1
Introduction

A poem may be quite nice and elegant and yet have no spirit. . . . Spirit *in an aesthetic sense is the animating principle in the mind.*

—*Immanuel Kant,* Critique of Judgment

Romantic poets and makers of all sorts—from the philosophical to the fictional, from Samuel Taylor Coleridge to Victor Frankenstein—were in quest, literally, of the principle of life. Such a principle or power, whose permutations were many, promised to relieve "the burden of the mystery" by explaining "the mystery of life." We are all too familiar now with the latter phrase; the former (for which Keats had a particular fondness) derives from Wordsworth's "Tintern Abbey," in which the speaker enters that "blessed mood" when "the breath of this corporeal frame, /

And even the motion of our human blood" seem suspended, and we "become a living soul." What might this mean: to become a living soul? For Wordsworth, as for others, it was above all a condition of power, when "with an eye made quiet by the power / Of harmony, and the deep power of joy, / We see into the life of things."[1] The result of aesthetic concentration is the animation of the soul, the part of us that rises from corporeal slumber to penetrate the *life* of things. But what, then, is life?

The question is asked a thousand times in a thousand ways by all the major British Romantic poets writing in the period from 1760 through 1830. Shelley, who died before he could finish "The Triumph of Life," left the question dangling at the end of that last major work: "'Then, what is Life?' I said . . . the cripple cast / His eye upon the car which now had rolled / Onward, as if that look must be the last, / And answered . . ." (ellipses in original). How the cripple responds is of no consequence. The question remains fundamentally unanswered and, for the poet seeking wisdom in mangled forms, perhaps unanswerable. "We are struck with admiration of some of its transient modifications," Shelley wrote of life in a notebook of 1819, "but it is itself the great miracle" (*SPP* 505). The ephemeral configurations of a power known as life could be discerned in its material forms, the result of a transcendent power named variously *Lebenskraft, Bildungstrieb, vis essentialis,* and *vis vitae,* to give a few of the linguistic constructs most popular at the time. Life was a version of power, and power was life. That was all the Romantics knew perhaps, but not all they needed to know. For unlike the other terms we are accustomed to seeing in that equation—Beauty and Truth—power is fearsome, and life, for most mortals, in need of control. To perceive beauty as a harmony of parts may be one thing, but to see living form as a harmony of power (or powers) is to risk the object's slipping out of representation, and hence out of imaginative control. As the Romantics recognized, power, even when in balance, is still power, and the slightest alteration in circumstance or environment could set that power in unpredictable motion.

European writers across the intellectual and historical field that fell somewhere between God and cellular biology could find no escape from the conundrum of life conceived as power: the unifying principle of organic form. Just as beauty was conceived as "multëity in Unity" (Coleridge's phrase), life became defined in similar terms as "unity in multëity" (*CCW* 11.1.369; *TL* 510). What the exchangeability of these definitions of life and beauty suggests is that once life was viewed vitalistically as power, science and aesthetics confronted the same formal problems. This, in a nutshell, is the rationale for treating literary works of the Romantic period, particularly some of the more seemingly formless ones, within the wider context of organicism as an interdisciplinary field responding to the problem of life. Despite decades of historical challenge to the rubric of Romanticism as a shared intellectual project, the writers discussed here were all committed to defining and representing the incalculable, uncontrollable—often capricious, always ebullient—power of vitality.

Although Romantic life science, obsessed with the idea of life as *power,* has been considered a dubious episode in the history of science, it made possible the analogy between aesthetic and biological form upon which we still rely. In the early nineteenth century scientists still did not know that mammals develop from a zygote, or fertilized egg, nor that this particle was capable of generating the entire organism through the processes of division and differentiation. Generation and reproduction, or the production of creatures and parts of creatures, marked a threshold in natural science that neither chemistry nor the mechanistic physiology of the previous century could cross. The unique properties of living form became the subject of much debate, and, as M. H. Abrams has recounted, they consisted of unity, vegetation (or growth), assimilation, internal design (or self-generation), and the interdependence of parts. Such properties are also sometimes conceived as a triad (assimilation, reproduction, autonomy) or as a binary (generation and reproduction). However grouped, they tend to imply agency and autonomy.[2] Yet, even for Coleridge, on whom subsequent ideas of organic form have been based, living or organic form was never equivalent to undifferentiated unity. Instead, the unpredictable vitality of living form, its very liveliness—protean, procreative, for some terrifying—served as a model for "genuine" art.

Vitality was, to be sure, the mark, the distinguishing feature, of Romantic aesthetics. When William Hazlitt took up his pen as a knight of "the Round Table" in *The Examiner,* he insisted that a work of art must have "the internal character, the living principle in it" since without this it is merely "a smooth surface, not a warm moving mass" (*HCW* 4:77). Any authentic work of art must seem alive: it must contain the living principle that characterized what was called living form. A year later, in *Biographia Literaria* (1817), Coleridge defined the imagination as the "living Power and prime Agent of all human Perception," declaring that "could a rule be given from *without,* poetry would cease to be poetry, and sink into a mechanical art" (*BL* 1:304, 2:83). Like works of nature, aesthetic products conceived as living form could not be mechanically constructed through rule and line. Nor could they be reproduced. "The form is mechanic, when on any given material we impress a pre-determined form, not necessarily arising out of the properties of the material," Coleridge wrote, "as when to a mass of wet clay we give whatever shape we wish it to retain when hardened. The organic form on the other hand, is innate. It shapes, as it developes itself from within, and the fullness of its development is one & the same with the perfection of its outward Form." Nature provides the model for the artistic genius, whose products are formal expressions of a power that was purposive but not necessarily intentional. "Such is the Life," Coleridge explained, "such the form" (*CCW* 5.1:495). By syllogistic logic it would follow: such is the *power,* such the form. Yet too much power, or power potentially unhinged or gone awry, lay forever on the horizon of Romantic vitalism.

As the concept of vital power sparked a preoccupation with self-generating and self-maintaining form, it quickened the category of the aesthetic, elevating natural researchers into natural philosophers attempting to account for a mysterious power buried deep within the structures of nature. Life scientists focused on the dynamics of organic form in an effort to explain how form emerged and maintained itself, despite the physical laws of an environment that worked, meanwhile, to reduce it to its constituent parts. Aesthetic theorists and practitioners alike focused on the vitality of form, which from the 1790s on had been imbued (by way of Kant's critique of aesthetic and teleological judgment) with the Aristotelian notion of purpose. Yet the problem with the merger of science and aesthetics at the turn of the nineteenth century boiled down to the following: while the sublime object always threatened to exceed formal constraints, when it slid from theory into praxis, from imagined into actual, animated power, it could also slide out of the sublime and into a distinctly Romantic version of monstrosity.

As long as life was *pre*formed, as earlier Enlightenment science had held it to be, all aberrations from standard patterns (embryological deformities, monstrous births) could be interpreted as static manifestations of evil, material signs of God's judgment within a greater divine plan. Organic development was a stable, ongoing process of unfolding that plan, and God took responsibility for any wayward forms of life that might be considered monstrous. Yet once life came to be seen as power, monstrosity came to represent life's relentless fecundity and "the monstrous" a mode of uncontainable vitality.[3] It is striking that most scientific works on generation from the late eighteenth and early nineteenth centuries led inevitably to meditations on monstrous generation. Because what could grow and generate living form could also change, it ran the risk of going "wrong" in the developmental process—or at least of going its own way. The problem with Romantic organicism as it is traditionally understood on the idealist model is that it leaves out the dynamics of power underwriting unexpected forms of both nature and art. This book takes up poems by Christopher Smart, William Blake, Percy Bysshe Shelley, and John Keats that seem to defeat their own formal and allegorical structures.[4] In truth, I have had trouble convincing some readers that the first poem discussed, Smart's *Jubilate Agno,* is even a poem, much less a Romantic one. My purpose is to provide a methodology for reading these seemingly "formless" forms as manifestations of an epigenesist poetics, a sadly awkward phrase that will nevertheless serve us well in reading these somewhat awkward poems. Yet before undertaking such a venture, it is necessary to clarify precisely what was meant by the natural-philosophical term *epigenesis.*

Epigenesis

Aristotle, who formulated the first significant theory of epigenesis, had no microscope with which to investigate living organisms. Originally, the concept stood for a gradual, internally motivated process of morphogenesis, commencing from what we might call an epicenter. The matter making up the ancient world was readily disposed to taking on life—or form or soul. (In Greek these terms were interchangeable, and the ideas were not distinct.) Unorganized but inspirited matter thus had the capacity to produce living, or organic, forms *de novo*. Following Aristotle, William Harvey's treatise *On Animal Generation* (1651) provided the first major study of generation in the modern period, and in it the scientific revolution ran up against the ancient idea of vitalism. Harvey's empirical methodology and sense of the human body as a hydraulic machine were here put in dialogue with the inexplicable: an invisible living principle. Standing at the crossroads of ancient animism and an orthodox creationism based on the Bible, this work proposed something that had never been heard before: *omne viva ex ovum* (all life from an egg), as the Latin epigraph to his treatise on animal generation read. Of course, what Harvey meant by egg (ovum) is unclear since this was more of a conceptual category than a distinct, anatomical particle.[5] But by overturning the received wisdom that viviparous (producing living young) rather than oviparous reproduction was the model for all organic growth, Harvey, who paradoxically clung to the ancient concept of epigenesis, enabled a competing theory of generation that was more amenable to the Christian worldview. This was called *preformationism,* a doctrine according to which God, the omnipotent creator, makes the design for each species.

According to the age-old theory of epigenesis, by contrast, the male animal of each species implants the soul (essence, vital principle, form) into embryonic matter provided by the female. Then, "as soon as it has been formed," Aristotle noted, "a thing makes itself grow" by incorporating new, unformed material into its substance and shaping it to its own ends.[6] Harvey adhered to more rigorous modern standards of evidence, but he too believed that an unspecified "vital principle" was the teleological cause by which an animal makes itself out of nonliving matter. Timothy Lenoir helpfully explains such teleological causality as "cause and effect . . . so mutually interdependent that it is impossible to think of one without the other, so that instead of a linear series it is much more appropriate to think of a sort of circular series, A→B→C→A," in which the first cause is also the last.[7] Harvey contrasted this theory of generation *per epigenesin* to the alternate model of generation *per metamorphosin,* whereby "forms are created as if by the impression of a seal, or, as if they were adjusted in a mould"; as he put it, "An animal which is created by epigenesis attracts, prepares, elaborates, and makes use of the material, all at the same time; the processes of formation and growth are simultaneous."[8] The distinctive biological processes of generation and vegetation, through which organic matter takes on and maintains a specific form, thus relied on powers that were only suspected to be present and whose autonomy was potentially in conflict with an all-powerful Christian God.

Not surprisingly, when the idea of self-shaping substance came face to face with the Christian view of creation as a divine fiat, a counter-theory of generation emerged. Based on Harvey's work, this theory, known as preformationism or evolution (from the Latin *evolutio,* "to unfold"), held that God had premade all forms of life at the time of the Creation, and these forms simply awaited their proper time and place in the universe to begin the process of embryonic unfolding. Harvey had described how a chick takes shape gradually inside an egg, but when his Italian contemporary Marcello Malpighi repeated his experiments with a better microscope than Harvey's, he announced that what his English peer had failed to see during the first three days of incubation—already formed parts of the chick—had been present all along. Malpighi claimed to have observed these embryonic parts prior to the appearance of the famous *punctum sanguinum* (point of blood), traditionally thought to initiate the heartbeat and other vital processes. He did not explicitly say that these parts were preformed, or that they had somehow preexisted since the biblical Creation, but his work provided the basis for ovist preformation theory: a blueprint model of generation in which God produced the design for each species.[9]

Such a scenario included no room for unexpected change or invention. Regardless of whether what preexisted in the egg was design or an actual miniature of the animal, advocates of preformation considered generation a mechanical realization, by way of nutrition, of already articulated parts. One can see how this theory lent itself readily to both the mechanistic physiology and the taxonomic approach to nature common within the European scientific community. Naturalists sought to identify and classify given structures, determining how these worked as parts in the natural world, how they related to one another and to the larger machine of the universe. Bit by bit, they were able to accumulate natural knowledge and piece it together, though any view of nature achieved through this means was necessarily flawed—or rent, since the seams between discrete epistemological units were not continuous. Still, the model was self-contained, and the natural researcher did not have to account for matter with the capacity to rise up suddenly from its predetermined place in the whole and take on original, possibly unexpected, forms. The emphasis was on analysis, not synthesis, of the creaturely world.

When in 1671 the Italian scientist Francesco Redi demonstrated that living creatures which had seemed to appear out of the blue in putrid matter were the result of eggs laid by flies, he finally laid to rest the ancient faith in spontaneous generation. Preformation theory ascribed all productive power to a transcendent maker, and natural historians and philosophers who supported this theory worked to wipe out all remaining vital sparks and spirits from the legitimate sphere of Enlightenment science.[10] Throughout the eighteenth century these lingered metaphorically, but they had become associated with a more primitive, superstitious age. Starting in the 1740s, Marc J. Ratcliff explains, "the natural experimental laboratory—with several microscopes at its center, surrounded by a profusion of tools such as glass jars, bottles, labels, scalpels . . . began to acquire its distinctive modern physiognomy, of riotous life enclosed in a designated space. The many jars containing infusions, plants, insects, worms, batrachians, eggs, and the like exhibited the swarming of nature—but under the control of scientific instruments and subjected to the naturalist's gaze."[11] The obvious fact to which the abundance of scientific instruments paid tribute, of course, was that such control was extremely precarious.

Although buried temporarily beneath the structured patterns of Enlightenment science, animating sparks and powers of the natural world remained. Ideas about generation suffused many aspects of culture, such that in *A Defence of Poetry* Shelley compared poetic language to "the first acorn, which contained all oaks potentially" (*SPP* 528). Whether intentionally or not, the image refers back to Nicolas Malebranche's *Search After Truth* (1674), which cites Malpighi's work as evidence that "a chicken that is perhaps entirely formed [can be] seen in the seed of a fresh egg that has not been hatched." Malebranche, having observed what he thought was a miniature tulip inside a tulip bulb, extended the theory of preformation to plants, postulating that "in a single apple seed there are apple trees, apples, and apple seeds, standing in the proportion of a fully grown tree to the tree in its seed, for an infinite, or nearly infinite number of centuries." According to Malebranche, "nature's role is only to unfold these tiny trees by providing perceptible growth."[12] He called his theory of embedded miniature life forms *emboîtement* (encasement) and speculated that an individual organism contained in a germ needed only to increase in size, gaining new matter but not form, to realize its purpose. This radical version of preformationism, known also as preexistence, led even the preeminent physiologist Albrecht von Haller to some dubious calculations, such as his estimation that our first mother, Eve, must have stored two hundred thousand million diminutive human beings within her ovaries.

Within a few years of ovist preformation theory, scientists had discovered a sea of swarming "spermatic animals," alternately called animalcules or spermatic worms, in the semen of male animals, which many took to be the source of preformed life. Accordingly, an alternate, "spermist" version of preformationism arose. The Dutch microscopist Antoni van Leeuwenhoek, credited with the discovery of the spermatic worms, concluded in 1678 that only male animals possessed the preformed germs of life.[13] As François Jacob remarks in *The Logic of Life: A History of Heredity*, "When Leeuwenhoek and Hartsoeker observed 'animalcules' frantically swimming around in the spermatic fluid of many different types of male animals, they immediately found a use for them—but not the right one."[14] The spermist creation theory returned the female animal to her ancient role of providing matter for organic growth and raised as many questions as it answered.[15] Why, for instance, such a multitude of preformed embryos for a single act of reproduction? Why so much wasted life when experience showed that nature never does anything without a purpose? Some proposed that the swarming, wormlike things found in semen were parasites having nothing to do with sexual reproduction. Others, who were convinced of the utter irrationality of emboîtement and who doubted the logic of either ovist or spermist preformation theory, began to discern new productive powers in nature.

Naturalists in the Enlightenment steered clear of the term *epigenesis,* but starting in the 1740s the concept of vital power reentered the scene of generation. When the English microscopist John Turberville Needham peered through his lens at prepared infusions of vegetable and animal matter (specimens soaked in water and sealed in a vessel), he saw what he took to be an entirely new class of animals, whose "greatest Characteristic is, that they neither are generated, subsist by Nutriment, as other Plants and Animals do, or generate in the ordinary Way."[16] Although Needham's experiments were retested later in the century by Lazzaro Spallanzani, who proved that Needham had not sealed his vessels tightly enough to prevent the intrusion of air (thereby invalidating his experimental results), Needham's work formed part of a wider challenge to the theory of preformation that was gaining force at this time.[17] Like others, he concluded that there must be some "productive power" in nature that enabled unorganized material to generate new living forms.

Like Spallanzani, the French naturalist Charles Bonnet was vocal in defending the Christian theory of preformation from dangerously compelling *forces produtrices*, but he unwittingly provided further evidence against it in 1740 when he discovered the phenomenon of parthenogenesis in aphids. These miniscule animals, commonly known as plant lice, he found, could reproduce without the assistance of a sexual partner (in this case, the male). Although small, the creatures were larger than Needham's microscopic animalcules, and their manner of reproduction overturned a central tenet of Christian preformation theory, the necessity for sexual coupling to populate and fructify the earth. Bonnet had accused Needham of straying from the literal into "the poetic ground of physiology" (to borrow a phrase from the Romantic physiologist William Lawrence; *L* 83) by endorsing the concept of formative power. Yet Bonnet's own effort to defend preformationism through a nebulous definition of the germ as "every pre-ordination, every preformation of parts capable by itself of determining the existence of a Plant or an Animal" suggests that by midcentury this germ could no longer be thought of as a homunculus, or miniature life form complete in all its parts.[18]

A third major challenge to preformation theory beyond Needham and Bonnet occurred in the 1740s with the discovery of the spectacular ability of the arm-polyp, a creature today called a hydra, to regenerate its lost or mutilated parts. When the amateur naturalist Abraham Trembley cut into the creature, he found that not only could it produce new parts, it could also generate new *creatures* from dismembered scraps of itself.[19] An unusually plastic form of life and a possible link between the animal and plant kingdoms, the polyp was more than a match for proponents of preformation. If all life was preformed, skeptics wondered, how could a severed piece of a creature generate an entirely new living form? Were all the fibers of the polyp populated with germs ready to be stimulated into development by the naturalist's knife? And if this were the case, how many germs (or animating principles, souls) could one polyp have, if indeed it had any? I shall return to the debates surrounding the prolific polyp in Chapter 3; here let us merely situate the creature next to Needham's animalcules and Bonnet's aphids on the margins of standard classifications of plant and animal life. Taxonomy had been the goal of Enlightenment scientists seeking to follow an epistemological path to the divine through rational religion and the accrual of facts, but here was a significant challenge to any theory of life based on organic structures. As Linnaeus recognized, botany, or the science of classifying plants, was analogous to comparative anatomy, which also classified animals by way of structure. The morphological oddity of the polyp challenged the structural stability of the natural world and redirected naturalists back to the unsettling idea of formative power.

To test the theory of preformation, the French doyen of natural history Georges-Louis Leclerc, comte de Buffon, performed some experiments with Needham in Paris that served as the basis for his own theory of generation, expounded in his *Natural History* (1749), a monumental work that sparked a revival of vitalism. Buffon decided that what his English peer took to be spontaneously generated creatures "of a class apart" were instead "organic particles," or indissoluble, rudimentary building blocks of organized life. According to his organic-particle theory, the bodies of animals and plants consisted of a certain number of organic particles, identical in figure and substance to the fully formed organism. Under the guidance of so-called penetrating powers, these organic particles would incorporate themselves into the internal mold of a developing life form.[20] For Buffon, the penetrating powers represented the agency that made certain material penetrate certain parts of the mold, expanding ultimately into an organized form resembling that of the parent organism. An embryo developed, in other words, as its penetrating powers caused nutritive material to penetrate the internal mold at the right time, in the right place, and in the right proportion to bring about innate design.

Buffon's contemporary Pierre Louis Moreau de Maupertuis, the physicist responsible for the dissemination of Isaac Newton's work in France, developed a similar theory about animals in which male and female "semen" (both viable quantities at the time) contained organic particles destined to form the different organs as like particles were attracted to like and combined. In response to criticism that a simple force, even attraction, was inadequate to account for the production of organisms as complex as mammals, Maupertuis equipped his hypothetical force with memory, to guide the organic particles into a form resembling that of the parents.[21] New life forms would occur when an excess of these particles, stored in the "seminal reservoirs" of adult animals, united through the penetrating powers. For Maupertuis as for Buffon, death meant the detachment of these particles, not their destruction. Assuming a minimum level of organization, therefore, the organic-particle theory fell somewhere between preformation and epigenesis, the latter necessitating that the primal matter in which an organism takes shape be undifferentiated and unorganized.

Pivoting between natural history and natural philosophy, Buffon's work was enormously influential on European life science throughout the latter half of the eighteenth century. In England, Erasmus Darwin translated Buffon's organic particles into "molecules with formative propensities," reasoning that certain particles might have greater powers of attraction than others (and others a greater aptitude to be attracted), which might allow for an explanation of organic self-generation on chemical grounds.[22] Shortly after its first appearance in print, Buffon's *moule intérieur* was translated into German as *Kraft* (power), a change that signaled a paradigm shift in the study of organic form: life now denoted power, rather than structure. Painted in broad strokes, this shift entailed the move from an empiricist natural history to a more speculative natural philosophy and the elevation to a symbolic level of powers formerly though to be mere force.

The German term for vital power appeared on the scene with Medicus's *On the Lebenskraft* (1774), though the idea of *vis viva* (life force) had been gaining support since 1757, when Albrecht von Haller demonstrated sensibility and irritability, or the powers of the nerves to react and of the muscles to contract, respectively. These vital powers were distinct from chemical or physical forces insofar as they occurred only in matter that was alive.[23] The German physiologist Johann Friedrich Blumenbach, who contributed his theory of *Bildungstrieb* (formative drive) to the rising tide of vitalism, observed that "vitality is one of those subjects which are more easily known than defined, [for] its effects are sufficiently manifest, and ascribable to peculiar *powers* only. The epithet *vital* is given to these powers, because on them so much depend the actions of the body during life, and of those parts which for a short time after death preserve their vitality, that they are not referrible to any qualities merely physical, chemical, or mechanical."[24] Following Haller's work on sensibility and irritability, scientists were forced to acknowledge mysterious powers in living matter that allowed it to resist physical laws: warm-blooded animals maintain a consistent body temperature, for example, despite the changing temperature of the environment, and all living creatures resist the chemical decomposition that sets in immediately at death.

However, while Haller marked out a path for physiology beyond mechanism, he did so by comparing the vital powers of sensibility and irritability to Newton's (calculable) force of attraction. So too biologists following Haller based their ideas about nature's productive powers on an analogy between biology and the physical sciences, physics and chemistry. Newton had left the origin of the attraction of gravitation unexplained, and Haller thereby felt himself liberated to study the effect of vital power (the material phenomena of sensibility and irritability) without explaining its cause. The origin of vital power "is placed far beyond the power of the scalpel or the microscope," he wrote; "beyond the scalpel or microscope I do not make many conjectures."[25] By the same logic, Blumenbach claimed that "just in the same way as we use the name of attraction or gravity to denote certain forces, the *causes* of which however still remain hid, as they say, in Cimmerian darkness, the formative force (*nisus formativus*) can explain the generation of animals."[26] Biologists compared vital power to forces like electricity and magnetism, but the key difference was that their power could not be quantified or mathematically predicted in the same manner as physical force. This conundrum of vitalism applied both to products of nature and of art, to plants and polyps as well as poems.

As biology veered away from the realm of calculability that characterized Newtonian science, it came to depend on discursive constructs (*moule intérieur, nisus formativus*) to guide the science of generation, although none of the forces that emerged from the epistemological ruptures of the 1740s could be equated with life in the way that the Latin *anima* had been or that the concept of Lebenskraft would later be.[27] Powers of vegetation and generation had been postulated before, but they were insufficient to explain the self-organization of creatures more complex than microscopic life. Buffon's organic particles presupposed a degree of preorganization, and Needham's version of formative power produced mere animalcules. Then, in 1759, the young German embryologist Caspar Friedrich Wolff caused a breakthrough with what appeared to be detailed microscopic evidence for epigenesis in complex animals—mammals, specifically young incubating chicks, whose development he described from the earliest stages of unformed substance.

Wolff's work shocked the scientific establishment of Europe and revived the controversy about epigenesis in the years from 1760 through 1790, itself a philosophical stopping point between Enlightenment notions of preformed life and Kantian notions of teleological power.[28] His much-publicized dispute with Haller, based on claims made in his dissertation *Theory of Generation* (1759), served to focus the debate about life as power that began in earnest in the 1760s. Haller's own career exemplified the volatility characterizing the science of generation at this time. As a student of the mechanist Herman Boerhaave, he had initially accepted the preformationist theory of spermatic worms, or animalculism. Following Trembley's discovery of the polyp's powers of regeneration, however, he ambivalently embraced epigenesis. He simply could not comprehend "how the same parts [of the polyp] which in the morning were little cuttings of a spine, a stomach, or a head, [could] by afternoon change into true heads and whole stomachs."[29] Nor in studying living form as closely as he did could he understand how a simple force could produce the organic complexity he witnessed on a daily basis. After a brief period of anxiously lending his authority to the theory of epigenesis, which seemed dangerously close to materialism, he returned to the religious haven of preformation. From there he faced the genius upstart Wolff.

What was so radical about Wolff's theory—and the reason Haller gave it the serious attention he did—was that it demanded viewing living form from a different perspective than either anatomy or physiology could provide. Wolff identified what he called an "essential power" (*essentliche Kraft,* or *vis essentialis*), responsible for a particular mode of generation (*Enstehungsart*) that would allow structure to be seen as a byproduct, and a variable one at that, of power. While anatomists studied organisms through the structure of their parts and physiologists through the internal structure of the relations of diverse organ functions, Wolff assumed that all life forms develop analogously based on the workings of the vis essentialis. He called this "the very power through which, in the vegetable body, all those things which we describe as life are effected." He assumed that it could explain the development of even the most complex forms of life and labeled it essential "because, namely, a plant will stop being a plant if this power is taken away" (*TG* 160). As the distinguishing feature of life, it drove the formative activity of the organism and did so in a manner independent of purpose (*Zweck*). In the second edition of his *Theory of Generation* (1764), translated from Latin into German, Wolff boldly stated: "I hold the collective opinion of physiologists to be wrong and . . . believe [myself] to have found traces of an essential power in certain plants as well as animals, whose performance I have described as the distribution of juice [*Saft*] and nutrition in plants and in animals, from the first moment of nutrition into full growth" (*TG* 269). By classifying species independently of structure, he permanently unsettled the theory of preformation and breathed new life into the ancient idea of epigenesis.

The chief point Wolff posited and stuck to was that while an organism might look like an assemblage of parts, such organization is accidental, not essential, to living form. Too radical for his colleagues at the College of Medicine in Berlin, Wolff moved in 1766 to the Russian Academy of Sciences in Saint Petersburg, where he used his academic position as professor of anatomy and physiology and curator of the royal gardens and cabinets of monstrosities to continue studying the power he believed responsible for generation and vegetation. "What is the nature of this force?" he asked as late as 1789, and the answers he received, in prize-winning essays from Blumenbach and Ignatius Born, published with an essay of his own, suggested that it would be possible to omit the vis essentialis as a cause and still describe the development of creatures in the same way. He recognized his own term as a heuristic device, or "instrument of judgment" as Joan Steigerwald refers to it, which could allow the scientist to explain life in a manner independent of structure.[30] Wolff was willing to forgo the name of the power he described to concentrate on its operation, and Born, too, was ambivalent about naming the formative power whose workings he explained: "Call it a *vis fluida infita, innata, vis propria feu essentialis, vis organica* or *vegetationis, vis primordialis* or *primegenia,* a *Bildungstrieb* or *nisus formativus,* or a *vis essentialis organica,*" he wrote, "the important thing is that such a power exists as a motile, formative power."[31]

Whereas Wolff theorized generation in terms of a simple force operating universally in matter, his successor Blumenbach, head of the Göttingen school of physiology, posited an explicitly *formative* drive (*Bildungstrieb*) that could shape unformed but organizable [*organisibare*] substance into organic form. "A drive belongs," he wrote, "to the vital powers, which is just as significant as the other kinds of vital power in the organized body (contractibility, irritability, sensibility) and the general physical power of the body overall, but different. The most important power for procreation, nourishment, and reproduction appears to be this one, which, to distinguish it from the other vital powers, I give the name of *Bildungstrieb* (*nisus formativus*)" (*UB* 32).[32] Blumenbach distinguished this drive from Wolff's essential power, emphasizing that the latter was merely a force driving nutrition through the unorganized material of developing organisms. The vis essentialis was "requisite to the Bildungstrieb, but not by any means the Bildungstrieb itself" since the former could be discerned even in the most "unnatural outgrowths" of living matter, where no formative power was manifest. By the same token, it was possible for "the vis essentialis in badly nourished bodies to be very weak where the actual Bildungstrieb is undamaged" (*UB* 39–41). Kant, like other theorists of the Romantic era, came to rely on Blumenbach's biological concept of formative power in developing his idea of organic purpose.[33]

This is not to say that all natural philosophers of the Romantic period embraced the concept of vital or formative power. F. W. J. Schelling, who considered the natural world to be an animated whole, refused to acknowledge individual powers like Lebenskraft or Bildungstrieb.[34] With his successor Hegel he preferred the idea of spirit (*Geist*) working itself out in nature according to the teleology of an original image (*Urbild*), an idea Goethe accepted as well, though Schelling found himself resorting to the biological term, *Bildungstrieb*.[35] Goethe, likewise critical of the Lebenskraft, proposed a theory of organic morphology based on the concept of Urbild, described as the