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## Systematicity in Kant's third *Critique*

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**Abstract:** Kant's *Critique of the Power of Judgment* is often interpreted in light of its initial reception. Conventionally, this reception is examined in the work of Fichte, Schelling and Hegel, who found in Kant's third *Critique* a new task for philosophy: the construction of an absolute, self-grounding system. This paper identifies an alternative line of reception in the work of physiologists and medical practitioners during the 1790s and early 1800s, including Kiemeier, Reil, Girtanner and Oken. It argues that these naturalists called on Kant's third *Critique* to solidify an experimental natural history that classifies organic form within system of laws. Kant held both kinds of system in tension, which is why the third *Critique* remains a singular and provocative text.

**Keywords:** Kant, *Critique of the Power of Judgment*, systematicity, philosophy of science, teleology

### Introduction

Kant's *Critique of the Power of Judgment* is often interpreted in light of its initial reception in the 1790s and early 1800s.<sup>1</sup> In *The Twenty-Five Years of Philosophy*, Eckert Förster describes this period as one of the most productive – if not *the* most productive – in philosophical history.<sup>2</sup> In Förster's reconstruction, Kant's third *Critique* outlines a passage from reason to nature by means of a negative representation of the understanding's capacity to legislate nature according to the *a priori* principles of judgment. It thereby provides the scaffolding for a philosophical system capable of grounding itself on a principle immanent to its own operation.<sup>3</sup> While practically none of Kant's successors felt that his project had succeeded, they nevertheless saw the construction of a complete, self-grounding system as the basic

task of philosophy.<sup>4</sup> Sebastian Gardner provides a similar account of the third *Critique*'s reception as follows:

the *CPJ* exerted its greatest influence by a long chalk in the immediate Kantian aftermath on the German Idealists, who regarded it as the most important of the three *Critiques* – not of course in a sense that would imply its independence from the others, but in so far as they took it to *set the agenda* for what philosophy after Kant should do, or put another way, which for them came to the same thing, what should be *done with* Kant's philosophy.<sup>5</sup>

The interpretation of Kant's third *Critique* presented by Gardner is characterized by what I will call *absolute systematicity*, the establishment of a complete philosophical system. While Kant argues that the discursive nature of cognition entails that freedom and nature are present to us from two discontinuous standpoints, the German Idealists identified in the third *Critique* – and in §§76-77 in particular – a quasi-speculative account of intuition for which reason and nature cohere as a system of final ends. On this interpretation, the entire thrust of the analytic of the beautiful and the antinomy of the teleological power of judgment is to exhibit our reflective capacity to represent a non-discursive intellect for which nature is intuited as both ordered and free.

The reconstruction presented by Förster and Gardner identifies a productive tension in Kant's third *Critique* between discursive cognition and judgment's capacity to operate beyond the limits of the understanding. Yet this was not the only way the text was received in the immediate Kantian aftermath. The goal of this paper is to identify an alternative line of reception in the work of physiologists and clinical practitioners working in medical departments across Germany in the 1790s and early 1800s, including Karl Friedrich Kielmeyer, Johann Christian Reil, Christoph Girtanner and Lorenz Oken. These naturalists viewed Kant's project in the third *Critique* as necessarily incomplete, for it casts the task of harmonization as a matter of empirical research. This line of interpretation is characterized by what I will call of *experimental systematicity*, for it identifies in Kant's third *Critique* a programme of research grounded on the assumption that organic structure features within nature as a system of laws. While the discursive nature of cognition means that the naturalist cannot construct a complete natural system, reflective judgment enables the naturalist to conduct empirical research within a projected and yet unknown natural system. If

we follow the experimental systematists, the achievement of the third *Critique* is to harmonize the metaphysics of nature Kant developed in the first *Critique* and *Metaphysical Foundations* with empirical nature, thereby opening a scientific framework for classification.

The experimental systematists have received far less attention in the literature than the philosophers normally associated with the Kant to Hegel picture. For historians of philosophy, their focus on embryology, reproduction and comparative physiology seems too empirical to be of interest. For historians of the biological sciences, their work is ‘an unfortunate era dominated by arid speculation’, as Timothy Lenoir puts it.<sup>6</sup> In most histories of pre-Darwinian biology, Kiemeier, Reil, Girtanner and Oken are viewed within the romantic tradition of *Naturphilosophie*, which presents nature as a global organism. In contrast to this view, I argue that – with the exception of Oken – they explicitly opposed *Naturphilosophie* and sought to identify an alternative theoretical basis for physiology and natural history in Kant’s third *Critique*. Their appeal to Kant served to *distance* their work from the *Naturphilosophen*, who were seen as transgressing the experimental limits of natural history.<sup>7</sup>

This paper is primarily concerned with historical understanding. Both lines of reception, I suggest, provide a deeper grasp of Kant’s project in the third *Critique* by highlighting the alternative standpoints made possible by reflective judgment. Each demonstrates a particular strategy of vindicating the critical project, and yet each found it necessary to go beyond the boundaries Kant tried to maintain between determinative and reflective judgment. The first aims to ground the unity of reason on a fundamental principle, the second aims to build a system of laws. Kant sought to hold both kinds of system in tension, which is why the third *Critique* remains a singular and provocative text.

### **A Göttingen school?**

A common feature that unites Kiemeier, Reil, Girtanner and Oken is that each naturalist, at some stage of his career, came into contact with Johann Blumenbach’s lectures on physiology and natural history in the medical department at Göttingen. Noting this commonality, Lenoir identifies a ‘Göttingen school’ of physiology united by a shared commitment the scientific conception of natural history shared by Kant and Blumenbach. This conception of natural history, according to

Lenoir, was based on a ‘teleomechanist research programme’ that enabled the development of transcendental morphology at the turn of the nineteenth century.<sup>8</sup> Lenoir’s claim is not that Kant’s successors followed the methodological approach to organic systems outlined in *Critique of the Power of Judgment* as some kind of programmatic textbook but rather that Kant ‘set forth a clear synthesis of the principal elements of an emerging consensus among biologists.’

While Lenoir’s proposal has significantly increased our understanding of this period of history by bringing the neglected work of the so-called Göttingen school to the attention of historians of science, in what follows I provide an alternative account. The Göttingen connection, I suggest, is in some senses arbitrary; Kielmeyer spent only a year under Blumenbach’s tuition, and Oken arrived after receiving his education in Würzburg, and was critical of Blumenbach from the start of his tenure.<sup>9</sup> More significantly, there is little textual evidence to support Lenoir’s reading of Blumenbach as the figurehead of a teleomechanist programme of research based on Kant’s natural history.<sup>10</sup> Alternatively, I suggest that while this group of naturalists were clearly influenced by Blumenbach’s natural history, they were critical of his failure to resolve the tension between the mechanistic interpretation of Newtonianism and the vitalist account of the *Lebenskraft* offered by the *Naturphilosophen*. To find a solution they drew from the transcendental structure of Kant’s natural history, which does not ground experimental inquiry on facts about nature but rather on the structure of cognition. On my account, the joining thread of the physiologists and medical practitioners interested in Kant’s third *Critique* was a methodological form of vitalism that maintained a creative tension between the discursive nature of cognition and the ideal of a completed system.

Before turning to this interpretation of Kant, it is important to begin with a brief sketch of Blumenbach’s conception of natural history. Blumenbach studied medicine at both Jena and Göttingen during the 1770s, where he came to know several of the founding figures of the Romantic Movement along with some of the most innovative medical practitioners of his day.<sup>11</sup> His dissertation ‘On the Natural Varieties of Human Beings’ (1775) was widely read, and gained him the status of Privatdozent at Göttingen. His work grew rapidly in influence, and within three years he had advanced to ordinary professor.<sup>12</sup> Textual evidence suggests that Blumenbach began to consider Kant’s philosophy in 1786 as a result of the dispute stemming from Kant’s reviews of Herder’s ‘Ideas for a Philosophy of the History of Mankind’ and

Kant's exchange with Georg Forster.<sup>13</sup> The dispute concerned the epistemic status the formative force by which we can examine the development of organic form across time. While Herder presented the formative force as the hypothetical ground of natural phenomena though an analogy with Newton's account of gravity, Kant sought to qualify the formative force as a regulative principle that governs our search for affinity in nature (see RHI 8:62).

In *Über den Bildungstrieb*, Blumenbach presents this formative force as a drive responsible for organic effects. Like Herder he conceives of the *Bildungstrieb* through an analogy with Newton's gravitational force. Yet in contrast to Herder, he does not present the drive as a fundamental force that unites the totality of natural products in a universal natural history. Blumenbach seems to have agreed with Kant that such an account would merely assume what was meant to be discovered. Rather, he presents the *Bildungstrieb* as a programmatic hypothesis that enables the naturalist to examine the regularity of organic functions through experiment and observation:

Hopefully it is unnecessary to remind most readers that *the word* *Bildungstrieb*, like the words attraction, gravity etc., should serve no more and no less than to signify a force [*Kraft*] whose constant effect is recognised from experience, and whose *cause*, like the causes of the aforementioned widely recognised natural powers, is for us an *qualitas occulta*.<sup>14</sup>

Blumenbach presents his account of the *Bildungstrieb* as a postulated force that shares the hypothetical status of Newton's gravity. Here Blumenbach builds not on Herder's universal natural history but on Albrecht von Haller's physiological method, which, in Blumenbach's words, 'begins as usual with the thing with which one denies the status of truth; and there, one harvests at long last that which possessed a mere honorific status, and one can now say, "*that* is what we have long been acquainted with!"'<sup>15</sup> To examine the properties of organised beings, Haller proposed that the naturalist follows Newton's procedure by positing an unknown faculty as *X*, and then seeks to discover its value without speculating in regards to its cause.<sup>16</sup> Just as the hypothetical postulation of a force enabled Newton to discover the laws governing celestial dynamics, the *Bildungstrieb* enables the naturalist 'to give closer determination to [organic] effects and bring them under general laws.'<sup>17</sup>

Noting Blumenbach's programmatic account of natural history in *Über den Bildungstrieb*, Lenoir claims that 'Blumenbach's ideas on natural history underwent a thorough revision in light of Kant's analysis of the conceptual foundations for the construction of a scientific theory of organic form.'<sup>18</sup> Two pieces of evidence suggest that Blumenbach was at least aware of Kant's work. First, in August 1790, shortly following the publication of the third *Critique*, Kant (C 11:185) sent a letter to Blumenbach in which he praised his 'excellent essay "On the Formative Impulse" [*Über den Bildungstrieb*]', for he found much instruction on the matter of 'the union of two principles that people have believed to be irreconcilable, namely the physical-mechanistic and the merely teleological way of explaining organized nature.' Second, in the 1807 version of his *Handbuch der Naturgeschichte*, Blumenbach praises Christoph Girtanner's book *Über das Kantische Prinzip für die Naturgeschichte* (1796), which fuses Kant's account of classification with Blumenbach's *Bildungstrieb*. Yet as several scholars have contested, this evidence is insufficient to substantiate Lenoir's claim that Blumenbach revised his work in light of Kant.<sup>19</sup> For Robert Richards, the praise passed between Blumenbach and Kant does not indicate a shared research project but rather a misunderstanding of each other's work, for Blumenbach grants the *Bildungstrieb* epistemic parity with Newton's gravity, a comparison that Kant flatly denies.<sup>20</sup> In the following sections I suggest only Girtanner remained impervious to the differences between Blumenbach and Kant. For Kielmeyer and Reil, Kant's account of natural history placed reason's systematicity within an experimental framework, opening an alternative conception of science to that presented in *Naturphilosophie*.

### **Kielmeyer's physics of the animal kingdom**

In a lecture given at the Hohen Karlsschule in 1793, *Über die Verhältnisse der organischen Kräfte*, Kielmeyer outlines a new method for natural history that seeks to classify the organic world as a 'series of organisations [*Reihe der Organisationen*].'<sup>21</sup> Kielmeyer takes up the methodological idea assumed by Blumenbach and Kant that the *scala naturae* provides a hypothesis that enables the naturalist to go looking for the forces that enable the logical connections that hold in one's model. For Kielmeyer, such forces regulate the distribution of vital functions throughout the animal kingdom. These laws mark out a 'Physik der Tierreichs' discovered through comparative anatomical studies among animals. The goal of natural history is to systematise and

unify the patterns by which form has unfolded to find common relations that give rise to general laws.

Kielmeyer presents his programme of research as a new method of classification grounded on experimental methodology. In Blumenbach's account of the *Bildungstrieb*, the naturalist is able to discover the laws governing organic form by following Newton's method of positing an *X* as the unknown force responsible for organic effects. Yet Blumenbach failed to distinguish this procedure from the discovery of the universal laws of nature, which means that the limits of mechanistic and teleological inquiry remained unestablished. Kant, on the other hand, denied that the Newtonian form of causation could capture the dynamics of organised beings. He argued that experimental Newtonianism does not discover particular causal laws by observing connections in nature but rather by representing connections in the form of categorised experience such that one can *search* for the grounds responsible for the effect. Connections in nature for Kant are necessarily represented in the form of causation, which provides the universal form *X* is the cause of *Y*. In *Metaphysical Foundations* Kant argued that natural history does not qualify as an experimental science precisely because it operates according to an alternative form of causation in which things of *such and such a kind* do *Y* when *X* happens (*MF* 4:468); for example, the thickness of a bird's feathers increase as climactic temperature decreases (*DR* 2:434). In the third *Critique*, Kant explains that the form of occasional forces is foreign to categorised experience, and claims that it is rather derived via an analogy with the form of practical reason (*CPJ* 5:351).

In light of Kant's qualification, Blumenbach might seem like a more obvious source if one were to propose a physics of the animal kingdom. Yet Kielmeyer nevertheless opens the address with a revised version of Kant's account of space and time as forms of intuition.<sup>22</sup> This account required modifications, however; for Kielmeyer, the capacity to identify some objects as living beings is not a matter of reflection that arises once determinant judgment has failed to provide sufficient determination. Rather, the examination of organic structure is a matter of the schematising understanding:

If we, by the power of our minds, separate the phenomena of nature – for us connected in a system by space and time – for their connection, then surely those appearances that we isolate and subsume under the name 'animate



nature', I mean the organisations of our earth, are the most able to fill us with feelings of nature's greatness of those with which we are closely acquainted. To be sure, no masses, volumes, or distances found here are like those of the skies, by which nature convinces us of its greatness. However, if, when judging the greatness of an object, we can deign to give voice and listen with a little patience to the multiplicity [*Vielheit*], manifoldness [*Mannigfaltigkeit*] and harmony [*Harmonie*] of effects in a small space and short periods of time, then there are things of another kind, that speak to us no less forcefully.<sup>23</sup>

In this passage Kiehmeyer extends the idea of an organised system to the entire biosphere. The idea is that the manifold of nature is presented to us in intuition within a spatio-temporal system, which is then schematised by the understanding. This system is not *determined* by particular laws; it is rather *amenable* to the determination of possible laws, for the understanding, in Kant's view, is not concerned with 'the totality of connections' but with the sensibly given manifold, which it seeks to structure as classificatory and causal (B164). To provide further determination, we separate the phenomena to discern the particular grounds of their connection. While naturalists traditionally turn to the ordered movement of celestial spheres as the greatest example of the capacity of reason to order the cognitions of the understanding, Kiehmeyer invites his listeners to turn instead to the independently structured multiplicity of the organic sphere, and to discern the harmony of effects and causes that speak to us of another kind of order. First, this leads us to note the incredible diversity of forms on the surface of the earth, which is an extremely small space compared to the planetary system. Second, this leads us to note the how these things occupy time: the changes that an organism undergoes results in the reciprocal adaptation of all the other organs, thus forming a system that is so united that 'each is reciprocally cause and effect of the other.'<sup>24</sup> This same configuration characterises the organisms within a species, and the organisms within an environmental system, which come together to 'form the life of the great machine of the organic world.'<sup>25</sup>

Kiehmeyer's temporal portrayal of the part-whole relationship that governs organic structure clearly builds on Kant's account of organic form. However, his consideration of the organic sphere as a counterpart to celestial dynamics places the study of animate nature on the same footing as mechanical nature. This move shifts the study of particular organised beings, which Kant reserved for the historical

doctrine of nature, to the domain Kant described as experimental physics (*MF* 4:468). Animate nature for Kielmeyer is not firstly a matter of reflective judgment but of intuition; it occupies space as an unfathomable manifold, in the same way as non-living nature, and yet it occupies time in a fundamentally different manner: as a reciprocal relation of cause and effect, where the effect can also be understood as grounds for the cause. The system of the organic world is not made present through the symbolic equivalent to the schematism, as Kant had argued in the third *Critique*, which transposes the form of rational agency into a symbol for the reflective application of judgment (*CPJ* 5:352). Rather, animate nature for Kielmeyer is schematised *by the understanding*. Yet the judicial structure of animate nature is not fixed, for the system changes itself in time as natural history. The universal principle that structures animate nature as a unity is the ‘law of compensation [*Kompensationsgesetz*]’, by which each part self-regulates in dynamic relation to all the other parts.<sup>26</sup> Such a principle cannot simply be a matter of the understanding, which operates according to laws that are universal and necessary, but also of reason, for it concerns the capacity of organised beings to respond to environmental conditions according to an inner principle of change. Kielmeyer’s goal is thus to systematise and unify the patterns by which form has unfolded to find common relations that give rise to general laws, thereby providing a scientific foundation for the system of nature. While the constitutive causes of organic nature cannot be grasped, nature must be examined as if it exhibited a technique analogous to purposeful action:

we still must confess that the chain of effects and causes in most cases seems like a chain of means and ends to us and that we would find it advantageous for our reason to assume such a chain.<sup>27</sup>

As Richards notes, Kielmeyer frames his claim in such a way that nature might not have intrinsic purposes, and that the search for higher goals might ultimately appear to be illusory.<sup>28</sup> The success of the research program would however provide evidence that such a system *does* track an order in nature. The lecture demonstrates Kielmeyer’s commitment to a thoroughly materialist scientific program, displaying a goal that Kant and Blumenbach at least claimed to hold in common, that of uniting a

thoroughly Newtonian account of matter with teleology. The form of Kiermeier's solution, however, is decidedly Kantian.

To grasp what defines this program as an experimental *science*, we need to return to the first *Critique's* Architectonic of Pure Reason. There Kant argues that 'systematic unity is that which first makes ordinary cognition into a science, i.e. makes a system out of a mere aggregate of it':

I understand by a system ... the unity of the manifold cognitions under one idea. This is the rational concept of the form of a whole ... [this whole] is *articulated* (*articulatio*) and not *heaped together* (*coacervatio*); it can, to be sure, grow *internally* (*per intus susceptionem*) but not *externally* (*per appositionem*), like an animal body, whose growth does not add a limb but rather makes each limb stronger and fitter for this end without any alteration of proportion. (*CPR* A832-3/B860-1)

It is no accident that Kant calls on an organic metaphor to elucidate reason's systematicity. The systematic structure of rational cognition is not the result of a mechanical process, it is not fixed, and neither is it an artefact produced by a designer. Rather, the growth of a rational system is internal and enhances the proper functioning of its parts. Natural science forms a part of this system to the extent that it tells us what nature is from the theoretical standpoint, that is, as ruled by the legislation of the understanding. What Kant calls the 'metaphysics of nature' reveals the principles of physics (i.e. special metaphysics), which govern the application of mathematics to appearances.

Yet the project Kiermeier pursues is not one of natural science as the study of the rules of the understanding, but rather the construction of a natural system of empirical laws. This is where the third *Critique* comes into play. If we follow Kiermeier's lead, the problem Kant sets out to investigate in his *Critique of the Power of Judgment* is how it is possible to move from the metaphysics of nature to empirical nature. While efficient causes are sufficient to explain events, the *arrangement* of matter is contingent on such laws, which are blind to rationality. Kant explains this in the Introduction as follows:

The understanding is of course in possession *a priori* of universal laws of nature, without which nature could not be an object of experience at all; but still it requires in addition a certain order of nature in its particular rules, which can only be known to it empirically and which from its point of view are contingent. (*CPJ* 5:184)

This problem, Kant informs us, concerns the division between the theoretical and the practical spheres. This is not the problem of harmonizing nature and freedom in a philosophical system, however, but harmonizing them for the sake of experimental research. On the one hand, the theoretical sphere concerns propositions that determine experience according to the laws of nature, providing a conception of nature as an aggregate of appearances in time and space. On the other hand, the practical sphere concerns propositions that *give* law, and thus concern only the possibility of a represented object (through voluntary action). Thus a practical physics is an absurdity, for our construction of physical models is the pure consequence of a theory. Yet Kant notes that there *is* a practical part to physics insofar as it rests on empirical principles. In the First Introduction Kant calls such an investigation ‘experimental physics’ (FI 20:198), which proceeds not ‘mechanically’ but ‘technically’ in order to discover the ‘hidden laws of nature’. An experimental physics is ‘practical’ to the extent that it assumes that nature is the product of reasoned activity, and yet, unlike practical reason, it does not constitute what it represents. Rather, it searches for order within the manifold of appearances. Kant describes the process as follows:

Now it is clear that the reflecting power of judgment, given its nature, could not undertake to *classify* the whole of nature according to its empirical differences if it did not presuppose that nature itself *specifies* its transcendental laws in accordance with some sort of principle. Now this principle can be none other than that of the suitability of the capacity of the power of judgment itself for finding in the immeasurable multiplicity of things in accordance with possible empirical laws sufficient kinship among them to enable them to be brought under empirical concepts (classes) and these in turn under more general laws (higher genera) and thus for an empirical system of nature to be reached ... The special principle of the power of judgment is thus: *Nature*

*specifies its general laws into empirical ones, in accordance with the form of a logical system, in behalf of the power of judgment. (FI 20:215-6)*

Kant's idea here is that we project the principle of reflective judgment up the order of cognition: 'Through this [principle] we present nature as if an understanding contained the basis of the unity of what is diverse in nature's empirical laws' (*CPJ* 5:181). Thus, by virtue of our capacity to examine the manifold of appearances as produced by an intuitive understanding, a sphere opens up between the metaphysics of nature and practical reason that we can observe in search for lawful appearances. As Kant later explains in §77, we can only 'represent the agreement of natural laws with our power of judgment' if we 'at the same time conceive of another understanding' for which the reciprocal relation between ends and means is not contingent on mechanical laws but necessary (*CPJ* 5:407). This negative representation sets the regulative ideal of an ordered system of nature. Without presupposing the agreement of laws and judgment, Kant explains, 'we would have no order of nature in accordance with empirical laws, hence no guideline for an experience of this in all its multiplicity and for research into it' (*CPJ* 5:185). With this presupposition in place we are able to credit some of our empirical generalizations with a necessary status by virtue of their incorporation in a system that is constructed by following certain rules that *are* necessary. Kant states that we consider such statements 'as rules, (i.e., as necessary), because otherwise they would not constitute an order of nature, even though it does not and never can cognize their necessity' (*CPJ* 5:185). The idea is that as our discursive representation gains in systematicity we can claim that it tracks reality as given to an intuitive intellect. The absolute limitation is reflected in the necessity of employing concepts that cannot be taken to determine an object but rather serve as formal rules.

Kielmeyer's address conveys a direct reference to Kant's argument, for it argues that forces must be regarded as teleological principles that distinguish organisms from non-living matter. We must assume a *Bildungstrieb* as the organizational principle of each organized body so that we can go about classifying natural kinds according to 'affinity', what Kant defines in the first *Critique* as unity in variety and variety under unity 'insofar as they have all sprouted from the one stem [*Stamm*]' (*CPR* A660/B688). As Kant argues at length in the third *Critique*, this drive is not posited by analogy with Newtonian force but as an occasional force that

responds to varying environmental conditions according to a pathway determined by an inner principle of organisation. The governing questions of Kiehmeyer's research program are thus, which forces gather in most individuals? What are the reciprocal relationships between these forces in different kinds of organisation? According to which laws are these relationships modified in the series of different kinds of organisation? In addition to the two Hallerian forces, sensibility and irritability, Kiehmeyer identifies three more, which pertain to the formative force: reproduction, secretion, and propulsion. Each force is grounded on empirical observations, allowing Kiehmeyer to view animal organization as a result of great machine of the organic world.<sup>29</sup>

### **Reil and the *Lebenskraft***

What is distinctive about Kiehmeyer's address is that it presents a general scientific field concerned with the laws that regulate the organisation of living nature as a whole through examining the reciprocal relations that govern animate nature. Reil advanced a similar field of inquiry in his account of the *Lebenskraft* in the first edition of his journal, *Archiv für die Physiologie*. In the opening section he states that 'the appearance of living bodies have their ground above all in matter.'<sup>30</sup> While this explicitly contradicts Kant, it does not signal a commitment to Blumenbach's Newtonian analogy or to Herder's *Naturphilosophie*. Rather, Reil adopts a Kantian position by limiting our knowledge of matter to appearance in 'outer sense', which receives determination by the forms of representation provided by 'inner sense'. In the Analogies of Experience Kant had established outer sense as the mark of objectivity, for the change in the appearances is not attributed to something occurring in us but rather in the object (A242/B197). In *Metaphysical Foundations*, our capacity to represent a system in outer sense is the hallmark of a scientific field of research (MF 4:468). For Reil, reason cannot determine *a priori* the specific causal structure of living beings, for organic structure is not a matter of inner sense. Drawing explicitly from Kant's notion of force in *Metaphysical Foundations*, he claims that 'Structure and organization is ... the appearance and effect of matter itself.'<sup>31</sup> In Reil's account, if appearances in outer sense are the effects of matter in motion, then the representation of organic beings cannot be a mere matter of inner sense but 'must be grounded in the spatial, in matter.'<sup>32</sup> The 'doctrine of nature [*Naturlehre*]', he states, 'is the science of the qualities of things in the world of sense.'<sup>33</sup> Living and dead

matter can be separated according to their qualities, just as vegetable and animal matter can again be separated. Matter alone for Reil simply cannot determine *a priori* the variety of natural bodies, for if that were so, ‘there would be no necessity for employing the concept of *Kraft*.’<sup>34</sup> Consider the case of generation: how the seed (*Keim*) or stem (*Stamm*) originally arose, how it formed, and whether it contains the entire organic individual in miniature or only a part, this ‘we do not know’.<sup>35</sup> Yet we can proceed by searching for affinity within the world of sense on the assumption that a seed is there to be found. Reil cites Kant’s account of the natural end, and agrees that we must consider organisms as individuals in which each part is related to the other reciprocally as means and ends.<sup>36</sup> Yet his language suggests that he understood the organising force as a causal relation established by cognition. He argues that ‘each part forms itself and maintains itself through its own energy’, suggesting that the connection each part holds with the others is the *result* of this energy rather than a *manifestation* of it.<sup>37</sup> For Reil, the *Lebenskraft* enables the naturalist to examine the part-whole dynamic of organised beings as a *causal relation*, thereby opening an experimental science concerned with the laws governing the organic sphere.

Kant of course recognised the gap between the metaphysics of nature and empirical nature in *Metaphysical Foundations* and *Critique of the Power of Judgment*. Reil does not reject Kant’s view of experimental physics in favour of Herder’s empirical hypothesis or Blumenbach’s Newtonian analogy. Like Kant, he held that natural science requires transcendental grounding if its results are to be more than arbitrary, unverifiable propositions. Unless the naturalist has grounds to represent their experimental system in outer sense they lose the capacity to convince others that their system carves nature at its joints (see A820/B848). Yet Reil – like Kielmeyer – argues that Kant’s addition of a reflective modality of judgment did not go far enough to bridge the gap between understanding and reason. Kant’s account of reflective judgment supposedly traverses the gap between reason and nature by enabling judgment to reflect on the cognitions of the understanding through the principle of purposiveness. Yet what are the effects in the manifold by which we identify the reciprocal cause and effect temporality of animate beings? How could we possibly recognise them, if reflective judgment were based on an analogy with something in *inner sense*? The solution for Reil involves the expansion of Kant’s physics to bestow a quasi-objective status to occasional causation, granting to the *Lebenskräfte* the capacity to guide the naturalist toward the discovery of empirical causal laws.

## **Girtanner and the Kantian principle**

Christoph Girtanner was more willing to accept the limits Kant placed on the judgment of organisms as natural ends than Keilmeyer and Reil. In *Über das Kantische Prinzip für die Naturgeschichte* (1796) he presents Kant's account of reflective judgment as the basis for a research programme that, for the first time, warrants the name *natural history*. Girtanner's system of classification accepts Kant's account of the germs and dispositions outlined in his essays on race, which determine the limits of structural adaptation in organised beings by manifesting various qualities in response to changes in environmental conditions. While Kant had proposed a methodological account of the *Bildungstrieb* to account for the structural modifications *within* a species to determine various lines of descent as races, Girtanner uses the *Bildungstrieb* to examine common lines of descent that lead to various *species*. Following Kant, he claims that the task of natural history is to show 'how the original form of each and every original stem [*Stammgattung*] of animals and plants was constructed, and how species [*Gattungen*] have gradually been derived from their original stems.'<sup>38</sup> Yet lacking the sophistication of Keilmeyer and Reil's treatment of Kant's epistemology, Girtanner proposes a system of classification based on laws *in* nature. He claims that because organised bodies are both 'end and means' for themselves, that is, because they are *self-causing*, natural history provides an account of natural laws that are real and genetic (*Naturgattungen*):

Natural history, in the philosophical sense, divides organized bodies into stems according to their affinities in respect to generation. It is based on the communal law of propagation [*fortpflanzung*]. The unity of the species is according to the unity of their generative forces. In this way a system of nature is formed for the understanding, a classification of organized bodies under rules, and in particular, under the laws of the formative drive [*Bildungstrieb*].<sup>39</sup>

Girtanner's aim not simply to apply Kant's principle of classification to natural history but also to establish the compatibility of Kant and Blumenbach's views on generation, for both explain how environmental changes on earth occasioned dramatic changes in life forms. While he clearly overlooks the difference between



Blumenbach's Newtonian presentation of the *Bildungstrieb* and Kant's reflective account of organic structure, he nevertheless extends Kant's claim in the third *Critique* that under such a principle the 'agreement of nature without our faculty of cognition is presupposed *a priori* by the power of judgment in behalf of its reflection on nature in accordance with empirical laws' (*CPJ* 5:187). To frame his research program in opposition to the speculative program advanced by the *Naturphilosophen*, wherein new species emerge through non-lawful breaks in a line of descent, Girtanner endorses Kant's demonstration that however dramatic natural changes might be, the variation within species always emerges under the guidance of laws.

### **The third standpoint: from the top or the bottom of the ladder?**

The interpretation of the third *Critique* found in Kielmeyer, Reil and Girtanner provides an alternative representation of Kant's project to that found in the familiar Kant to Hegel picture. The absolute systematicity reading emphasizes Kant's awareness of the impassable gap between nature and freedom. It thus suggests that the third *Critique* sets out to reconcile the critical dualism by identifying our access to the supersensible substrate through our faculty for feeling pleasure and displeasure. Reflective judgment allows us to climb the ladder from the many to the one to represent nature as an organic whole, a self-organising system. The experimental systematicity reading, on the other hand, emphasizes Kant's awareness of the gap between the metaphysics of nature and empirical nature. This is still a practical problem, but one concerning the need for a quasi-practical (i.e. technical) experimental physics. On this view, reflective judgment enables the naturalist to presume a point at which empirical laws ultimately converge in the form of a system, the possibility of which is vindicated by the establishment of it. For Kielmeyer and Reil, this involves a modified version of Kant's transcendental physics; the *Lebenkräfte* are granted a quasi-objective status by virtue of their role within the system that we build from the ground up toward the practical guidelines set by reason.

Both interpretations find in Kant's account of reflective judgment a ladder that allows us to climb from the metaphysics of nature to nature as a system of laws *even though* such a system is not (yet) available to us. The first stresses the speculative view from the top: by judging nature as a self-organizing system, thereby completing the absolute system, we can then investigate empirical laws.<sup>40</sup> The second stresses the experimental view from the ground: we search for empirical laws along the guiding

lines set forth by reflective judgment in order to vindicate our reflective estimation of nature's purposiveness. In this sense both interpretations find in Kant's third *Critique* a manifesto for an *experimental science*, which, as Schelling explains in the *First Outline*, had hitherto been viewed as 'a mongrel idea that implies no consistent thought, or rather, is an idea which cannot be thought at all.'<sup>41</sup> The first pursues this along the lines of *Naturphilosophie*, the second of a methodological form of vitalism.

In this final section I want to examine the singularity of Kant's project; why it stands apart from other philosophies of nature and how the tensions it captures generate the extensive philosophical energy evinced by interpretations that can be traced back to it. As Philippe Huneman notes, if we were concerned with comparing the philosophical *theses* of those thinkers at the turn of the nineteenth century interested in transforming natural history into a scientific endeavour, 'one would have to stress Kant's isolation.'<sup>42</sup> As is well-recognised in the literature, any attempt to identify Kant as the father of either German Idealism or biology as a unified science must distort Kant's views on the level of theory.<sup>43</sup> Yet if our history of this period aims rather to compare conceptual lineages opened by creative moments of philosophical synthesis, then we discover in the third *Critique* an extremely rich collection of problems that remain strikingly relevant to contemporary philosophy.<sup>44</sup>

The work of Lorenz Oken represents a confluence of both interpretations of the third *Critique*. Oken worked as a *Privatdozent* at Göttingen several years after Kiehmeyer, Reil and Girtanner had attended as students (1805-7). In contrast to Kiehmeyer, Reil and Girtanner, Oken was educated at Würzburg and was strongly influenced by Schelling's circle and their early work on *Naturphilosophie*. He rejected Blumenbach as the figurehead of a new science of organisms, writing to Schelling in May 1805 that Blumenbach 'lectures on the classification of animals as if it were a mathematical truth that they must be divided just as he has divided them – not a word to justify this classification, or about others.'<sup>45</sup> The issue at stake, Oken insists, is how systematicity is justified. In his view, the fundamental task of natural history is to build to a system of comparative physiology on empirical sources that provide a view in miniature of developmental change.<sup>46</sup> His method is not 'to start directly at the origin of the organic world, but rather to go back to the first stirring of the universe, and to let the whole of nature emerge gradually from there.'<sup>47</sup> Of course, Oken was aware that we cannot build an objective history of nature's development. Kant was charged for presenting a 'science of the gods' by Forster in 1786, which

initially motivated his reflective account of judgment in his teleology essay of 1788.<sup>48</sup> During the late 1780s Kant became increasingly aware of the problematic gap between empirical nature and a genuine metaphysics of nature, and sought to provide a way that the natural researcher might transition from one to the other. Yet for Oken, natural history can extend further than the discovery of affinities between fossilized remains and the present diversity of organic life. The task of natural history, as he saw it, is ‘to find the universal order *within* the particular givenness of natural processes.’<sup>49</sup> Kant had claimed that the experimental investigation of empirical objects strives towards a universal understanding of nature; every empirical investigation presupposes that nature ‘adheres to a parsimony suitable for our judgment and a uniformity we can grasp’ (*CPJ* 5:213). Oken provides a liberal interpretation of Kant’s experimental presentation of systematicity to the extent that he connects description, classification, anatomy, physiology and chemistry into one all-encompassing theoretical framework called ‘biology’. However, if the basic goal of systematicity is to establish the individual laws of nature as necessarily true, and if the only way this can be achieved is by the integration of these laws into a system, it would seem that systematicity is a condition of the possibility of experience itself. That is, it would seem that systematicity is on par with the constitutive principles of the understanding. For Oken, the task of the *Naturphilosoph* is to remove the assimilation of thinking and finite thinking – to adopt the standpoint afforded by Kant’s reflective judgment – so that life and thought become one. Goethe presents a similar thought in ‘Pure Concepts’ (1792):

Because the simpler powers of nature are often hidden from our senses, we must seek to reach out to them through the powers of our mind and to represent their nature in ourselves, for we can not behold them outside ourselves. ... [for] our mind stands in harmony with the deeper lying simpler powers of nature and thus can represent them purely, as we perceive the objects of the visible world with a clear eye.<sup>50</sup>

Goethe identifies a deeper confluence between inner and outer sense than Reil had sketched in his reading of Kant. For Kant, while reason looks for the unconditioned the understanding is limited to the series of conditioned effects. This is precisely why reflective judgment can investigate the space between the conditioned and the

unconditioned. Yet for Goethe, the organism is a special case, for it leads us toward the speculative thought of the organism's existence as a free natural purpose, even though such an existence must remain inexplicable for the understanding. Goethe saw that Kant's teleological approach to nature provided a way to speak of final causes in nature without invoking a divine artisan in nature's etiology. His notion of metamorphosis defines the process by which the archetype moves through nature with various functions and with frequent changes in form, none of which are preordained but all of which form part of nature as a whole. When 'an organism manifests itself', he claims, we are able to 'grasp the unity and freedom of its formative impulse.'<sup>51</sup>

The program of *Naturphilosophie* developed by Oken, Schelling and Goethe departs from Kant to the extent that it accepts that freedom and nature can be unified without eliminating freedom. The experimental physics of Kiemeyer and Reil oversteps the reflective limits Kant placed on our knowledge of the *Lebenkräfte*. What both interpretations establish is that Kant's recognition of a third standpoint, one that warrants its own critique, opens an investigative field between the metaphysics of nature and nature understood as an empirical manifold that is neither preestablished nor the product of a divine artisan, but rather an underdetermined field of phenomena that is subject to experimental investigation and systematic reconstruction. Kant continually denied this field equal status with experimental physics on the grounds that we cannot examine historical structural modifications in experience. Yet this restriction stemmed from Kant's unswerving commitment to avoid explanations that lie 'outside the field of the observational doctrine of nature' and belong instead to 'speculative nature' (RHI 8:54). The strategy shared by the absolute and experimental systematists not so much to overcome Kant's limitations as it is to show that we *do* have evidence within the observational field by which to determine the laws governing the organic sphere. Kant's attempt to hold two seemingly irreconcilable commitments – to nature as an exhaustively determined sphere subject to rigorous scientific analysis and to freedom as the capacity for self-legislation – opened this third standpoint from which we reflect on nature as a whole. His insight is made possible by his recognition that the question of the unity of nature and freedom, and the question of the lawfulness of organic structure, bears on us as *humans*, not merely as *knowers* or *agents*. Kant's third *Critique* remains a singular and provocative text to the extent that what it means for us as organic creatures to look out upon nature, to

feel its potency, beauty and its self-expressive order, remains a philosophically energizing standpoint today.

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<sup>1</sup> Citations of Kant's works refer to the volume and page number of *Kants gesammelte Schriften*, Akademie Ausgabe, except for *Critique of Pure Reason*, where I used the standard A/B page numbers from the first and second editions. Citations are in text with the following abbreviations: C = *Correspondence*, DR = 'Of the Different Races of Human Beings [1777]', CPR = *Critique of Pure Reason*, MF = *Metaphysical Foundations of Natural Science*, CPPr = *Critique of Practical Reason*, RHI = 'Reviews of Herder's Ideas on the Philosophy of the History of Mankind', FI = 'First Introduction' to *Critique of the Power of Judgment*, CPJ = *Critique of the Power of Judgment*.

<sup>2</sup> Eckart Förster, *The Twenty-Five Years of Philosophy*. Trans. Brandy Bowman. (Cambridge, Mass.: Harvard University Press, 2012).

<sup>3</sup> Andrew Seth's *The Development from Kant to Hegel* (1882) is one of the earliest versions of this interpretation, which is now found in many 'Kant to Hegel' books such as Dieter Henrich's *Between Kant and Hegel* (1973). Henrich's expressed aim is to examine 'the relationship between Kant's philosophical system and the idealism that succeeded it': 'Fichte

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and Hegel considered themselves to be the true successors of Kant. Each claimed that only *his* philosophical program ultimately could defend Kant's position, making it coherent and superior to all alternatives.' Andrew Seth, *The Development from Kant to Hegel*. (London: Williams and Norgate, 1882). Dieter Henrich. *Between Kant and Hegel: Lectures on German Idealism*. (Cambridge, Mass.: Harvard University Press, 2008).

<sup>4</sup> See Predrag Cicovacki (ed.), *Kant's Legacy: Essays in honour of Lewis White Beck*. (Rochester: University of Rochester Press, 2000).

<sup>5</sup> Sebastian Gardner, 'Kant's Third *Critique*: The Project of Unification', *Royal Institute of Philosophy Supplement* 78 (2016), 161-185, 170.

<sup>6</sup> Timothy Lenoir, *The Strategy of Life: Teleology and Mechanics in Nineteenth-Century Biology*. (Dordrecht, Holland: D. Reidel, 1982), ix.

<sup>7</sup> For the few studies that argue for the distinctness of *Naturphilosophie* and vital materialism, see Lenoir, *The Strategy of Life: Teleology and Mechanics in Nineteenth-Century Biology*; Richards, *The Romantic Conception of Life*; Andrea Gambarotto, 'Lorenz Oken (1779-1851): *Naturphilosophie* and the reform of natural history', *British Journal for the History of Science*, 50 (2017), 329-340.

<sup>8</sup> Lenoir, *The Strategy of Life*, 2.

<sup>9</sup> Not only was Kielmeyer's connection to Göttingen a year spent as a visiting student, but he seems to have had greater contact with Lichtenburg during his stay. See Kai Torsten Kanz. 'Carl Friedrich Kielmeyer, Lichtenberg und Göttingen. 1786-1796.' *Lichtenberg-Jahrbuch* 1989, 140-160.

<sup>10</sup> Zammito and Richards are extremely critical of Lenoir's notion of a teleo-mechanist research programme, for they argue that Kielmeyer, Reil and Girtanner interpreted Kant incorrectly. In this paper I am not concerned with the question of whether they understood Kant correctly but with how their readings of Kant's third *Critique* shed light on its historical significance. Kant argued that Fichte and Hegel fundamentally misunderstood him, but we nevertheless find in their work important clues for understanding his work. John Zammito, 'The Lenoir Thesis Revisited: Blumenbach and Kant', *Studies in History and Philosophy of Biological and Biomedical Sciences* 43 (2012), 120-132. Robert Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe*. (Chicago: University of Chicago Press, 2002).

<sup>11</sup> In particular, Johann Michaels, professor of theology and father of Caroline Schelling, and Christian Heyne, who taught the Schlegel brothers. See Robert Richards, 'Kant and Blumenbach on the *Bildungstrieb*: A Historical Misunderstanding.' *Studies in History and Philosophy of Biological and Biomedical Sciences* 31 (2000), 11-32, 17.

<sup>12</sup> Richards, 'Kant and Blumenbach on the *Bildungstrieb*', 17.



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<sup>13</sup> See John Zammito, “‘This Inscrutable *Principle* of an Original *Organization*’: Epigenesis and ‘Looseness of Fit’ in Kant’s Philosophy of Science.’ *Studies in History and Philosophy of Science* 34 (2003), 73-109, 75.

<sup>14</sup> Johann Friedrich Blumenbach. *Über den Bildungstrieb*. 2. Aufl. (Göttingen: Johann Dieterich, 1789), 25-26.

<sup>15</sup> Blumenbach, *Über den Bildungstrieb*, 27.

<sup>16</sup> For example, in an entry to the Swiss edition of Diderot and d’Alembert’s *Encyclopédie*, Haller presents his methodology in terms of temporary place-holders: ‘Every time we see effects, the mechanical cause of which is unknown to us, we can refer to this cause as a *faculty*, like we refer to an unknown quantity as *x*. If luminous experiments or perfected anatomy discover the mechanism which produces this effect, we would then erase the *name in waiting* [*nom d’attente*], as one erases the character marking an unknown quantity.’ Cited in Charles Wolfe. ‘On the Role of Newtonian Analogies in Eighteenth-Century Life Science.’ In *Newton and Empiricism*. Edited by Zvi Biener and Eric Schliesser. (Oxford: Oxford University Press, 2014), 241.

<sup>17</sup> Blumenbach, *Über den Bildungstrieb*, 26.

<sup>18</sup> Lenoir, ‘Kant, Blumenbach, and vital materialism in German biology’, 77.

<sup>19</sup> Zammito for instance claims that ‘Only by misunderstanding Kant did biology as a special science emerge at the close of the eighteenth century.’ John Zammito, ‘Teleology then and now: The question of Kant’s relevance for contemporary controversies over function in biology.’ *Studies in History and Philosophy of Biological and Biomedical Sciences* 37 (2006), 748-770, 765.

<sup>20</sup> Richards claims that ‘Those biologists who found something congenial in Kant’s third *Critique* either misunderstood his project (Blumenbach and Goethe) or reconstructed certain ideas to have very different consequences from those original intended (Kielmeyer and Schelling).’ Richards, *The Romantic Conception of Life*, 229.

<sup>21</sup> Thomas Bach. *Biologie und Philosophie bei C. F. Kielmeyer und F. W. J. Schelling*. (Stuttgart: Frommann-Holzboog, 2001), 93.

<sup>22</sup> Marie Luise Heuser-Keßler. ‘Raum, Zeit, Kraft und Mannigfaltigkeit. Kant und die Forschungsmethodologie der Physik des Organischen in Kielmeyers “Rede”.’ In *Philosophie des Organischen in der Goethezeit*. Edited by Kai Torsten Kanz. (Stuttgart: Steiner, 1994), 113.

<sup>23</sup> C. F. Kielmeyer, *Über die Verhältnisse der organischen Kräfte*. (Stuttgart: Marburg an der Lahn, 1793), 3.

<sup>24</sup> Kielmeyer, *Über die Verhältnisse der organischen Kräfte*, 4.

<sup>25</sup> Kielmeyer, *Über die Verhältnisse der organischen Kräfte*, 5.

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- <sup>26</sup> The law can be stated as follows: ‘the more one of these forces on one side is cultivated, the more they are neglected on the other.’ Kiehmeyer, *Über die Verhältnisse der organischen Kräfte*, 35-36.
- <sup>27</sup> Kiehmeyer, *Über die Verhältnisse der organischen Kräfte*, 6.
- <sup>28</sup> Richards, *The Romantic Conception of Life*, 242.
- <sup>29</sup> Kiehmeyer, *Über die Verhältnisse der organischen Kräfte*, 5.
- <sup>30</sup> J. C. Reil, ‘Von der Lebenskraft’, *Archiv für die Physiologie* (1795), 1.
- <sup>31</sup> Reil, ‘Von der Lebenskraft’, 44.
- <sup>32</sup> Reil, ‘Von der Lebenskraft’, 2.
- <sup>33</sup> Reil, ‘Von der Lebenskraft’, 7.
- <sup>34</sup> Reil, ‘Von der Lebenskraft’, 24.
- <sup>35</sup> Reil, ‘Von der Lebenskraft’, 44.
- <sup>36</sup> Reil, ‘Von der Lebenskraft’, 29.
- <sup>37</sup> See Richards, *The Romantic Conception of Life*, 259.
- <sup>38</sup> Christoph Girtanner, *Über das Kantische Prinzip für die Naturgeschichte*. (Göttingen: Vandenhoeck und Ruprecht, 1796), 2.
- <sup>39</sup> Girtanner, *Über das Kantische Prinzip für die Naturgeschichte*, 3-4.
- <sup>40</sup> Schelling for example proposed a ‘speculative physics’, a view of nature from the ladder’s highest rung: ‘Because mechanically motion results only from motion to infinity, there remains for the real construction of speculative physics only one way open, the dynamic, with the presupposition that motion arises not only from motion, but even from rest; we suppose, therefore, that there is motion in the rest of Nature, and that all mechanical motion is the merely secondary and derivative motion of that which is solely primitive and original, and which wells forth from the very first factors in the construction of a Nature overall (the fundamental forces).’ F. W. J. Schelling, *Introduction to the Outline of a System of the Philosophy of Nature* (1799), in *First Outline of a System of the Philosophy of Nature* (1799), trans. K. R. Peterson. (Albany, NY: SUNY Press, 2004), 196.
- <sup>41</sup> Schelling. *Introduction to the Outline of a System of the Philosophy of Nature* (1799), 201.
- <sup>42</sup> Philippe Huneman, ‘From the *Critique of Judgment* to the hermeneutics of nature: Sketching the fate of philosophy of nature after Kant’, *Continental Philosophy Review* 39 (2006), 1-34, 9.
- <sup>43</sup> Richards, *The Romantic Conception of Life*; Zammito, ‘The Lenoir Thesis Revisited’.
- <sup>44</sup> See for example continuing debates over the epistemic status of teleology in philosophy of biology. For an overview of the debate, see Andrew Cooper. ‘Two directions for teleology: naturalism and idealism.’ *Synthese* 195 (2018), 3097-3119.
- <sup>45</sup> Oken, in F. W. J. Schelling, *Briefe und Dokumente: Bd. III, 1803-1809*. (Bonn: Bouvier, 1975), 215.

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<sup>46</sup> Oken's recapitulation theory accounts for the development from fertilized egg to adult allows an animal of a given class to progress through all the stages of all the classes that rank below it: 'the foetus is a representation of all animal classes in time: At first it is a simple visicle, stomach, or vitellus, in the Infusoria. Then the vesicle is doubled through the albumen or shell, and it obtains an intestine as in Corals ... With the appearance of the osseous system, it is modified into the class of Fishes. With the evolution of muscles, into the class of Reptiles. With the ingress of respiration through the lungs into the class of Birds.' Lorenz Oken, *Elements of Physiophilosophy*, trans. Alfred Tulk. (London: Ray Society, 1847), 45.

<sup>47</sup> Lorenz Oken, *Abriß der System der Biologie: Zum Behufe seiner Vorlesungen*, (Göttingen: Verdenhoek und Ruprecht, 1805), ix.

<sup>48</sup> 'Who has the means of making known the ancestral tree of even a single variety up to its species', Forster asks, 'if that variety did not first come into being from another before our very own eyes?' G. Forster, 'Something More About the Human Races.' In Jon Mikkelsen (trans. & ed.), *Kant and the Concept of Race: Late Eighteenth-Century Writings*. (Albany: State University of New York Press, 2013), 146-167, 156.

<sup>49</sup> Daniel Rothbart & Irmgard Scherer, 'Kant's *Critique of Judgment* and the Scientific Investigation of Matter', *HYLE: An International Journal for the Philosophy of Chemistry* 3 (1997), 65-80, 71-2.

<sup>50</sup> J. W. Goethe, *Sämtliche Werke nach Epochen seines Schaffens*, ed. K. Richter. (Munich: Carl Hanser Verlag, 1985-98), VI 2:332.

<sup>51</sup> J. W. Goethe, 'The Formative Impulse', *Goethe: Scientific Studies*, trans. D. Miller. (New York: Suhrkamp Publishers, 1988), 35-36, 36.