breitenbach suggests the need to undertake precisely such an investigation, writing that "more will need to be said...about the compatibility of considering parts of nature as objectively purposive and the explanations of natural objects in terms of efficient causality" (Breitenbach [2014], p. 146). My aim, in line with Breitenbach's suggestion, is to understand the positive research program that teleological judgment offers and differentiate it from the program developed through judgments according to mechanism and efficient causality. Thus I take teleological judgment as contributing to a *scientific* account of nature, even if not an account that accords with Kant's earlier conception of science.

¹⁰ Kant (1790), AA 5, 400. Richards (2002, p. 229), for instance, argues that this statement "delivered up a profound indictment of any biological discipline attempting to become a science." See also Zammito (2003), who argues that the significance of this claim must be understood in relation to Kant's regulative/constitutive distinction.

¹¹ See for instance, Kant's essay "On the only possible proof for the existence of God," where he maintains that living beings are contingent and thus inexplicable from the laws of nature. Kant (1763), AA 2, 107.

¹² Kant (1790), AA 5, 398.

research or research programs. The thesis claims that scientific investigation should proceed according to mechanical principles alone, while the antithesis contends that in some instances, it is necessary to proceed according to teleological principles.¹³ Both statements concern the power of judgment in its reflective, rather than determinative, mode—i.e., insofar as judgment is regarded independently of the understanding. This means that both have only a regulative status. Reflective judgment plays a purely heuristic role, serving as a guide in scientific investigation, without, however, claiming to determine the objective character of nature. In other words, these statements are only relevant for empirical scientific research (and not a priori science).

While it is not surprising that the antithesis is purely regulative, it is very surprising that judgment according to mechanical laws (the thesis) has merely regulative status as well. After all, Kant's a priori (and thereby constitutive) account of nature, as elaborated in the *Metaphysical Foundations of Natural Science* and the *Critique of Pure Reason*, implies mechanism. In other words, the claim expressed in the thesis appears to be a constitutive claim, and thus not on par with the antithesis. This apparent difference in status has led some commentators to argue that there is a fundamental difference between Kant's conception of mechanism in the *Critique of Judgment* and the conceptions he had developed in the *Critique of Pure Reason* and the *Metaphysical Foundations*.¹⁴ They claim that the regulative status of the mechanical principle in the third *Critique* has to do with the fact that in this later text, Kant is concerned with determining particular things in empirical nature, i.e., with determining objects for which there is no a priori legislation. In the *Critique of Pure Reason*, Kant outlines the transcendental principles of knowledge, and thereby establishes the laws of nature *purely transcendently*, i.e., on a general level without making any specific claims about corporeal reality. In the *Metaphysical Foundations*, he is concerned with what he calls the "special metaphysical" part of science, which determines the a priori laws of nature as instantiated in corporeal substances, i.e., matter. By contrast, in the third *Critique*, Kant is concerned with the possibility of explaining "particular material objects of experience."¹⁵ Because this is a task that necessarily involves empirical research as opposed to a priori determination, it follows that its results would be merely regulative.¹⁶

While these claims accurately depict the different projects that Kant is undertaking in the first *Critique* and the *Metaphysical Foundations*, on the one hand, and the third *Critique*, on the other, they do not ultimately offer a solution to the antinomy. Rather, they

amplify the conflict that it seeks to resolve. For the implication is that any explanation of empirical objects—including an explanation according to mechanical principles—is merely regulative, such that it cannot claim apodictic scientific status. This means that Kant cannot draw a hard and fast distinction between the scientific status of mechanical explanation and the non-scientific status of teleological explanation, or claim that there can be no Newton for a blade of grass (both of which Kant of course does). Furthermore, given the larger context of Kant's mechanical conception of nature, it is extremely difficult to understand what kind of insight an anomalous non-mechanical principle can contribute to scientific knowledge. How can a principle (i.e., teleology) that fundamentally contradicts the (mechanical) laws of nature contribute to understanding these laws? This is the fundamental problem that the antinomy is aiming to resolve, and its resolution can only be achieved (or at least broached) if we take account of Kant's conception of science.

To begin with, we must consider Kant's notion of "proper science," as elaborated in the *Metaphysical Foundations of Natural Science*. For it is here that Kant develops the distinctively narrow conception of science that leads to the view that biology cannot be a proper science. Kant writes that "proper science [*eigentliche Wissenschaft*]" is the domain in which "certainty is apodictic."¹⁷ Inquiry based on cognition with "mere empirical certainty" cannot be characterized as proper science. For, he continues, "in any special doctrine of nature there can be only as much *proper* science as there is *mathematics* therein."¹⁸

In the *Critique of Pure Reason*, Kant was concerned with establishing the transcendental principles of experience and thereby providing the a priori foundations for objects of experience in general. The aim, he writes, is to determine "the laws that make the concept of nature in general possible, without relation to any determinate object of experience." By contrast, the "metaphysics of nature" elaborated in the *Metaphysical Foundations* "is concerned with a special nature of this or that kind of thing of which an empirical concept is given..."¹⁹ In other words, the aim is to explicate how the laws of nature are instantiated in empirical concepts—i.e., how they are realized in material nature. In the *Metaphysical Foundations*, then, we are specifically concerned with objects of outer sense and with the way in which the transcendental principles of the first *Critique* can be applied to these empirical objects.

Now, as an object of outer sense, matter cannot be determined solely by concepts but also requires the pure forms of intuition (space and time). This means that the concept of matter must be *constructed* on the basis of the laws that pertain to space and time.²⁰ Thus the program of the *Metaphysical Foundations* is to apply the a priori concepts of the understanding to the empirical concept of matter as an entity in space and time. By applying the categories of relation (subsistence, causality and community), Kant arrives at the three laws of mechanics that closely resemble Newton's three laws of motion.

Like Newton's laws, Kant's laws of mechanics concern change in matter. The fundamental character of matter, Kant explains, is that it is space-filling and thus impenetrable. This means that it exerts a repulsive force on other material beings, so that they cannot occupy

¹³ Although the antinomy contains two different antinomies, over the last two decades scholars have agreed that only the first of the two is relevant. For this reason, and for the sake of space, I will neither provide an explanation of the second antinomy or of the reasons why scholars have dismissed it (see Allison [1992] and Breitenbach [2006]). Furthermore, the first antinomy specifically concerns the power of judgment and thus more directly concerns the task at hand: namely what is involved in scientific knowledge, and what is the scientific status of the life sciences.

¹⁴ See especially Allison (1992) and Breitenbach (2006).

¹⁵ Breitenbach (2006), p. 701.

¹⁶ Breitenbach in particular pushes this line. This is because, she maintains, all empirical laws of nature are left underdetermined by the transcendental structure of experience and the a priori construction of the empirical concept of matter (the task of the *Metaphysical Foundations*), thereby making the determination of empirical laws regulative. She writes: "empirical laws about regularities in nature...face the same underdetermination problems as any empirical causal law in general. The mechanical laws are underdetermined both by the transcendental principles of the understanding and the pure mechanical laws of nature...Despite their uncertain status, however, empirical laws are the only means we have to explain the empirical world" (Breitenbach [2006], p. 708). And on this basis she concludes that "particular causal laws will merely turn out to be more or less well confirmed conjectures" (p. 709).

¹⁷ Kant (1786), AA 4, 468.

¹⁸ Kant (1786), AA 4, 470.

¹⁹ Kant (1786), AA 4, 469–70. See also Watkins (1998), p. 569.

²⁰ This further emphasizes the mathematical underpinnings to "proper science," for, Kant explains, the construction of empirical concepts depends on mathematics: "rational cognition through construction of concepts is mathematics" (Kant [1786], AA 4, 470).

the same space. Repulsion alone, however, would result in an “infinite expansion” so that matter would “disperse to infinity.”²¹ For this reason, there must be a force to counter repulsion—namely attraction. Thus Kant deduces the fundamental character of matter, explaining that “matter, as mere object of outer senses, has no other determinations except those of external relations in space, and therefore undergoes no change except by motion.”²²

This has several implications. In the first place, it means that a material unity is composed of parts, which are either externally drawn together or repelled from one another. The parts that constitute a material unity are thus united through their presence in one space, such that their relation is essentially external, i.e., determined by their location and motion in space. Thus Kant contrasts material unity, which is based on external relations, and unity with “internal activity” which he identifies as spontaneity.²³ Furthermore, precisely because matter lacks internal activity and spontaneity, it is, Kant contends, “lifeless.”²⁴ Life belongs only to substances that determine themselves or act in accordance with an *internal* principle.

In light of this, Kant’s claims that hylozoism is “the death of all natural philosophy” should not be surprising.²⁵ After all, hylozoism assumes that matter is not inert. Natural science, however, rests on the laws of motion, and this means that natural science is founded on a lifeless conception of matter. In other words, the *a priori* construction of matter *does not permit* a conception of matter as living. Only a science based on a lifeless conception of matter can be considered proper science.

Kant reiterates this view in the *Critique of Judgment* where he repeatedly states that science implies mechanism. As he puts it, without “the principle of mechanism,” “there can be no science of nature at all.”²⁶ Importantly, Kant’s understanding of mechanism in the third *Critique* reflects the account he offered in the *Metaphysical Foundations*. Thus in the later text he speaks of matter in terms of the laws of motion, and identifies both with mechanism and efficient causality. He describes mechanism as “the capacity for movement”²⁷ “in accordance with the mere laws of motion.”²⁸ And he describes “a material whole... [as] a product of the parts and of their forces and their capacity to combine by themselves...”²⁹ Furthermore, Kant argues that mechanical causality must be efficient causality, wherein an external force is the only possible cause of change. Efficient causality is “a connection that constitutes a series (of causes and effects) that is always descending,” such that every effect presupposes a cause that is necessarily external and antecedent to it.³⁰ Material–mechanical unity and efficient causality result in what Kant calls a “physical–mechanical connection” in contrast to a “connection to ends.”³¹

Thus despite the claim that Kant’s account of mechanism differs in the *Critique of Judgment* from earlier texts, there are clear and significant continuities, as evident in his conception of mechanical

causality and notion of mechanical unity.³² This means that Kant’s injunction against the science of life should be read in light of his account of proper science and the entailing conception of matter, as developed in the earlier texts. Indeed, Kant seems to say precisely this at various points in the third *Critique*. He maintains, for instance, that without the principle of mechanism, “no insight into the nature of things can be attained.”³³ Or to quote the passage cited above, without “the principle of mechanism,” “there can be no science of nature at all.”³⁴

Yet, Kant introduces teleological judgment in order to bring insight into nature where mechanical explanations are unable to offer any insight. Thus, despite his affirmation of the principle of mechanism for science, Kant contends that teleological judgment must play a role in scientific investigation.³⁵ The difficulty is obvious: mechanical explanations must be prioritized because they affirm the *a priori* laws of nature, yet they are incomplete. Teleological judgments are supposed to somehow complete them. However, given that teleological judgments contradict the laws of nature, it is hard to fathom what role they can actually play in any scientific investigation. The underlying problem concerns the tension between empirical scientific research (and teleological judgment as part of that) and the *a priori* account of nature, i.e., proper science, which Kant develops in his earlier writings. And it is ultimately this conflict that the antinomy aims to convey. Before going into further detail, it is important to consider Kant’s reasons for introducing teleological judgment.

2. Teleology and explanation

Throughout the “Critique of Teleological Judgment,” Kant speaks of the “need” or “necessity” to employ a principle other than the mechanical in order to judge certain entities. In particular instances, he writes, “we must conceive of a causality different from mechanism...no matter how rash and indemonstrable that would be...”³⁶ That this is the case, he goes on, is self-evident: “No one has doubted the correctness of the fundamental principle that certain things in nature (organized beings) and their possibility must be judged in accordance with the concept of final causes...”³⁷ And, as noted above, Kant goes so far as to describe teleology as “indispensable” for scientific research.³⁸

Why does he claim that, in some cases, teleological judgment is indispensable? Furthermore, if that is the case, then in what sense can it contribute to scientific research, and how does its contribution differ from the competing claim of mechanical explanation?

Already in the first section of the “Critique of Teleological Judgment,” Kant offers preliminary answers to these questions. Speaking of the structure of a bird, he writes:

if one adduces, e.g., the structure of a bird, the hollowness of its bones, the placement of its wings for movement and of its tail for steering, etc., one says that given the mere *nexus effectivus* in nature, without the help of a special kind of causality, namely that of ends (*nexus finalis*), this is all in the highest degree

²¹ Kant (1786), AA 4, 508.

²² Kant (1786), AA 4, 543.

²³ Kant (1983), AA 29, 913.

²⁴ Kant (1786), AA 4, 544.

²⁵ Kant (1786), AA 4, 544.

²⁶ Kant (1790), AA 5, 418.

²⁷ Kant (1790), AA 5, 374.

²⁸ Kant (1790), AA 5, 390.

²⁹ Kant (1790), AA 5, 408.

³⁰ Kant (1790), AA 5, 372.

³¹ Kant (1790), AA 5, 388. Kant uses the expression “physical–mechanical” in a number of contexts, in order to distinguish between physical–mechanical laws and those laws that “produce an organic body” (Kant [1763], AA 2, 436). See also AA 8, 179.

³² I thus disagree with Breitenbach and Alison (see n. 14 and 16 above).

³³ Kant (1790), AA 5, 410.

³⁴ Kant (1790), AA 5, 418.

³⁵ Kant (1790), AA 5, 398.

³⁶ Kant (1790), AA 5, 389.

³⁷ Kant (1790), AA 5, 390.

³⁸ Kant (1790), AA 5, 398. Kant also claims that “teleology, as a science, ... does not belong to any doctrine at all, but only to critique...” Kant (1790), AA 5, 417. Here, I agree with van den Berg (2013), who illustrates that Kant specifically implies the Wolffian account of teleology as a distinct science, and does not mean, as Zammito (1992, p. 224) argues, that teleology cannot play a role *within* scientific inquiry.

contingent [zufällig]: i.e., that nature, considered as mere mechanism, could have formed itself in a thousand different ways without hitting precisely upon the unity in accordance with such a rule, and that it is therefore only **outside** the concept of nature, not within it, that one would have even the least ground *a priori* for hoping to find such a principle.³⁹

What does it mean to claim—as Kant does—that the structure of a bird appears to be contingent? To being with, his claim seems to imply that the structure would be highly unlikely, if it were the outcome of mechanical laws. However, to simply state that something is highly unlikely does not tell us much about the thing—its structure and form, the relations between its parts, their various functions, and the extent to which its structure reflect its environment. In other words, while calling something “contingent” may be appropriate from one perspective (namely that of general mechanics), it is inappropriate from another perspective: the perspective that seeks to order and specify nature. This point reveals a second meaning of contingency: underdetermination. Precisely because the universal and necessary laws of the understanding determine nature only in the most general manner, they leave large portions of nature underdetermined, making them appear contingent. Contingency implies that there is no *a priori* legislation provided by the understanding to determine how we must judge a bird’s structure.

Now, as we have seen, in the *Metaphysical Foundations*, Kant sought to provide greater determination of nature by constructing the empirical concept of matter. In this way, he was able to conclude, first, that a material unity is a composite of different parts, and, second, that the causality which can be properly applied to matter is efficient causality. Thus in the *Metaphysical Foundations*, Kant was able to determine nature more concretely than he had done in the *Critique of Pure Reason*. Importantly, the greater determination achieved in the *Metaphysical Foundations* concerns only those objects which can be grasped through the laws of motion. This means that the entities which appear contingent are those whose structure (and unity) cannot be explicated by these laws. In other words, in the third *Critique* contingency does not describe underdetermination in general, but a specific form of underdetermination, namely, the underdetermination of those beings that are not explicable by, or reducible to, mechanical laws.⁴⁰

The question then is: what kind of determination or explanation can teleological judgment offer, which mechanical principles fail to offer, and how can this explanation be incorporated into scientific research?

At this juncture, it is important to continue reading Kant’s passage. For immediately after mentioning the structure of the bird, Kant goes on to claim that “teleological judgment is rightly drawn into our research into nature, at least problematically, but only in order to bring it under principles of observation and research in **analogy** with causality according to ends, without presuming thereby to **explain** it.”⁴¹ If teleological judgment does not, as Kant maintains, provide an “explanation,” then it seems necessary to raise the question as to what exactly teleological judgment *provides*, and how it differs from an *explanation*.

Various attempts to understand Kant’s conception of mechanical inexplicability have focused on the nature of the objects that demand teleological judgment—i.e., living beings, and, as Hannah

Ginsborg has argued more recently, machines which are constructed in accordance with an idea or purpose.⁴² In this way, these studies have sought to determine the extent to which the specific structure of these objects, their whole–part relation and their causal structure, requires a principle that does not reduce the relations between the object’s parts to the mechanical laws of motion. In so doing, however, they have overlooked the fact that teleological judgment, according to Kant, does not provide an explanation, such that invoking teleological principles to understand a watch or a tree does not mean that I can *explain* the object.⁴³

The fact that this point has not been adequately emphasized shows that the key aspect of teleological judgment—its distinctive role and significance in scientific research—has also not been fully grasped. The essential question must not only concern the reasons why teleological judgment fails to offer an explanation, but also, and more importantly, what teleological judgment *does* offer that is *not* an explanation. In other words, if teleological explanation is not possible, then what exactly can teleological judgment contribute to scientific research?

To answer this question, we must begin by considering why Kant invokes teleological judgment in the first place, i.e., why he considers it necessary for grasping organisms. Kant begins his consideration of organisms by noting that the very notion of a “natural end” is contradictory.⁴⁴ Nature, after all, implies efficient causality, while end implies final causality. The only way to overcome this contradiction, Kant goes on, is to think of the organism as both “cause and effect of itself.”⁴⁵ What does this involve?

For a thing to be an end, it must be “comprehended under a concept or an idea,” which determines both the parts and their relations.⁴⁶ Importantly, this criterion obtains for machines as well as natural ends. In a machine, however, the material reality remains fundamentally unchanged by the idea—the idea (the purpose or end) does not *form* the different parts of a machine, but simply determines their external relations to one another.⁴⁷ In a natural end, by contrast, the parts must “be combined into a whole by being reciprocally the cause and effect of their form,” i.e., the parts are *formed* through their relations with one another.⁴⁸ Or, as Kant puts it later on, an organized being “must be thought of as an organ that **produces** the other parts (consequently each produces the others

⁴² Ginsborg (2004).

⁴³ Hannah Ginsborg has argued that machines are *not* mechanically explicable, because they are determined by an idea and are thus inexplicable apart from it. As she puts it, “there is no less a need for teleology in understanding a machine such as a watch than there is understanding an organism” (Ginsborg [2004], p. 37). While I think that she is right to emphasize fundamental similarities between organisms and machines, Ginsborg’s point only makes sense if we think that teleological judgment actually offers an “explanation” of its object, which for Kant means that through teleological judgment, we can “derive” the object from a principle (Kant [1790], AA 5, 417). However, as Kant makes clear, teleological judgment does not furnish explanations (Kant [1790], AA 5, 360). In light of that, it seems absurd to claim that we *cannot explain* watches. The fact that we *can explain* watches indicates that we do not require teleological judgment. Importantly, Kant draws a distinction between a “useful” and an “indispensable” use of teleological judgment (Kant [1790], AA 5, 389). I think this shows that while teleological judgment *can be used* to understand a watch, it is, in fact, *not indispensable* for understanding a watch. In turn, and in light of his claim that teleological judgment does not explain, it follows that the use of teleological principles for understanding a watch only makes the watch *more intelligible*, without, however, giving us insight into its origins (i.e., deriving it). See Section 4 for an account of the difference between “explanation” and the insight provided by teleological judgment.

⁴⁴ Kant (1790), AA 5, 370.

⁴⁵ Kant (1790), AA 5, 371.

⁴⁶ Kant (1790), AA 5, 373.

⁴⁷ Kant (1790), AA 5, 373.

⁴⁸ Kant (1790), AA 5, 373.

³⁹ Kant (1790), AA 5, 360.

⁴⁰ Cf. Breitenbach (2006). See also n. 16 above.

⁴¹ Kant (1790), AA 5, 360.

reciprocally),” and is therefore rightly described as “self-organizing.”⁴⁹

The relationship between the parts in an organic unity is thus not simply a relation of cooperation to achieve an end, but a relation of absolute dependence, so that the parts exist only through one another; they “produce” one another. Kant’s claim implies that a living being exhibits a very particular causal structure, in which cause and effect are interchangeable. Clearly, this differs from efficient causality, in which cause and effect are distinct. Furthermore, the fact that each part is both cause and effect implies that there is no successive temporal structure. For in a living being, it is not only the future that is determined by the past—i.e., the effect determined by the cause—but also the past is determined by the future—the cause is determined by the effect. For instance, in the same way that the formation of the fruit presupposes the formation of the flower, so also the possibility of the fruit is implied in the development of the flower. In other words, the past, present and future are internally related to one another, such that the end or purpose (future) is inscribed at the beginning and at every moment of development. For this reason, Kant describes an organic being as having a “formative power,” in contrast to the “motive power” of a machine.⁵⁰

It is important to dwell on this momentarily. The ultimate difference between an organism and a machine, according to Kant, has to do with the interactions between their differing parts. Within a living being, the parts exhibit a self-forming capacity or formative power; within a machine, by contrast, the various parts are determined by external motion alone. In other words, in the case of living beings, we have material entities that are not acting in accordance with the fundamental laws of motion, as outlined in the *Metaphysical Foundations*.

It is precisely on account of this difference that, Kant goes on, an organized being “cannot be explained [erklärt] through the capacity of movement alone (that is, mechanism).”⁵¹ Living beings cannot be explained, in other words, because the relations between their parts (their activity, their interactions) are not reducible to the laws of motion. This has several significant implications.

First, it implies that any entity composed of parts that act in accordance with the laws of motion is mechanically explicable—a machine is thus (in spite of the fact that it is designed with a purpose) mechanically explicable. Second, and this pertains to the topic at hand more directly, explanation specifically implies determining the cause of something through physical-mechanical laws. Indeed, it seems that Kant says precisely this when he emphasizes that teleological judgment can only be drawn into scientific research “problematically” on the basis of “analogy.” For, he goes on, teleological judgment can only “bring it [i.e., nature] under principles of observation and research...”⁵²

Toward the end of the “Dialectic of Teleological Judgment” (the section in which the antinomy is located), Kant once again points to the limited explanatory power of teleological judgment. He writes: “It is an equally necessary maxim of reason not to bypass the principle of ends in the products of nature, because even though this principle *does not make the way in which these products have originated more comprehensible*, it is still a heuristic principle for researching the particular laws of nature...”⁵³ For, he goes, “to explain is to derive from a principle [denn erklären heißt von einem

Prinzip ableiten].”⁵⁴ This means that teleological judgment does not tell us anything about how living beings come about; it does not illuminate their a priori conditions of possibility or determine their causes. For this reason, Kant identifies teleological judgment with “description [Beschreibung]”⁵⁵ and “elucidation [Erörterung]”⁵⁶ as opposed to “explanation.” Ultimately, teleological judgment cannot determine the origins of organized beings—it cannot explain the physical (natural) cause of an object, establish its existence or derive its necessity—because it does not offer an explanation based on the laws of motion.

This is not entirely surprising; after all, teleological judgment is concerned with grasping those things for which there is no a priori legislation (i.e., that which is underdetermined or contingent). Thus, rather than attempting to explain by derivation from an a priori principle, teleological judgment must work with the empirically given.

This helps to illuminate the fundamental difference between the thesis and antithesis in the antinomy. For although both are regulative, in that they are working with the empirically given, mechanical principles can and indeed do offer explanations of empirical objects, while teleological principles cannot. In other words, when judgments according to mechanical principles are used for empirical research, they inhabit a distinctive space: although they are reflective, their accounts of natural beings coincide with the laws of nature, such that they offer explanations and thereby contribute to the larger aims of proper science. Teleological judgments do not offer any explanations, because their objects cannot be derived from the a priori laws of nature. They must offer something else, and must thereby contribute to a different scientific enterprise. At this stage, however, the contribution of teleological judgment is entirely negative: we have stated what it *cannot* do. In order to determine what it *can* do, and seek to reconcile mechanical and teleological judgments, we have to consider the positive contribution of teleological judgment more carefully.

3. Teleological judgment as analogical reflection

The negative account of teleological judgment (what it *cannot* do) is based on Kant’s statement that teleological judgment proceeds according to analogy: “teleological judgment is rightly drawn into our research into nature, at least problematically, but only in order to bring it under principles of observation and research in **analogy** with causality according to ends, without presuming thereby to **explain** it.”⁵⁷ It is precisely because teleological judgment is analogical that Kant denies it explanatory powers.⁵⁸ However, it is also precisely because it is analogical that Kant introduces it at all. In other words, it is on account of its analogical character that teleological judgment provides us with a distinctive approach to the natural world, and it is only through this analogical approach that we can begin to think about natural organisms.

As a form of reflective judgment, teleological judgment proceeds by comparing and holding together given representations for which no concept is given. Precisely because reflective judgment has no determining concept, it does not proceed according to a rule, and the question emerges as to *how* comparison can proceed at all.

⁴⁹ Kant (1790), AA 5, 374.

⁵⁰ Kant (1790), AA 5, 374.

⁵¹ Kant (1790), AA 5, 374; emphasis added.

⁵² Kant (1790), AA 5, 360.

⁵³ Kant (1790), AA 5, 411; emphasis added.

⁵⁴ Analogy does not offer an explanation because it does not derive an object from an a priori principle, but rather, as we shall see, it compares the empirically given according to a heuristic principle of reflective judging. On differences between Kant’s earlier views of analogy and analogy as elaborated in the *Critique of Judgment*, see Nassar (2015) and Breitenbach (2014).

Kant's answer is that reflective judgment functions on the presupposition of a suitability or harmony between my cognitive faculties and the world.⁵⁹ This means that reflective judging proceeds “technically” or “artistically,” rather than “mechanically,” because it assumes technique or artistry in nature. The experience of beauty thus expands our concept of nature insofar as it points to an analogy between our creative capacities (as artists, or makers) and the natural world, and in this way “invites profound investigations into the possibility of such a form [i.e., purpose in nature].”⁶⁰ Thus one can say that reflective judging itself proceeds according to an analogy, while teleological judgment, as a form of reflective judgment, distinctively *employs* the analogy and the analogical method in order to undertake investigation of the natural world.

In section 59 of the “Critique of Aesthetic Judgment,” titled “Beauty as a Symbol of Morality,” Kant describes symbol as “a presentation [*Darstellung*] in accordance with mere analogy.”⁶¹ Analogy, he goes on, is a presentation “in which the power of judgment performs a double act.” In the first instance, it applies “the concept to the object of a sensible intuition,” and then it goes on to “apply the mere rule of reflection on that intuition to an entirely different object, of which the first is only the symbol.”⁶²

Analogy involves applying a rule from one object onto a second object. The situation, however, is more complicated; for the relation is not between two similar objects or two objects with similar attributes; rather it concerns a relation between concept and intuition. Thus, Kant continues, analogy is a “carrying over [*Übertragung*] of reflection on one object of intuition to another, quite different concept, to which perhaps no intuition can ever directly correspond.”⁶³ In other words, it is not two already presented or cognizable objects that are being compared here. Rather, in this context, analogy involves bringing to presentation that which is otherwise unrepresentable.

To understand how Kant arrives at his conception of analogy and symbol, it is necessary to consider another form of presentation, which Kant discusses in the *Critique of Pure Reason*, namely schemata. In the first chapter of the “Analytic of Principles,” Kant explains that the categories are “heterogeneous from empirical intuitions,” such that they “can never be met with in any intuition.”⁶⁴ In other words, the categories fundamentally differ from sensible intuitions, such that it appears to be impossible for them to be *presented* through sensible intuitions. Kant resolves this problem by distinguishing between the *content* and *form* of each. While the categories and intuitions are indeed heterogeneous with regard to content, they are homogenous with regard to form. They share the form of time. Intuitions are implicitly temporal, and it is their temporality that makes them commensurate with the categories. The schemata make this implicit temporal form explicit, and thus enable the subsumption of an intuition under a concept. In this way, the schemata bring categories to presentation in intuition.

In the third *Critique*, Kant notes that there are ideas for which “absolutely no intuitions can be given that would be adequate to them.” That is to say, there are ideas that cannot be schematized—they are thought outside of temporal conditions. For this reason, he goes on, these ideas can only be brought to presentation “in a way merely analogous to the procedure [judgment] follows in schematizing.”⁶⁵ In other words, ideas for which there is no

adequate intuition can be brought to presentation in a manner analogous to (but different from) the work of schematizing. This is exactly what takes place in the case of a symbol. It involves analogical reflection to “carry over” a rule of reflecting on one object to reflecting on a second object, which is itself not presented in intuition.

The organism is, according to Kant, one such object. An organized being consists of inherently connected parts that are necessary for the proper functioning of the whole. As such, the parts and their relations are determined by the whole. Now, our understanding, Kant maintains, proceeds analytically from the universal to the particular, wherein the particular is subsumed under the universal concept. This means that the only unity we can grasp is one composed of externally related parts, parts that are independent of one another and the whole.⁶⁶ In other words, discursive understanding cannot grasp parts that are internally (and thus necessarily) connected to one another; it cannot grasp an organic unity (and for this reason the structure of a bird appears to be merely contingent; its parts, from this perspective, lack internal coherence and necessity).

Teleological judgment is invoked to make this kind of unity intelligible. As such, it proceeds analogically by employing the notion of purpose in human activity (as guided by ends) in order to bring to presentation the distinctive structure and activity of natural organisms. Thus, the principle of end-directed human activity is “carried over” to the natural world, such that the activity of human reason becomes a symbol for organized activity in nature.⁶⁷

It is thus only through the work of analogy (symbol) that the organism becomes an object of reflection for us. In other words, it is only by way of analogy with a goal-directed rational being that organisms become objects of experience at all. Kant says precisely that when he writes, “even the thought of them as organized beings is, without associating the thought of generation with intention, impossible.”⁶⁸ It is by reflecting on nature analogically—by performing the “double act” of judgment, in which one object comes to stand for another—that the thought and experience of organisms become possible in the first place.

Analogical reflection thus delivers the very thought of an organized being and thereby enables us to conceive of natural organisms, i.e., it allows us to think of a non-mechanical unity and a non-efficient causality and in this way brings living beings to presentation. In other words, analogical reflection provides us with our very object of investigation. The question remains, however, as to whether analogical reflection, as a distinctive mode of knowledge and approach to nature, can, in addition to delivering the notion of a natural end, *guide* us in our investigation of this object. The answer to this question must be affirmative, given Kant's repeated insistence that teleological judgment is a tool for *investigating* living beings, and not simply for *recognizing* them. What kind of investigation would this be?

⁵⁹ Kant (1790), AA 5, 400.

⁶⁰ Kant (1790), AA 5, 246.

⁶¹ Kant (1790), AA 5, 352.

⁶² Kant (1790), AA 5, 352.

⁶³ Kant (1790), AA 5, 352–3.

⁶⁴ Kant (1781/1787), A137/B176.

⁶⁵ Kant (1790), AA 5, 351.

⁶⁶ Kant (1790), AA 5, 400.

⁶⁷ Importantly, Kant uses the analogy of the animal body in order to explicate his conception of reason in the *Critique of Pure Reason* (A833/B861). Thus, it appears that Kant is using the structure of a living being to provide the rule, which is then carried over to the realm of human activity (and especially human reason). See Breitenbach (2009). Breitenbach interestingly argues that “the analogy between organism and reason thus points to a certain reciprocal relation, which should not only offer an explication for our understanding of organisms, but also for our understanding of our own reason” (Breitenbach [2009], p. 105; my translation). This emphasizes that for Kant analogy is much more prevalent and significant than he would otherwise suggest—it enables us to grasp natural organization, as well as human reason—such that Kant's entire philosophical corpus is based on an original analogy between nature and reason. I will not pursue this point here, but will rather focus on the significance of analogy for the natural sciences.

⁶⁸ Kant (1790), AA 5, 398.

⁵⁹ Kant (1790), AA 20, 213–4.

⁶⁰ Kant (1790), AA 5, 246.

⁶¹ Kant (1790), AA 5, 352.

⁶² Kant (1790), AA 5, 352.

⁶³ Kant (1790), AA 5, 352–3.

⁶⁴ Kant (1781/1787), A137/B176.

⁶⁵ Kant (1790), AA 5, 351.

Kant does not elaborate a scientific program based on analogy. In fact, he is quite critical of attempts that employ analogy in natural history, because they imply a conception of nature as continuous which in turn undermines differences between living and non-living beings, and, above all, between human beings and animals.⁶⁹ Nonetheless, Kant supports the use of analogy, so long as any scientific program using analogy remains cognizant of the analogical character of its research, in other words, so long as it does not take nature as *in fact* continuous. After all, such an assumption would imply that analogy can deliver *explanations*, i.e., developmental accounts based on historical-causal connections between species. If, however, analogical reflection did not seek to offer explanations, then it can be fruitfully employed to contribute to a different, non-explanatory model of science.

As non-explanatory, teleological judgment would involve description and elucidation. This does not mean, however, that it would amount to a random collection of data. Rather, such a descriptive account of nature would be based on the analogy with human reason or goal-oriented human activity, such that its descriptions would be essentially guided by this analogy. Thus an analogical account would aim to illuminate the structure of a living being through discerning how its various parts are in dialogue with one another, how each, in its own way, is a reflection of the whole, and how the differing parts achieve their specific functions in relation to one another and in relation to the whole. A descriptive account based by analogical reflection aims to grasp the structure and integrity of living beings without seeking to determine their origins. Let us look at this more closely.

4. The science of life as the science of form and structure

In section 73 of the *Critique of Judgment*, Kant enumerates and criticizes various attempts to “explain” living beings. The problem, he argues, is that “the possibility of an animated matter” “can by no means be understood *a priori*,” such that it would only result in “a circle in the explanation.”⁷⁰ In other words, these attempts seek to explain life by deriving it either from an *a priori* principle or from non-living matter, such that they are both reducing life to something other than itself. In contrast to these accounts, Kant lauds the efforts of a scientist who distinctively does not seek to explain life. Blumenbach, Kant writes, “begins all physical explanation of these formations with organized matter.” Unlike his contemporaries, Blumenbach has no desire to determine “anything about this first beginning...”⁷¹ Whether or not Kant was misreading Blumenbach, one thing is clear: Blumenbach’s claim that the *Bildungstrieb* is “for us a *qualitas occulta*” implied, for Kant, that it is beyond explanation.⁷²

While Kant’s claim that there can be no Newton for a blade of grass suggests the impossibility of a science of life, his interest in and laudatory remarks on Blumenbach attest to a different (even if not explicitly stated or worked out) attitude. The claim implicit in Kant’s support of Blumenbach amounts to this: the science of life is not a science of explanation, i.e., a science that aims to determine origins or derive objects from *a priori* principles. Rather, and

following the methodology of teleological judgment, the science of life is a science that employs analogical reflection to grasp a distinctive kind of unity, focusing on describing and elucidating its form and structure. It is a science concerned with grasping structure analogically, i.e., by seeing it through something else—“carrying over” the rule of one object in order to make the other intelligible—without, however, offering what Kant calls an explanation. The aim, rather, is to discern the form of the whole in each of the parts, and grasp the form in relation to other forms.

Now, as late as 1788, Kant would have not granted a science based on describing forms the name of science at all. In various essays, he offers critiques of the merely descriptive character of natural history and repeatedly argues that in order to become a proper science, natural history must incorporate causal explanations. Thus, in an essay on physical geography from 1775, his aim is to distinguish “natural history” from mere description, and this requires “transform[ing] the currently diffuse systems of **academic natural description** into a **physical system for the understanding** [i.e., science].”⁷³ In other words, he continues, natural history must “bring forward purposive causes where natural ones are not easily discerned, and natural ones where we cannot observe purposes.”⁷⁴ What distinguishes the *science* of natural history from mere description, Kant maintains, is that the former offers causes for natural phenomena, while the latter does not.

Kant reiterates this distinction in his 1788 essay on the use of the teleological principle, where he differentiates natural history from travel narrative. Travel narrative does not tell us anything “of a purposive nature,” because such a thing could not be found “through mere empirical groping without a guiding principle of what to search for...” This is in contrast to the *science* of natural history, which would consist “in tracing back, as far as the analogy permits, the connection between certain present-day conditions of the things in nature and their causes in earlier times according to laws of efficient causality...”⁷⁵

Kant’s stance towards the science of describing changes in 1790, when he discovers the principle of reflective judgment. Describing forms on the basis of an analogy with ends is no longer an arbitrary task that leads to merely aggregate knowledge; rather, precisely because it is based on reflection according to analogy, the work of describing becomes principled, proceeding with a distinctive aim and according to a specific principle. And this principled mode of describing provides us with a new, non-explanatory research program. The investigator of life must not aim to explain the origins of living beings, but, as Kant puts it in the *Critique of Judgment*, the life scientist should strive “to know [the] constitution [of living beings] through observation, without rising to the level of an investigation into their fundamental origin.”⁷⁶ That is to say, the aim of the life scientist is to illuminate the “internal constitution” of organisms through principled reflection on their form and structure.⁷⁷

In section 80 of the third *Critique*, Kant takes up the idea of a science based on “an analogy of form.”⁷⁸ Although his aim here is to challenge radical epigenesists, who seek to derive living beings from non-living beings, and thereby explain life and organization mechanically, his critique specifically focuses on the non-explicability of life, and not on analogical reflection per se or on the possibility of developing a science of form. Rather he is critical of comparative anatomists who, on seeing likeness of form among

⁶⁹ This is a key aspect Kant’s critique of Herder’s *Ideen zu einer Philosophie der Geschichte der Menschheit*. See Nassar (2015).

⁷⁰ Kant (1790), AA 5, 395.

⁷¹ Kant (1790), AA 5, 424.

⁷² In the second edition of *Über den Bildungstrieb* (1789), Blumenbach writes, “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 and whose cause, like the causes of the aforementioned and the commonly recognized natural powers, is for us a *qualitas occulta*” (Blumenbach [1789], 25–6).

⁷³ Kant (1775/1777), AA 2, 434.

⁷⁴ Kant (1775/1777), AA 2, 435.

⁷⁵ Kant (1788), AA 8, 61.

⁷⁶ Kant (1790), AA 5, 389–90.

⁷⁷ Kant (1790), AA 5, 398.

⁷⁸ Kant (1790), AA 5, 419.

natural beings, draw the conclusion that these beings “seem to have been produced according to a common archetype,” such that their functions can be explained (derived) from “raw matter,” i.e., from “forces governed by mechanical laws.”⁷⁹

However, he continues,

... ultimately he [the archaeologist of nature] must attribute to this universal mother an organization purposively aimed at all these creatures, for otherwise the possibility of the purposive form of the products of the animal and vegetable kingdoms cannot be conceived at all. In that case, however, he has merely put off the explanation, and cannot presume to have made the generation of those two kingdoms independent from the condition of final causes.⁸⁰

In other words, the archaeologist of nature who, on seeing an “analogy of forms” among living beings, seeks to “explain” them mechanically. He cannot succeed, however, because, as the section title states, any attempt to find a commonality between natural beings must ultimately “subordinate” the mechanical principle to teleology (in the form of final causality). It must, in other words, offer an explanation of how and why this commonality exists (by, for example, positing a common ancestor, or as Kant calls it, a “universal mother”). This is clearly problematic because it would imply that the scientist has access to the purpose of nature. What if, however, the archaeologist of nature, upon recognizing an “analogy of forms” did not seek to “explain” or derive the origins of these forms mechanically, but rather sought to grasp their “inner constitution through observation, without rising to the level of an investigation into their fundamental origin”? What if, in other words, the archaeologist of nature could learn something from the analogy of forms that is *not* equivalent to a priori derivation, or mechanical explanation? Kant hints at the advantages of such a science in the essay on the use of teleological principles.

Precisely because teleological judgment does not involve explanation, it does not require that we determine the origin of species or of variety within species. For this reason, Kant implies in the essay that it alone provides us with the ability to understand phylogenetic variation—how one phylum can manifest itself differently across space and time—and thus understand adaptation, without having to resort to an external (non-natural) principle, i.e., without having to invoke a non-natural principle by which to explain variation. Insofar as analogical reflection remains with the forms and does not seek to explain them, Kant implies, it allows us to discern natural relations, variation and adaptation, without having to offer an a priori derivation of their origin.⁸¹

Even though Kant did not properly explicate the science of forms as a kind of scientific knowledge, he provided theoretical foundations for its methodology and distinctiveness. In turn, as he struggled to preserve a strict conception of scientific knowledge,

and to criticize any form of knowledge that claimed to be scientific but did not abide by Kant's account, his contemporaries were learning from him and developing precisely the science of form that Kant identifies with teleological judgment and analogical reflection.⁸²

Thus, Kant, despite himself, challenged his distinction between explanation and description, proper science and teleological judgment (or analogical reflection), and in this way laid the theoretical foundations for the emerging science of life, the science of describing the structure, function and processes of living beings, without invoking an unknown, unknowable or occult cause—in other words, the science of form, which, as Hans Driesch writes just over a century after Kant, “furnishes the foundation of all biology.”⁸³

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⁷⁹ Kant (1790), AA 5, 419.

⁸⁰ Kant (1790), AA 5, 420.

⁸¹ Kant (1788), AA 8, 162.

⁸² See esp. Nyhart (1995). See also Huneman (2006), although I disagree with Huneman's reading of section 80 of the *Critique of Judgment*, insofar as it places Kant in opposition to the science of form. As I see it, Kant was not specifically critical of the science of form, but rather with the attempt to offer a mechanical explanation of the “continuum of forms,” which seeks to derive living beings from nonliving matter “according to the analogy of the physical continuum.” See Kant (1970), AA 28, 762.

The new emphasis on form that we witness in the *Critique of Judgment* brings Kant much closer to his contemporaries, such as Herder, who argued that all we can know are the “forms and effects” of nature, and Goethe, who developed the science of form par excellence, morphology. It is important to note that Herder and Goethe developed their science of living forms independently of (and to some extent prior to) Kant. See Nassar (2015).

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