Kant and the problem of form: theories of animal generation, theories of mind

Jennifer Mensch[1]

Kant has long been revered as an uncompromising moralist and a committed transcendental idealist, but in the past two decades he has been introduced to a new generation of students as an anthropologist, as a physical geographer, and even as a theorist of race. This change has much to do with the recent addition of Kant's lectures on Physical Geography and Anthropology to the edited collections of Kant's works. These textual additions to Kant's corpus and, in their wake, the re-characterization of Kant as something of an eighteenth-century naturalist, have raised all manner of questions for scholars seeking to connect the careful edifice that is the critical system with the wide-ranging discussions now known to have been taking place across the rest of Kant's work. Paul Menzer raised this question already in 1911 in *Kants Lehre von der Entwicklung in Natur und Geschichte*, answering then (and in essential anticipation of the view held by the majority of subsequent Kant scholars) that it was necessary to view Kant's forays into natural history as a set of discussions requiring sharp delineation from his epistemology and ethics, for these were discussions running on "parallel tracks," as he would put it, and their impact on the critical system, if any, was merely metaphorical.[2]

The first inroads against this policy would be made by researchers investigating the centrality of natural historical considerations in Kant's early social and political essays, essays such as *Idea for a Universal History of Mankind* (1784) wherein Kant's prominent application of teleology to history signaled the continued adoption of a methodological device first used by him in his account *Of the Different Races of Human Beings* in 1775. Similar connections were made between Kant's support for Basedow's attempts to reform educational practices in the mid

1770s and the increasing attention paid by Kant to *Bildung*, in all its various instantiations, as he sought throughout the 1780s and ’90s to sort out just what was meant when referring to the formation of character and indeed to the vocation of humankind as a whole.[3] As an increasingly comprehensive view of Kant’s position came to show, his well-regarded works on ethics and governance simply could not be meaningfully separated from his views on education and history. But these latter views had in turn come out of works in the 1770s, works that had been saturated by natural historical terms: were these now to be also taken into consideration when approaching Kant’s position on moral and political life? For many researchers today, the answer is an unqualified yes.[4]

In this essay I proceed in very much the same vein so far as I will be here investigating the connection between Kant’s theory of cognition and his interest in debates regarding biological generation and development that were taking place at the time. During the eighteenth century investigations into embryogenesis too fell under the broad umbrella of natural history. Indeed the wide array of topics under consideration by naturalists was part of the great attraction held by the field, as Thomas Ramsay observed in 1772: “Natural history is, at present, the favourite science over all Europe, and the progress which has been made in it will distinguish and characterize the eighteenth century in the annals of literature.”[5]

1. From Taxonomy to Natural History

Natural history’s rise in popularity had gone hand in hand with the field’s own development during the eighteenth century. In 1735 Linnaeus’ taxonomical handbook, the *Systema naturae*, became a near-overnight success, providing the tools of the systematist to learned and layman alike. As one biographer put it, his great reputation rested “in the democratizing accessibility of his achievement. For the value of Linnaeus’s classifications lay in their humdrum, everyday usefulness … In his guides and handbooks, and in the structure of his systems as such, Linnaeus lowered the educational and financial entrance fee to the study of nature.”[6] Linnaeus was able to combine this accessibility, moreover, with a system claiming sensitivity to the critiques that had been launched by Locke and Ray regarding the arbitrariness of classification schemes altogether.[7] As a follower of Cesalpino (and thereby Aristotle) Linnaeus both believed in the existence of a natural system and recognized the near impossibility of its discovery.[8] He thus recognized that his system was artificial, and that by focusing on the “fructification organs” of plants and animals that it was bound to produce cases with counter-intuitive results.[9] But it was a success nonetheless: its nomenclature met the needs of systematists and it provided naturalists everywhere with a coherent program for investigation. As one contemporary summarized it, with these “tables we can refer any fish, plant, or mineral, to its genus, and, subsequently, to its species, though none of us had seen it before. I think these tables so eminently useful, that everybody ought to have them hanging in his study, like maps.”[10]

The ready acceptance of Linnaean taxonomy would change by mid-century. Hans Sloane in England, Michel Adanson in France, and Albrecht von Haller in Germany each contributed important criticisms regarding the weakness of any system which relied on only a handful of characteristics in the determination of species. Linnaeus' most trenchant critic, on this point, was Buffon. Beginning in 1749, Georges Leclerc, Comte du Buffon published the first three of what would eventually become some thirty-six volumes dedicated to a freshly conceived history of nature.[11] And Buffon opened the first volume of his *Natural History* with a direct attack on Linnaeus. "Who does not see," Buffon demanded, "that whatever proceeds in such a manner cannot be considered a science? It is at the very most only a convention, an arbitrary language, a means of mutual understanding. But no real cognizance of things can result from it."[12] Critical of the "bizarre assemblages" in Linnaeus's taxonomy—"the elm and the carrot, the rose and the strawberry, the oak and the bloodwort"—Buffon suggested that the success of such "ridiculousness" could only be due to the fact that it was "presented with a certain appearance of mysterious order and wrapped up in Greek and botanical erudition."[13] Indeed Linnaeus's failure went beyond his attention to an arbitrarily chosen set of organs, as Buffon saw it, for Linnaeus had more importantly failed to grasp the essence of natural unity, an interconnected web whose nuances would present an infinity of "intermediate species and mixed objects" to confound the systematist.[14] In place of this Buffon offered instead 'a natural history of all things general and particular,' a history whose new method—Buffon's synthesis of empirical observation, rational reflection, and probability theory—would provide "the complete description and the exact history of each particular thing," including "not only the history of the individual, but that of the entire species."[15] Buffon's attack on Linnaeus, combined with the attention he paid throughout the *Natural History* to questions of origin, generation, and genealogy, thus offered Buffon's readers not only a lesson regarding the limitations of classification, but his ambition to turn natural history into a genuinely explanatory science nonetheless.

2. Theories of Animal Generation

Buffon's investigations throughout the *Natural History* encompassed everything from cosmology to physiology, and it was wide-ranging discussions like these which soon came to define the field. While volume one of the *Natural History* was concerned with the birth of the cosmos, Buffon turned in volume two to the question of organic generation. Indeed it was critical that this part of the theory be introduced early insofar as it set the stage for Buffon's later approach to the processes of variation and heredity which occurred during the fashioning of the fetus. Buffon knew that degrees of variation were normal within a stable species line—indeed this was the primary fact upon which all breeders operated—but he was interested instead in the more radical transformations that could take place in a species line as a result of its degeneration.[16] For Buffon, a line would degenerate once environmental conditions had been changed enough to effect the reproductive processes. The key to understanding this lay in Buffon's notion of "organic molecules." These living nutrients came from the soil and operated throughout the food chain so far as they were taken up by plants and, through these, by animals as well.[17] While climate and habits were capable of effecting the external features of a species (colour, fur), only the organic molecules had the power to effect the embryogenetic production of a seed or animal to the extent that a heritable change to the line itself could occur. So long as members of a given species remained close to the their point of origin, Buffon argued, the line would stay true. Degeneration thus occurred primarily as a result of migration since this meant entirely new environmental factors including, most importantly, food.

To make sense of Buffon's account of reproduction we need to remember that in this time period the greatest stumbling block facing any theory of generation concerned the problem of form. Traditional accounts had relied on Aristotle's notion of an entelechy as the source of both direction and force when it came to understanding the production of organisms. But by the middle of the 17th century this view of nature was out of favour, and mechanism was in its ascendancy, so the Modern period saw great confusion in the life sciences as theorists struggled to make sense of reproduction on the basis of mechanical principles alone.[18] It was in light of these difficulties that "preexistence" theories of generation began to gain traction. Although there were a number of versions of the theory, the main point in each concerned the manner in which the problem of form was solved. In the earliest of these, God was said to have made each organic individual at the time of creation. The location of these submicroscopic individuals varied—the Ovists located the future generations in the female, the Animalculists or Spermists in the testes of the male members of a species, the Panspermist Claude Perrault took them to be in the soil—but in each account the critical fact was that all individuals had been entirely preformed and were only waiting until that predetermined point at which they could begin to expand.[19] An expansion that all theorists agreed could b certainly explained by way of mechanics.

Having laid out his own theory of generation in the opening chapters of volume two, Buffon dedicated roughly the next one hundred pages of the volume to a systematic review and critique of the main theories, starting with an analysis of Plato's *Timaeus*, moving to Aristotle and Aquapadente, and including a detailed comparison of the Ovists, Harvey and De Graaf, and the microscopists Malpighi, Valisnieri, and Leeuwenhoek, before finally referring his readers to Maupertuis' *Venus Physique* (1745), which "treatise," Buffon explained, "although very short, has more philosophical ideas than there are in many folio volumes on generation."[20] Buffon appreciated that Maupertuis had similarly rejected preexistence theories—in both their Ovist and Spermist variations—and he followed him in taking patterns of inheritance to be signs of clear evidence in support of a joint parental contribution in the production of offspring, evidence, in other words, that should doom preexistence theory as it then stood. That said, Buffon disagreed with Maupertuis' specific solution to the problem of form.

Like Buffon, Maupertuis insisted that some sort of material blending occurred in the formation of a fetus, indeed this was key for explaining joint inheritance. And also like Buffon, Maupertuis understood this blending in Newtonian terms of an attraction and repulsion that was essentially mechanical in its operations. He departed from Buffon, however, when it came to accounting for the problem of form, since for this Maupertuis relied upon particles endowed with memory, particles endowed, in other words, with the means for remembering and thereby knowing where the various parts of the fetus needed to be. Arguing that the forces of physics and chemistry could never produce a living organism, Maupertuis described organic forces as ones following different laws altogether. "We must have recourse to some principle of intelligence," Maupertuis explained, "to something similar to what we call desire, aversion, and memory."[21] While the organic forces of desire and aversion still functioned similarly to the chemical affinities responsible for the attractive and repulsive forces at work in the formation of the Tree of Diana, for example, an organic force of memory was meant by Maupertuis to solve the problem of form, since it explained a particle's awareness of its previous location in the parent's body.[22] These forces were originally given to matter by God, after which, as Maupertuis described it, they functioned mechanically in their operations as properties of matter itself. As a result, Maupertuis' so-called "intelligent" particles were thus far more like simple replicating machines than anything else, leading "monstrous births," for example, to be henceforth explained as cases of poor memory on the part of the organized particles.

Buffon's own solution to the problem of form relied on organic structures that he likened to internal molds and which were responsible for the proper organization of the organic particles present in any fully developed system. Ingested as food, the organic particles were constantly diffused throughout the body, allowing for its nutrition and growth. At puberty, however, with the body fully grown, the excessive particles returned to the sexual organs bearing impressions of the body's internal "mold," an artifice produced for the "first individual of each species" by God but thereafter mechanically replicated by the actions of the molecules and a penetrating force.[23] "What can be the active power which causes this organic matter to penetrate and incorporate itself with this internal mould?"[24] For Buffon it was the penetrating force, a notion not only modeled on Newtonian forces but one that in its explanatory role paralleled the job assigned by Newton to gravity. As Buffon explained the working of this force,

> In the same mode as gravity penetrates all parts of matter, so the power which impels or attracts the organic particles of food, penetrates into the internal parts of organized bodies, and as those bodies have a certain form, which we call the internal mould, the organic particles, impelled by the action of the penetrating force, cannot enter therein but in a certain order relative to this form, which consequently it cannot change, but only augment its dimensions, and thus produce the growth of organized bodies; and if in the organized body, expanded by these means, there are some particles whose external and internal forms are like that of the whole body, from those reproduction will proceed.[25]

Here it is important to remember Buffon's eschewal of anything resembling what he took to be the occult properties associated with a *metaphysical* approach to organic life. "Living animated nature," Buffon warned, "instead of composing a metaphysical degree of beings, is a physical property, common to all matter."[26] The mechanics of reproduction were therefore modeled as much on nonorganic "growth" as anything else. Arguing that an individual is "a compound of an infinity of resembling figures and similar parts . . . which can expand in the same mode according to circumstances, and form new bodies, composed like those from when they proceed," Buffon took the case of crystal growth to be paradigmatic for understanding organic processes across the spectrum. Thus although Buffon's theory of generation is sometimes referred to as one of mechanical epigenesis, there was in fact nothing like William Harvey's account of a gradual formation of increasingly heterogeneous parts from out of an original homogeneous mass in Buffon's formulation. On the contrary, the organic molecules waiting in the sexual "reservoirs" of the parents were already molded in response to their original location, and putting together the embryo was thus like putting together a puzzle, since each "piece" was complete and only waiting its proper placement. It is in this sense that Buffon's position is best said to be *preformationist* so far as the parts of the embryo were in fact preformed by the parents.[27]

Now I have said that the immediate task facing generation theorists during these years was to provide a principle of order or some other kind of explanation of the means by which organization occurred within the complex system of the embryo. For Maupertuis and Buffon as much as for all the opposing preexistence theorists, the problem of form required recourse to supernatural agency. Maupertuis thought that the particles had been initially endowed with intelligence by God and Buffon took the internal moulds to have originally be made by God at the creation. But even with crutches like these, the problem of form remained unresolved so far as critics were concerned. Having a mould was one thing, they argued, explaining the precise manner by which the particles were organized by a penetrating force in concert with this mould was something else altogether. And no critic was more vociferous when it came to this point than the Swiss physiologist, Albrecht von Haller.

The German translation of Buffon's *Natural History* was undertaken by Abraham Kästner between 1750 and 1774, but it was indelibly linked to von Haller, who had prepared two Prefaces of his own for the German edition. [28] These were highly critical of Buffon's theory of organic generation, and Buffon's failure, as Haller saw it, to account for a principle guaranteeing organization. Thus, after rehearsing Buffon's discussion of internal molds and the penetrating force, Haller complained that these could not provide a reasonable source of organization given the complexity of the body. As he put it, "Mr. Buffon needs a force which has foresight, which can make a choice, which has a goal, which, against all the laws of blind combination, always and unfailingly brings about the same end."[29] "In brief," Haller concluded, "what is the cause which arranges the human body in such a way that an eye is never attached to the knee, an ear is never connected to the hand, a toe never wanders to the neck, or a finger is never placed on the extremity of the foot"?[30]

It was on the basis of precisely such difficulties that Kant took the prospects for any genuine advance in the life sciences to be gloomy. Physics was easily reducible to a set of mechanical causes, but Kant utterly rejected the possibility that organic processes could be explained by means of the same set of attractive and repulsive forces at work in celestial mechanics. Thus when contrasting discussions of celestial origin with the case presented by organic life in 1755, Kant explained that in cosmology all of the questions regarding the coincidence or eccentricity of orbital paths could "be reduced to the simplest mechanical causes. But can we claim such advantages," he asked, "about the most insignificant plant or insect?"

> Are we in a position to say: *Give me matter and I will show you how a caterpillar can be created*? Do we not get stuck at the first step due to ignorance about the true inner nature of the object and the complexity of the diversity contained in it? It should therefore not be thought strange if I dare to say that we will understand the formation of all the heavenly bodies, the cause of their motion, in short, the origin of the whole present constitution of the universe sooner than the creation of a single plant or caterpillar becomes clearly and completely known on mechanical grounds (NTH, AA 01: 230).

Celestial mechanics, with all their mathematical complexity, were nonetheless a perfectly knowable basis for understanding cosmological construction. Organic construction, by contrast, could not be grasped through mechanical laws. And the problem of generation, therefore, was simply closed off from examination so far as Kant was concerned.

While Kant would not change his mind essentially on this point, he was still interested enough in the problem of organic generation to have kept abreast of these debates during the 1760s. Remarking that "it would be absurd to regard the initial generation of a plant or an animal as a mechanical effect incidentally arising from the universal laws of nature," Kant took time in a 1763 piece to consider in turn the top two competing theories of generation. The first was preexistence theory, according to which each individual being was formed at the time of creation. Such a view, as Kant understood it, demanded that "each individual member of the plant and animal kingdoms is directly formed by God, and thus of supernatural origin, with only the reproduction (*Fortpflanzung*), that is, only the transition from time to time to the unfolding (*Auswicklung*) [of individuals] being entrusted to a natural law" (BDG, AA 02: 114).[31] The second theory Kant considered appealed to God's original agency when producing species lines—a type of generic preformation guaranteeing the reproduction of kinds—but argued for the subsequent generation of individuals according to natural means.[32] Is it possible, Kant asked when introducing this option, that "some individual members of the plant and animal kingdoms, whose origin is indeed directly divine, nonetheless possess the capacity, which we cannot understand, to actually generate (*erzeugen*) their own kind in accordance with a regular law of nature, and not merely to unfold (*auszuwickeln*) them?" (BDG, AA 02: 114). In this account, form was again supernaturally conceived, but while this generically maintained the stability of the species lines, the subsequent work of generating individuals actively belonged to nature.

Kant went on to rehearse positions that would seem to be examples of this, all the while critical of the specific attempts made in each case to provide a *mechanical* description of the natural means by which individuals would be subsequently generated.[33]

> It is utterly unintelligible to us that a tree should be able, in virtue of an internal mechanical constitution, to form and process its sap in such a way that there should arise in the bud or the seed something containing a tree like itself in miniature, or something from which such a tree could develop. The internal forms proposed by *Buffon*, and the elements of organic matter which, in the opinion of *Maupertuis*, join together as their memories dictate and in accordance with the laws of desire and aversion, are either as incomprehensible as the thing itself, or they are entirely arbitrary inventions (BDG, AA 02:115).

But while Kant rejected such accounts as "utterly unintelligible" and "entirely arbitrary inventions," he was equally resistant to the first hypothesis and its recourse to a supernatural origin for every individual member of a species. On this theory human investigation was completely foreclosed, though it could be, as Kant remarked, "supposed that the natural philosophers have been left with something when they are permitted to toy with the problem of the manner of gradual reproduction (*Fortpflanzung*)" (BDG, AA 02:115). Here Kant might have named Bonnet as a natural philosopher promoting a revised, even "updated" preexistence theory, so far as Bonnet argued that instead of complete individuals only the rudimentary parts or, for Bonnet, the imprint for the species, were contained in the "germs" of an organism. Such revision did not, however, escape the tincture of the supernatural according to Kant, "for whether the supernatural generation occurs at the moment of creation, or whether it takes place gradually, at different times, the degree of the supernatural is no greater in the second case than it is in the first" (BDG, AA 02: 115). Returning to the supposedly "natural order" offered by Buffon and others, what they had was "not a rule of the fruitfulness of nature, but a futile method of evading the issue" (BDG, AA 02: 115).

What Kant wanted was something different, a means of avoiding a supernatural solution even if all of the mechanical accounts of individual generation had so far failed. Indeed, as Kant wryly observed, an adequate mechanical explanation of fermenting yeast had yet to be found, but that had hardly led people to suggest supernatural grounds for its existence; the case of plants and animals should be no different. Unless one was willing to rely on God's constant creation, Kant concluded, "there must be granted to the initial divine organization of plants and animals a capacity, not merely to develop (*Auswickelung*) their kind thereafter in accordance with a natural law, but truly to generate (*erzeugen*) their kind" (BDG, AA 02: 115). This position followed the others in appealing to divine artifice in the initial creation of forms, but unlike Maupertuis or Buffon, Kant wanted to emphasize the need to conceive of an individual's subsequent capacity for self-organization: for *erzeugen* as opposed to mere *auswickeln*.[34] The position that would later be cautiously endorsed by Kant in 1790—a position explicitly identified by him in the *Critique of Judgement* as one in line with Blumenbach's *Bildungstrieb*—proposed just such a non-mechanical generation of individuals. In this instance generation took place according to an internalized plan for their species as a whole, a plan that was therefore only "generic" for the species line but which nonetheless afforded to nature the power of all subsequent generation of individuals; it was on this basis that Kant was thus able to identify "generic preformation" with epigenesis (KU, AA 05: 424).[35]

In Kant's consideration of Maupertuis and Buffon in the 1763 piece he did not use the term epigenesis. In 1769, however, Kant introduced an explicit discussion of biological epigenesis into his course on metaphysics. Kant always used A. G. Baumgarten's *Metaphysica* as the basis for this course, and the topics concerning the soul ranged from discussions of human understanding to mind-body interaction and the afterlife.[36] In a section devoted to the origin of the soul, Baumgarten had rehearsed the reigning theories of organic generation: preexistence, spontaneous generation—Baumgarten's example here was infusoria—creation *ex nihilo*, and finally, "concreationism," according to which the soul was produced through some sort of transfer accomplished by the parents, a position derived from Aristotle's treatment of the matter. When preparing his own notes for this section, Kant wrote out the questions that would be addressed in his lecture: Was the soul a pure spirit before birth? Had it lived on the earth before? Did it live in two worlds—the pneumatic and the mechanical—at once? The questions were accompanied by a quick list of the various theories of generation, with Kant noting that the central division was between supernatural approaches to the question of origin and a naturalistic account, an account Kant described as an "*epigenesis psychologica*" (HN, AA 17: 416). The majority of Kant's commentary, however, was devoted to the comparative advantages of the preexistence theory of generation, in either its spermist or ovist variation, over the system proposed by epigenesis insofar as this system was here conceived of as one in line with both Maupertuis' and Buffon's emphasis on the embryo as something under the influence of joint inheritance. As Kant sketched it, in contrast to the preexistence theory, the naturalistic system of epigenesis assumed material contributions from each of the parents, and this, Kant observed, required that prospective couples consider each other with greater care when planning to marry and reproduce.[37]

In later years, Kant would use this section of Baumgarten's text to discuss the properties of the soul and would invariably dismiss the possibility of its epigenesis.[38] In 1769, however, Kant's commentary focused on the physical aspect of generation, identifying epigenesis with a theory of blending that was in line with what he knew of Maupertuis's and Buffon's use of heredity as a basis for their arguments against preexistence theory. The next time Kant came to add notes to this section in 1772, epigenesis was again considered in terms of its biological claims, with Kant now explicitly linking the theory to the desired account of species generation he had first sketched in 1763. In his words,

> The question is whether nature is formed organically (epigenesis), or only mechanically and chemically. It seems that nature does have spirit, given that in the generation of each individual there is a unity and connection of parts. And is there not also such a spirit, an animating essence, in animals and plants. In this vein one would have to assume an animating Spirit, operating within an original chaos, in order to explain differences between animals which can now only reproduce themselves (HN, AA 17: 591).

This two-step model is the same as that proposed in Kant's 1763 piece, so far as an initially divine organization—out of an "original chaos"—is then followed by the organic capacity for reproduction within the divinely delineated species lines. What these two sets of comments demonstrate for us however, (comments dated by Erich Adickes as having been written in 1769 and 1772, respectively), is that during a period of crucial formation with respect to the development of Kant's system of transcendental idealism, Kant was actively aware of the epigenesis alternative to preexistence theories of generation.

3. Theories of Mind

Now before going any further, I want to first just briefly rehearse three interrelated characterizations of epigenesis that are especially important for understanding the use Kant would make of the theory for his own purposes. The *first* characterization comes from a seventeenth century English physician who I have already mentioned in passing. William Harvey was interested in distinguishing the radical transformations taking place during 'metamorphosis' from the more gradual series of transformations that occurred during 'epigenesis'. In the latter case, Harvey tracked the manner by which a chick embryo developed, describing the process as the embryo's transition from an initially homogeneous state to one that was increasingly heterogeneous with respect to its parts. The *second*, though related, characterization of epigenesis concentrated on the capacity of organic structures to be self-organizing during their development, growth, and repair. Although this capacity was oftentimes linked to theories of spontaneous generation and vitalism, there was in fact no consensus position regarding the nature of either the origin or the self-organisation of organisms. In the early decades of the eighteenth century the vitalist Peter Stahl, for example, attributed formation to an anima but distinguished his mechanistic conception from Leibniz's entelechy. In the 1760s, Casper Wolff understood epigenetic growth in terms of an organism's transition from liquid secretions to solidified parts, a vegetative process that was driven in some manner by a life force or *vis essentialis*. And by the 1780s, as we have just seen, epigenesis had come to be identified with Blumenbach's *Bildungstrieb*. It was this characterization of epigenesis that appeared in the *Critique of Judgement*, and it understood epigenesis as a theory regarding the generic preformation of form or species types in nature.

These separate though related characterizations of epigenesis were applied differently by Kant depending upon whether he was thinking about cognition or biological organisms. For the most part, commentators have begun with Kant's statements regarding generic preformation in the *Critique of Judgement* and have sought to read Kant's theory of cognition and the epigenesis of reason through them.[39] But while Kant's comments in 1790 demonstrate an underlying continuity in his thoughts regarding biological organisms since the 1760s, they do not in fact add anything to our understanding of what he meant by the epigenesis of reason. To really understand the distinctive role played by epigenesis for Kant's theory of cognition, therefore, we need to detach "generic preformation" from the other two characterizations of epigenesis that were in play for Kant.

In order to discover the internal grounds for this detachment we need to consider the specific epistemic context within which Kant's work on cognition began: his overriding desire to reorient, and thereby protect, metaphysics from the Humean challenge. By 1765, Kant understood that any significant rehabilitation and defense of metaphysics would require its complete reformulation. Though initially conceived in terms of overcoming the problem of 'subreptive axioms,' Kant soon realized that the real task was instead to provide an account of cognition that could avoid scepticism without recourse to innatism. This is the epistemic context within which Kant began to formalise his theoretical programme in the 1760s, and it was against the backdrop provided by his first real attempt at such a theory, his *Inaugural Dissertation* of 1770, that Kant became ready to identify his own position with epigenesis as a position against the preformation system he took to be endorsed by Leibniz.[40] Thus it was at precisely this point that epigenesis provided 'a theory by which to work' for Kant. This was not epigenesis as generic preformation; *that* theory relied on supernatural forms to keep the species lines intact and was thus akin, for Kant, to both the 'mysticism' of Plato and the 'preformationism' of Leibniz. In 1770, Kant wasn't entirely sure what to use as a replacement with respect to accounting for the problem of form, but he was sure about one thing: innatism had to be rejected as much as did his previous reliance on the model of cognition that had been provided by Locke (e.g., HN, AA 17: 352). In their stead, Kant proposed the original generation of intellectual concepts, referring to them in the *Inaugural Dissertation* as produced by an "original acquisition" by attention to the workings of the mind (MSI, AA 02: 395).

Earlier I described Kant's first use of epigenesis when discussing Baumgarten, but more significant for our purposes now is the set of notes Kant composed shortly after finishing his *Dissertation*. For in these notes, Kant explicitly connected theories of generation to systems of reason and to claims regarding the origin of ideas in particular. Distinguishing empiricists from rationalists, Kant identified his own position with the most radical possibility of all. As he sketched it, "Crusius explains the real principle of reason on the basis of the *systemate praeformationis* (from subjective *principiis*); *Locke* on the basis of *influx physico* like *Aristotele*; *Plato* and *Malebranche*, from *intuit intellectuali*; we, on the basis of *epigenesis* from the use of the natural laws of reason" (HN, AA 17: 492). It was epigenesis, therefore, that Kant identified with the theory of "original acquisition" for explaining the generation of sensitive and intellectual concepts from the mind's own laws in the *Dissertation*. While it cannot be said for certain that Kant took epigenesis as his model when first drawing up his account of the origin of knowledge in 1770—though the evidence from 1769 certainly suggests this—it is certain that in the months following the *Dissertation*'s completion the connection had been made. The primary textual resources for proving this stem primarily from the 1770s—the so-called 'silent decade'—and they are gathered from Kant's letters, his lectures, his notes, and the marginal notations he made alongside the textbooks he used for his classes (e.g., HN, AA 17: 492, cf. HN, AA 17: 554, 18: 8, 18: 12, 18: 273–75). Many scholars have relied on these materials for making sense of Kant's theoretical programme during the silent decade. Rereading this material with an eye to Kant's frequent appeal to biological vocabulary when describing cognition, is what finally reveals the importance of epigenesis for the developing system.

4. The Epigenesis of Reason

Let us pause now and consider the status of the biological model for Kant. There have been a number of writers over the years to worry about what this particular model might have meant given that Kant urged epistemic caution regarding the various speculative hypotheses coming out of the life sciences at that time. The immediate problem is to ask then how it is that Kant—who was ready to dismiss the claims being made by generation theorists in the 1760s as not only uncertain, but unlikely—could nonetheless have been ready to repeatedly identify his own developing theory of cognition with epigenesis during the 1770s? It is certainly not the case that Kant took himself to be investigating an empirical claim about our physical brains (hence Kant's well-known dismissal of the nativism to be found in Tetens' psychological account, e.g., HN, AA 18: 23). So what was Kant up to when he identified his own position as epigenetic?

Here it is critically important to remember the epistemic context within which Kant's investigation was operating, and the significance, therefore, of the fact that he typically juxtaposed his own epigenetic theory with the 'preformation' system proposed by Leibniz and Crusius, on the one hand, and the 'physical influx' position advanced by sensationalists like Locke, on the other. For once we remember that this is indeed the context within which epigenesis became an interesting third option between innatism and empiricism for Kant, we can begin to make sense of what Kant meant by the "epigenesis of Reason" (KrV, B167).

Kant left the 1760s determined to reorient metaphysics by way of attention to a new theory of mind. Central to this was Kant's sense that scepticism could only be avoided so long as the theories under attack by Hume—those held by the innatists and the empiricists in their various stripes—were also avoided. This story regarding Kant's intellectual development—Kant's negotiation between rationalism and empiricism—is of course standard fare in any undergraduate course on the history of Modern philosophy, and it is so because in outline, at least, it fits: it makes sense of Kant's work in the 1760s and 70s to formulate an epistemological programme, and it makes both the goals and the achievement of transcendental idealism all the more clear. Reading Kant's notes during the 1770s, it thus makes sense to see that even despite the seeming intrusion of biological vocabulary amidst the worries over logical subordination or the tasks allocated to the various faculties, Kant is consistent whenever it comes to the cast of characters he is up against: Plato, Leibniz, and sometimes Malebranche, grouped together by Kant as mystics, preformationists, supporters of involution, and believers in intellectual intuition; Aristotle, Locke, and Crusius on the other side, supporting 'physical influx' or *generatio aequivoca*; and Kant's own position in the middle, as an epigenesist. The 'real principle of reason', as Kant put it during this period, rests "on the basis of epigenesis from the use of the natural laws of reason" (HN, AA 17: 492).

In the *Dissertation*, Kant relied on the mental laws for logical subordination as the basis for this generative work, while also leaving the origin of these laws unspecified. In the *Critique of Pure Reason*, Kant relied on these laws again, with the Metaphysical Deduction serving as the updated version of the older account's description of the 'real use' or means by which concepts could be generated. In the first *Critique* Kant explained therefore that the logical table of judgement served as the metaphysical 'clue' for understanding the origin of the intellectual concepts because the latter were in fact those same judgements, only applied now to sensible intuitions. Having already announced the isomorphic connection between the forms of judgement and the categories of experience, by 1781 Kant was also ready to be specific regarding the question of origin here as well. Like all the heterogeneous faculties which together made-up the so-called "transcendental apparatus," logic too had its origin in Reason. Experience relied on the concepts and thereby the table of judgments to provide that constancy of form required for coherency in the field of appearances, but the constancy of the form-giving concepts themselves was itself dependent upon Reason. Kant was clear when it came to the hierarchy of the faculties. He was clear that the understanding, for all its spectacular success when it comes to the construction of a coherent field of appearances, was nonetheless dependent upon Reason. To be specific, that the understanding was 'dependent' upon Reason in two significant ways: as is well known, Reason provided the principles which can alone unify and guide empirical investigations, but Reason was also taken by Kant to encompass the understanding and to thus serve as its seat.[41] Indeed, Kant's account of transcendental affinity was the key to understanding the precise manner by which an epigenetic Reason was ultimately necessary for the success of the Transcendental Deduction.[42] And as for Reason? Reason, as Kant identified it in both the Transcendental Deduction (KrV, B167) and the Architectonic (KrV, A765/B793), was itself epigenetic or 'self-born.'

This might sound radical, but before we get distracted by that, lets focus on the main point. Kant had a specific epistemic goal, the avoidance of scepticism and the achievement, thereby, of some kind of experiential certainty in the physical (if not the biological) sciences. Transcendental idealism, with empirical realism as its special yield, accomplished precisely that. But it did so on the basis of a story that was being told about the formative control enjoyed by the mind in the case of experience. The transcendental conditions for the possibility of experience relied on the central faculties—reason, understanding, judgement—and their accomplishment of particular tasks. Now Kantians, on the whole, are not prepared to entertain questions regarding the ontological status of these mental faculties. Most will, moreover, emphatically reject a nativist reading of the faculties, even if they feel less confident in rejecting a supernatural origin altogether, given the kinds of passing remarks one finds in the *Religion*. The safest interpretive route, most feel therefore, is to just stick with Kant's agnosticism on the point. In my own view, it is important to identify Kant here as a metaphysician in order to explicitly distance him from the consequences of identifying him as a nativist. And it is in light of this that we must understand the epigenesis of reason to be *metaphysically real* in order to make it clear that Kant was not providing a biological account of the brain. But there is more to this assessment than a simple contrast. Kant takes the mind to be whole. As in Harvey's model, however, this original unity becomes increasingly heterogeneous, as logically distinct faculties emerge or become realized in the face of the various cognitive tasks required of it. As for Reason itself, the word Kant uses for describing it is in a class of its own within his works: spontaneity. There is neither textual conflict nor indeed controversy regarding spontaneity as a basic definition of Reason, for Kant was clear in the *Critique of Practical Reason* regarding the ontological identity between reason in either its theoretical or practical guise,[43] and if, by the end of the *Critique of Judgement*, he seemed to have relegated speculative reason to a lesser position in comparison to the free causality of practical reason, it was only because moral teleology had by then displaced the investigatory aims of physic-theology for Kant, making the clearer formulation of rational faith all the more pressing. Reason, as Kant saw it, both generates and determines itself, and it is only as such that it could ground both the certainty of cognition within the sensible realm and our duties and character in the moral realm.

Kant was fully prepared to emphasize this aspect of Reason, by employing vocabulary borrowed from the language of organic growth and development when discussing it, and by describing reason's development from infancy to adulthood as an organic course of formation as a case of the "sheer self-development of reason." Rehearsing this, Kant explained,

> Systems seem to be formed in the manner of lowly organisms, through a *generatio aequivoca* from the mere confluence of assembled concepts, at first imperfect, and only gradually attaining to completeness, although they have one and all had their schema, as the original germ, in the sheer self-development of reason. Hence, not only is each system articulated in accordance with an idea, but they are one and all organically united in a system of human knowledge, as members of one whole, and so as admitting of an architectonic of all human knowledge (KrV, A835/B863).

What this history of reason demonstrated for Kant was that all attempts at metaphysics had been "organically united," that they were connected by virtue of their common origin in the germ of reason, and that they had been differentiated only as part of reason's own path of self-development. The history of reason thus provided its investigators with a genuine natural history, for each of its varieties could be traced in their entirety to their point of origin, a common descent that had been easy to overlook given the enormous modifications taking place in the history of the species as a whole. As varieties of reason, the systems of metaphysics functioned organically, like "members of one whole," so Kant could be precise when describing the manner by which reason had grown into a unified system. As he defined this organic growth, "The whole is thus an organized unity (*articulation*), and not an aggregate (*coacervatio*). It may grow from within (*per intussusceptionem*), but not by external addition (*per appositionem*). It is thus like an animal body, the growth of which is not by the addition of a new member, but by the rendering of each member, without change of proportion, stronger and more effective for its purposes" (KrV, A833/B862).[44] Kant believed that the connection between the parts of the system could be likened to the organic interworking of the organs in an animal body because the unity of the system, like the unity of an organism, determined not only the exact number and placement of its members but the end toward which they aimed. In each of these cases this was an end that had been reflexively defined from the start; in the case of reason it had been contained within the system as an idea of its completion from the very first moment of its self-conception. The end of the history of reason, that is, its idea of itself as a fully developed whole, was originally present within reason—present as an "original germ in the sheer self-development of reason"—a germ or idea that both set the goal for reason's completion and somehow also grounded the possibility of its actual achievement.[45]

It is in light of all this that I am hesitant to say that the biological theory of epigenesis functioned merely as an analogy or had only metaphorical value for Kant. For after reviewing all the evidence surrounding Kant's use of epigenesis in cognition, he seems, in the end, to have thought of Reason as something that was in fact spontaneous and free, a self-born activity that was both cause and effect of itself. Despite the radicality of Kant's claim, it is easy to see that only such a claim could guarantee both morals and certainty against the threat of scepticism so far as Kant understood the stakes of Hume's challenge. Indeed, it was not the autochthonous status of Reason that Hegel, for example, criticized in Kant—it was the checks Kant put in place on Reason's power.

By way of closing I just want to point finally to the surprising turn that has been taken in the life sciences today. We have, it seems, entered a post-genomic era. Only 20 years ago researchers could still rely on the explanatory power of the gene, or at least the information conveyed by that name—as the biologist Ernst Mayr had observed: development may be epigenetic, but inheritance of type depends on the gene—to explain the constancy of forms in biological life. Today, however, the very notion of a 'genetic programme' is under attack, and preformationism in the guise of the gene has been demoted as researchers turn instead to the field of epigenetics. It is hard to imagine that Kant would not have appreciated the possibilities for thought opened up by these discussions. The least tenable model has suddenly become the most plausible one for imagining the irreducible quality of the organism, one demanding our amazement not because of the intricate operations of its parts, but because we have been forced to acknowledge the primacy of the living organic context, the environmentally porous state within which such parts can emerge in order to mechanically function at all. This was precisely the kind of organic model that Kant had in mind when trying to grasp Reason, and in my view it is what locates him as a genuine forerunner of the organicism of both his own day and ours.

ABSTRACT: Although scholarly attention has been mostly paid to the many connections existing between Kant and the *exact* sciences, the landscape of Kant studies has begun to noticeably change during the last decade, with many new pieces devoted to a consideration of Kant's relation to the life sciences of his day. It is in this vein, for example, that investigators have begun to discuss the importance of Kant's essays on race for the development of Anthropology as an emerging field. The bulk of the contributions to this recent trend, however, have focused on Kant's remarks on organic life in the *Critique of Judgment*, such that Kant's "theory of biology" is now seen to be firmly located in that text. Amidst such consolidation, there are a few pieces that have begun to address Kant's appeal to organic vocabulary within the context of his theory of cognition, though these too remain dominated by the interpretive template set by the third *Critique*. My own strategy in this essay will be different. Kant did indeed borrow from the life sciences for his model of the mind, but in a manner that would reject a naturalized account. His preference for epigenesis as a theory of organic generation needs to be carefully distinguished, therefore, from the use he would make of it when discussing a metaphysical portrait of reason.

KEYWORDS: Kant, Buffon, Generation, Reason, Epigenesis

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NOTES

1 Jennifer Mensch specializes in the intellectual history of the Enlightenment with a special emphasis on the intersection of philosophy and the life sciences. Her recent book, *Kant's Organicism. Epigenesis and the Development of Critical Philosophy* (Chicago: University of Chicago Press, 2013), traces the influence of life science debates regarding biological generation on Kant's theory of cognition. She is currently Assistant Professor of Philosophy at the University of Waterloo (Canada), where she teaches philosophy and the history of science and medicine.

2 MENZER (1911, 404–445). For a more recent version of this view see Günter Zöller, who regards Kant's critical doctrines and his anthropological works to be in a "mutually supplementary relation," see Zöller (2011, p. 131–161).

3 Kant used Basedow's *Methodenbuch* as a textbook when lecturing on pedagogy during the winter semester of 1776–1777. A good sense of Kant's commitment to Basedow's school during this period emerges from his letter exchanges regarding it, see esp. 10:191–195. There have a been a number of commentators in recent years interested in connecting Kant's early views of education and his developing approach to character. On this see especially MUNZEL (1998; 2012) and also Louden's "Not a Slow Reform, but a Swift Revolution: Kant and Basedow on the Need to Reform Education," in LOUDEN (2012 and 2011, esp. ch. 11).

4 On this see especially KLEINGELD (2012). Robert Bernasconi has done the most work to investigate Kant's published essays on the natural history of race in terms of their implications for the ethical program developed during the 1780s and '90s. See especially BERNASCONI (2003, p. 13-19, and 2002, p. 145-166).

5 Thomas RAMSAY in praise of the naturalist Thomas Pennant (1774, p. 174).

6 Lisbet KOERNERS (1996, p. 145).

7 A helpful discussion of this is in Phillip SLOAN (1972, p. 1-53).

8 As Koerners recounts, Linnaeus "believed it [the natural system] was somehow encrypted in the relation between all seven basic parts of fructification (calyx, corolla, pericarp, pistil, seed, stamen, and receptacle). Another clue, he suspected, was to be found in his hypothesis that modern species, while probably fixed in the present, had hybridized from a small number of Edenic life-forms, each representing one of the present-day orders." In KOERNERS (1996, p. 148).

9 A.G. Morton details Linnaeus's awareness of this problem, describing its resolution as the precondition for a shift toward the concept of organic evolution, see MORTON (1981, pp. 262-276, esp. p. 270).

10 Cited in Lisbet KOERNERS (1996, p. 146).

11 The earliest edition appeared as *Histoire Naturelle, générale et particulière*, 15 vols. (Paris: Imprimerie Royale, 1749-1767).

12 Buffon (1981, p. 89-128). Also available as Buffon (1976, p. 133-181). A helpful discussion of the tensions between Linnaeus and Buffon is Phillip Sloan (1976, p. 356–375).

13 Buffon (1981, p. 105). Between the inability to determine criteria capable of determining essential divisions between species (since this required agreement regarding their 'essence'), and the empirical experience of the fluidity of forms (an experience frequently undermining belief in fixed essences at all), deep tensions within taxonomy had arisen by mid-century between arbitrarily determined criteria like reproductive organs and conflicting experience with respect to claims regarding biological affinity. Linnaeus understood this all well enough, but though he grasped not only the logical problem but the practical tensions within taxonomical science, the problem was in fact exacerbated by his defaulting, as a matter of practical necessity, to the idea of species fixity. Julius von Sachs details this tension in particular when discussing Linnaeus (1906).

14 Buffon (1981, p. 102). Cf. "Nature has neither classes nor species; it contains only individuals. These species and classes are nothing but ideas which we have ourselves formed and established" in Buffon (1797, vol. 3, p. 326).

15 Buffon (1981, p. 111).

16 Buffon provided an entry specifically devoted to the topic of generation only at the end of volume 14 in 1766, see "De la dégénération des Animaux" in Buffon (1749-1767, p. 311-374).

17 Buffon summarizes this connection before his investigation into the specific manner by which reproduction occurs: "[I]n the same mode as gravity penetrates all parts of matter, so the power which impels or attracts the organic particles of food, penetrates into the internal parts of organized bodies, and as those bodies have a certain form, which we call the internal mould, the organic particles, impelled by the action of the penetrating force, cannot enter therein but in certain order relative to this form … and if in the organized body, expanded by this means, there are some particles whose external and internal forms are like that of the whole body, from those reproduction will proceed." See "Of Nutrition and Growth," in Buffon (1749-67, p. 46).

18 A complicated exception here would be Robert Boyle's work to understand organic generation according his notion of material seminal principles. For Boyle, the sheer complexity of organic life exceeded the chance that its original formation had been due to the principles of secondary motion alone. Against the theory proposed by Descartes and his followers, therefore, Boyle argued for an original act of divine artifice that "did more particularly contrive some portions of that matter into seminal rudiments or principles, lodged in convenient receptacles (and, as it were, wombs), and others into the bodies of plants and animals." These seminal principles took on a formative function in directing the material unity of the organism, for "some juicy and spirituous parts of these living creatures must be fit to be turned into prolific seeds, whereby they might have a power, by generating their like, to propagate their species." See Boyle (1991, p. 70). Of course, Boyle's recourse to a physical yet "plastick" principle when explaining generation nicely demonstrates the genuine difficulties faced by midcentury theorists in accounting for biological processes. As Peter Anstey describes Boyle's position, "Study of Boyle's theory of seminal principles reveals a Boyle who is in tension, not a Boyle who abandons the corpuscular hypothesis when intruding on the biological domain and not a Boyle who is unaware of the need to reach beyond the sparse ontology of mechanical affections of matter. Boyle was unable to resolve this dilemma in his natural philosophy and as interpreters we should not do it for him." See Anstey (2002, p. 628).

19 Malebranche, the earliest proponent of this view, argued that all future generations of the human race existed as fully formed miniscule beings whose embryological development was nothing more—so far as form was concerned—than enlargement. Because Malebranche believed that future generations were contained in the sexual reservoirs of current ones, his position is referred to as *emboîtement* or "encasement theory." Initially, these miniscule "homunculi" were thought to be contained in the female, a position called "Ovism"; once the Dutch microscopist Antonin Leeuwenhoek discovered what he called "spermatic animalcules" under the microscope in 1674, the testes were thought instead to be the storage site, a determination that was referred to as "Spermism." As positions like Malebranche's began to suffer under the pressure of evidence for a shared parental inheritance, or discoveries of the regenerative capacities of certain species, preexistence theories were gradually adjusted until they became by the mid-eighteenth century, with Bonnet, arguments for the preexistence of only preformed germs for the species lines. Detailed discussions of the main figures associated with generation theory leading up to Kant can be found in the opening chapters of Elizabeth Gasking (1967), and in Jacques Roger (1997, especially pp. 205-369). For essays devoted to connecting life science theory and early Modern philosophy see Justin Smith's anthology (2006).

20 See "Experiments on the Method of Generation," in Buffon (1797, p. 76), corresponding to "Exposition des Systèmes sur la génération," Buffon (1747-67, vol. 2, p. 164).

21 Maupertuis (1761, §§3, 4, p. 15). A comprehensive listing of Maupertuis' unusually complicated publication history—a history comprising multiple editions under different titles, often published anonymously or even pseudonymously—is in Giorgio Tonnelli's "Introduction. Bibliographie et histoire du texte" included in Maupertuis's works, see P.L. Moreau de Maupertuis (1974, vol. 1, p. XI-LXXXIII). Maupertuis' publications regarding generation theory started in 1744 with three successive pamphlet editions of an anonymously written discussion of biological generation, a discussion occasioned by the sensation created in Parisian salon culture by an albino boy (born to African slaves living in colonial South America) who had been paraded around Paris by the aristocracy as a curiosity that year, see "Dissertation physique à l'occasion du nègre blanc" (1744). The following year this piece was reissued (and slightly changed) as an essay "Concerning the Origin of Animals" and printed together with a separate essay on "Varieties in the Species of Man" under the title *Venus Physique*—this too was published anonymously, with neither publisher nor location identified, only the date, 1745. In 1751 Maupertuis returned to the issue, this time publishing his essay

in Latin as a (fake) thesis from Erlangen written by a student identified only as Dr. Baumann, the original is no longer extant but at the time it was published (in Berlin, not Erlangen) as *Dissertatio inauguralis metaphysica de universali naturae systemate* (1751). An edition of Maupertuis's collected works appeared in 1752 which included the *Venus Physique*, thus revealing Maupertuis's authorship, see Maupertuis (1752). In 1754, Maupertuis anonymously reissued the Baumann thesis from 1751, now under the title *Essai sur la formation des corps organisés* (1754). The *Essai* was reissued two years later under the title *Systêm de la nature* for the next edition of Maupertuis's collected works, revealing thereby Maupertuis's authorship of the *Essai* (and the Baumann thesis), see Maupertuis (1756). Finally, in 1761, an anonymous translator working out of Potsdam issued a German translation of the Baumann thesis as *Versuch von der Bildung der Körper, aus den Lateinischen des Herrn von Maupertuis* übersetzt von einem Freunde der Naturlehre (1761); it was this edition which Kant owned.

22 Maupertuis (1761, §33, pp. 30–31).

23 Before Buffon, Louis Bourguet had insisted that something like an internal mold (*Moule*) determined the organization of the organic material when forming the organism and that this kind of mold was unique to organic mechanism. Whereas a crystal simply repeated the same mold or shape over and over again, the organism needed a different means for accounting for the innumerable different parts of its organization. This is not to say that the organism was reducible to its organization for Bourguet; as a Leibnizian, Bourguet took the entire process to be a case of mechanical accommodation to an underlying dominant monad. See Bourguet (1729, p. 146, 165).

24 Georges Buffon, "Of Nutrition and Growth," chap. 3 of *History of Animals*, in Buffon (1797, 2, p. 302).

25 Buffon (1797, 2, p. 303). Buffon repeatedly defended the use of analogies in line with Newton's own practice of reasoning. For example, "In my theory of expansion and reproduction, I first admit the mechanical principles, then the penetrating force of gravity, which we are obliged to accept, and, from analogy and experience, I have concluded the existence of other penetrating forces peculiar to organized bodies", in Buffon (1797, 2, p. 48).

26 Buffon (1797, 2, p. 272).

27 The terms "preexistence" and "preformation" are frequently used interchangeably by commentators to capture the difference between a description of embryological formation where the problem of form is "solved" and a description, as in the case of epigenesis, where it is not. Jacques Roger, and Peter Bowler after him, have argued for the need to clearly distinguish between these terms. "Preexistence," as Roger sees it, should strictly refer to those theories proposing that all individual embryos were made by God at the moment of creation, so that all embryos thereby "preexist" their moment of specific temporal development. "Preformation," according to Roger's distinction, should be reserved for a position like Buffon's for the reasons described above. On the argument for severing preexistence and preformation, see Roger (1997, p. 259–260); and Peter J. Bowler (1971, p. 221–244). Against this distinction, see J. S. Wilkie (1967, p. 138–150).

28 The German translation of Buffon's *Natural History* was published as *Allgemeine Historie der Natur: nach ihren besonderen Theilen abgehandelt*, trans. Abraham Gotthelf Kästner (1750-74). Although Buffon originally published the first three volumes together in 1749, Kästner translated and published only the first two of these into German in 1750; volume three appeared in German translation in 1752. Kant started teaching a course on physical geography in 1756, and anyone reading through Kant's course outline for his first courses on "physical geography" in the mid-1750s would have immediately seen just how closely acquainted Kant had already become by then with Buffon's early volumes. A helpful discussion of Kant's earliest lectures, including his likely sources, is provided by Werner Stark as part of the editorial apparatus put together for the recent Academy edition of Kant's so-called "*diktat* text" from 1756-58, see Stark (2009, esp. the "*Einleitung*" and the footnotes accompanying parts 2 and 3, p. 85ff.).

29 Haller's prefaces are available in English translation. See Haller (1991, p. 322).

30 Stark (2009, p. 320). These were of course the identical grounds upon which Caspar Friedrich Wolff attacked Blumenbach's *Bildungstrieb*, since force, as Wolff saw it, was an entirely different biological entity than the intelligent guidance which Blumenbach had mapped on to it. An account of Wolff's continued critique of Blumenbach is in Shirley Roe (1981).

31 In these passages David Walford has translated *Fortpflanzung* ("reproduction" in English) as "propagation." Within the context of Walford's translation as a whole, I think that this choice might be misleading at points, although propagation is good for capturing the nonsexual nature of reproduction according to encasement theory. Kästner used "*Vermehrung*" as a translation of Buffon's description of the "augmentation" of an embryo in preexistence theories. The taking in of nutrition, for example, yields "eine Vermehrung" and "diese Vermehrung der Größe nennet man das Auswickeln, weil man sie dadurch zu erklaren hat, daß man sagte, das Tier sey in kleinen gebildet, wie es seiner völligen Größ nach beschaffen ist, und daher, liese sich leicht begreiffen, wie sich seine Theile auswickelten, indem nach und nach eine dazu kommende Materie alle in gehörigen Ebenmaaße vergrößerte," in Buffon (1750-74, p. 27).

32 A helpful discussion of Kant's attempt to synthesize preexistence theory and epigenesis in this section is in Mark Fisher, "Kant's Explanatory Natural History: Generation and Classification of Organisms in Kant's Natural Philosophy," in Huneman (2007, p. 101–121).

33 Paul Menzer takes Kant—wrongly, in my view—to have Caspar Wolff's position in mind in the opening lines of this passage. See Menzer (1911, p. 104). That said, in Herder's notes from Kant's lectures on metaphysics during the same period as the 1763

piece it is clear that, without naming them, Kant could have understood that the specific difficulty facing Haller and Wolff was the lack of any decisive evidence in favor of one position versus the other. As Herder recorded him, "*Die Physikalischen beobachtungen zeigen, daß der Körper zuerst gebildet wurde, andere daß sie bei der Schöpfung gebildet sei*" (V-Met/Herder, AA 28: 889). In his notes Herder went on to report that the main conceptual difficulty facing the life sciences was twofold, at least so far as Kant understood their attempt to discern the processes of generation, namely, the conception of freedom on the one hand, and its generation in the world (*die Zeugung seines gleichen im Raum*) on the other.

34 In spite of this, Kant simply could not include organic generation as an example of natural laws at work for unlike the demonstrable laws guiding cosmological construction, the structure of plants and animals appeared to be unconstrained or contingent while still being oriented somehow toward particular ends. In Kant's words, "Große kunst und eine zufällige Vereinbarung durch freie Wahl gewissen Absichten gemäß ist daselbst augenscheinlich und wird zugleich der Grund eines besondern Naturgesetzes, welches zur künstlichen Naturordnung gehört. Der Bau der Plflanzen und Thiere zeigt eine solche Anstalt, wozu die allgemeine und nothwendige Naturegesetze unzulänglich sind" (BDG, AA 02: 114).

35 Kant liked the theory in 1790 for much the same reasons he had liked its outlines in 1763: epigenesis reduced an appeal to supernatural agency to a bare minimum, since it relied on God for only the original construction of the forms that the species lines would take, and it balanced a mechanical account of nutrition and growth with a teleological explanation of the organism's purposive development. And Kant singled out Blumenbach's notion of a *Bildungstrieb* for praise, precisely because it seemed to offer empirical evidence of the theory of generic preformation itself. Nonetheless, Kant's tone of caution regarding the life sciences was unchanged. However convincing our intuitions regarding nature's organic capacities might be, however promising the advances made by the life sciences might seem, the operating principles of the organism would simply never be revealed in an empirical investigation. Although much has been made of Kant's endorsement of Blumenbach and of questions regarding Blumenbach's influence on Kant in his discussion of epigenesis, one should not forget that, whatever influence might be claimed, Blumenbach in fact transgressed a clear boundary set by Kant between thinking about nature as purposive and claiming that nature was in fact purposive. Robert J. Richards emphasizes this difference between Kant and Blumenbach in Richards (2000, p. 11–32). See also Richards (2002, chap. 5., p. 216–237). As Timothy Lenoir describes Blumenbach's position, "The *Bildungstrieb* was not a blind mechanical force of expansion which produced structure by being opposed in some way; it was not a chemical force of 'fermentation,' nor was it a soul superimposed on matter. Rather the *Bildungstrieb* was conceived as a teleological agent which had its antecedents ultimately in the inorganic realm but which was an emergent vital force." See Lenoir (1980, p. 83). It was precisely this interpenetration of form and force—something Kant explicitly liked about Blumenbach's theory—that caused Caspar Wolff, the first author to describe vegetative growth and reproduction as a form of epigenesis, to complain about Blumenbach's position. For Wolff, force simply could not by definition also be responsible for form. See Wolff, "Von der eigenthümlichen und wesentlichen Kraft der vegetabilischen sowohl als auch der animalischen Substanz," in Wolff (1789).

36 A reprint of Baumgarten's text is included in the academy volume devoted to the notes Kant made in his own copy of the text. See HN, AA 17: 5–226. All of Kant's notes made within Baumgarten's text are identified in terms of their location and arranged according to their supposed chronology, such that, for example, Kant's various remarks on §§770–775, "Origo Animae Huminae," can be traced throughout Kant's career. Since Kant taught this text every year, determining the chronological sequence of any notes made for a given section is necessarily imprecise in that it can rely only upon placement, ink color, and so on. The academy edition's two volumes devoted to Kant's notes on metaphysics (vols. 17 and 18)—including numerous pieces written on so-called loose sheets—follow Erich Adickes's dating system, a system explained by Adickes at the start of the volumes devoted to Kant's notes, marginalia, and assorted *Nachlaß* (HN, AA 14: lx–lxi). Adickes's system is almost always followed by the Cambridge edition of Kant's notes, though the editors often suggest longer possible time frames for a given text. Translations are here taken from the Cambridge edition wherever possible. See Kant (2005).

37 Kant's elaboration of the epigenesist alternative can be compared to the relatively brief remarks—at least so far as Herder recorded them—when discussing this section of *Metaphysica* in 1762–1763, see V-Met/Herder, AA 28: 889.

38 Discussing the same passage in Baumgarten thirty-three years later, for example, Kant continued to use the term "epigenesis" in contrast to the preexistence theory of origin, but in place of his concern with the physical process of blending—in fact, in place of any consideration of biological generation at all—Kant focused on the Aristotelian-derived account of "concreationism" in Baumgarten's text, rejecting this option on principle, given the soul's nature as simple substance. In language deliberately borrowed from chemical analyses, Kant here characterized the soul as either an "educt"—a thing that preexisted its new form—or as a "product," something newly produced via epigenesis. The latter theory was completely impossible, according to Kant, because a noncomposite substance like the soul could not be expected to transfer a part of itself to its offspring (V Met/Dohna, AA 28: 684—these comments are taken from student lecture notes, "Metaphysics Dohna," from Kant's metaphysics course in 1792–1793). Kant made additional notes for this passage, rejecting the soul's epigenesis because of its immateriality (HN, AA 18: 190) and its immortality (HN, AA 17: 672, HN, AA 18: 429). Kant also considered the epigenesis of the soul separately in terms of a potential transfer of good or bad character (VARGV, AA 23: 106–107).

39 The assumption that Kant's attitude toward epigenesis in biological organisms is the key to interpreting his account of the epigenesis of reason, is made by the majority of commentators, including Phillip Sloan's influential essay, see Sloan (2002, p. 229–253); and John Zammito's several discussions indebted to Sloan's interpretation on this point, including most notably Zammito (2003, p. 73–109). Ingensiep's response to the Sloan-Zammito interpretation is worth noting: Ingensiep (2006, esp.

p. 70–73). Marcel Quarfood reaches different conclusions than Sloan and Zammito regarding Kant's supposed attitude toward preformation, but he follows the approach starting with Kant's biological discussions when considering the epigenesis of reason. See Quarfood (2004). This is also the case in Helmut Müller-Sievers's discussion of Kant in Müller-Sievers (1997); and in Duchesneau (2000, p. 233–256).

40 I lay out the case for this in Mensch (2013, chapter 4).

41 Kant would subsequently point to reason as the birthplace of the moral law as well. Thus in the *Groundwork*, for example, Kant would explain that "it is here that she has to show her purity as the authoress of her own laws—not as the mouthpiece of laws whispered to her by some implanted sense," but also not as having received them from experience, which "would foist into the place of morality some misbegotten mongrel patched up from the limbs of a varied ancestry and looking like anything you please, only not like virtue" (GMS, AA 04: 425–426). Morality would instead have to be born from out of pure reason itself, for only that kind of pedigree could ensure its sovereignty over the will on the basis of birthright alone. This account of reason's role in giving birth to individual morality ran parallel to its work to achieve the moral advancement of the species as a whole. Perfect moral advancement would culminate in the creation of a "kingdom of ends," according to Kant, and bring with it the completion of the history of reason. This was an idea of moral perfection born out of reason itself, an idea that lay invisibly within humanity as something whose conception was "self-developing" (*sich entwickelnden*) and whose existence needed to be understood as a "self-fertilizing germ" (*besamenden Keim*) of goodness in the species as a whole (MS, AA 06: 122). It was just this aspect of Kant's philosophy that would earn harsh criticisms from Hegel, however, since he took Kant's notion of pure reason to be impotent, something capable of supplying only an empty notion of unity, that is, one that had never been lifted out of intellect by the intellectual intuition of itself. On the basis of such sterility, as Hegel saw it, Kant could never explain how practical reason "is nonetheless supposed to become constitutive again, to give birth out of itself and give itself content." See Hegel's *Faith and Knowledge*, in Hegel (1977, p. 80).

42 I defend this claim at length in Mensch (2013, chapter 7).

43 Kant was clear regarding their identity: "practical reason has the same cognitive faculty for its foundation as the speculative, so far as they are both pure reason" (KpV, AA 05: 90; cf. MS, AA 06:382). But he was also delighted by the manner in which their investigation had proceeded in identical ways. As he summarized his findings in the analytic of practical reason, "Here I wish to call attention, if I may, to one thing, namely, that every step which one takes with pure reason, even in the practical field where one does not take subtle speculation into account, so neatly and naturally dovetails with all parts of the *Critique of Pure* (theoretical) *Reason* that it is as if each step had been carefully thought out merely to establish this connection" (KpV, AA 05: 106). It was precisely because of this that Kant felt confident in pursuing the strategy he had followed in the first *Critique* with respect to identifying the table of judgments as the genealogical basis of both the categories and the ideas of reason; in this case, with respect to the genetic grounds upon which he could identify causality and freedom (KpV, AA 05: 55–57, 5: 65–67, 5: 68–70).

44 Medieval philosophers described the work that Aristotle had attributed to the "nutritive soul" as a process of absorption, which they termed "intussusception." This term was later taken up by René Réaumur in 1709 to describe the processes of shell formation in "De la formation et de l'acroissement des coquilles des animaux tant terrestes qu'aquatiques, soit de mer soit de rivière," in Réaumur (1709, p. 364–400, esp. 366, 370). Bourguet took the term from Réaumur but insisted on the interiority of intussusception (71) in contrast to the kind of external, mechanical accretion occurring in crystals or shell formation. Buffon used the term "intus-susception" in line with Bourguet's account of an internal absorption or assimilation (e.g., *History of Animals*, chap. 3, "Of Nutrition and Growth"), as did Kant when arguing in the above citation that systems may "grow from within (*per intussusceptionem*), but not by external addition (*per appositionem*)" (KrV, A833/B861). The appearance of "intussusception" after Kant shows its meaning to have changed again, in this case via Schelling, who used it in his philosophy of nature to identify the universal tendency of attraction in nature. See *First Outline of a System of the Philosophy of Nature* (2004, p. 7). A brief review of Bourguet's position is in Roger (1997, p. 300–303). For a fuller treatment see Duchesneau (2003, p. 3–31). Thomas Hankins describes Buffon's "popularization" of Bourguet's main tenets in Hankins (2005, p. 128–129).

45 Kant made the same point in the *Metaphysics of Morals*: "Since, considered objectively, there can be only one human reason, there cannot be many philosophies; in other words, there can be only one true system of philosophy from principles, in however many different and even conflicting ways one has philosophized about one and the same proposition"; only by paying attention to that fact, according to Kant, would it be possible to demonstrate the "unity of the true principle which unifies the whole of philosophy into one system" (MS, AA 06:207). In *Religion Within the Bounds of Reason Alone* Kant also described the historical self-development of religion in a manner that was indebted to his description of reason. For example, "we must have a principle of unity if we are to count as modifications of one and the same church the succession of different forms of faith which replace one another . . . for this purpose, therefore, we can deal only with the history of the church which from the beginning bore with it the germ and the principles of the objective unity of the true and *universal* religious faith to which it is gradually being brought nearer" (MS, AA 06:125). This point would be mirrored in the social and political sphere once Kant took up the history of civil constitutions in his essay *Perpetual Peace*, a history whose epochal determinations were unified throughout, as Kant saw it, by the unfolding of reason's concept of right (ZeF, AA 08: 350)—a point that Kant repeated in terms of the "evolution of a constitution" in both the *Conflict of the Faculties* (SF, AA 07: 87, see also 07: 91) and the *Metaphysics of Morals* (MS, AA 06: 340). In his *Philosophy of Art* Schelling mirrored, therefore, Kant's account of philosophy's organic development across history, in Schelling's words: "There is only *one* philosophy and *one* science of philosophy. What one calls different philosophical sciences are mere

presentations of the *one*, undivided whole of philosophy under different ideal determinations. …The relationship between the individual parts in the closed and organic whole of philosophy resembles that between the various figures in a perfectly constructed poetic work, where every figure, by being a part of the whole, as a perfect reflex of that whole is actually absolute and independent in its own turn." See SCHELLING (1989, p. 281–282).

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