The Botanic Universe: Generative Nature and Erasmus Darwin's Cosmic Transformism

J.P. Daly
Stanford University

ABSTRACT: Erasmus Darwin is typically studied and celebrated for articulating the first systematic British theory of the transformation of biological species. This essay shows that such an evaluation of Darwin's evolutionary thinking is incomplete, because his transformism was not simply a theory of species change, but one of universal transformation, a view of nature in which everything transformed over time—from microcosm to macrocosm, encompassing animate and inanimate nature alike. Erasmus Darwin's insistence that nature was best understood as an organic, generative being rather than a passively mechanical entity was central to this broad transformist perspective because it placed a capacity and even desire for transformative change within nature itself. Recognizing these features of his natural philosophy, in turn, reveals the way in which his social and political commitments—particularly as manifest in his arguments regarding the transformations of human society through revolution and reform—both motivated and were in turn shaped by his larger transformist enterprise. While acknowledging Erasmus Darwin as a figure of both Enlightenment and Romanticism, this essay also argues that considering the full scope of Darwin's transformism further illuminates the critical role of Romanticism in the development of evolutionary thought. Darwin's philosophy of nature embodied a mode of Romantic natural philosophy that was universalist, holistic, and anti-reductive in both form (a fusion of poetry and prose) and substance (his organic, generative, universal theory of transformation across animate and inanimate nature). Because no one could witness the emergence and transformations of the universe, the transmutations of chemical entities, the emergence and transformations of life, or the fullness of human history and humanity's future, any theory of such transformations required imagination. Thus knowledge of the universe's unobservable changes was facilitated by Darwin's poetic form: using analogies with observable phenomena to guide the imagination, the unobservable could be virtually witnessed in the mind's eye. Though Darwin's poetry fell from favor with the violent excesses of the French Revolution, universal transformism and an allied organic, generative interpretation of nature became an important current in transformist and ultimately evolutionary thought, linking domains of inquiry across much of the nineteenth century.

In 1789, a provincial english doctor electrified the reading public with a titillating portrayal of the lives and loves of plants in vividly sexual terms in a poem titled *The Loves of the Plants*. A vegetable passion, he argued, was visible in a wide variety of erotic behaviors in plants, from the chaste intercourse of a romantic plant pair, to female plant parts entertaining multiple male suitors, to even wilder orgiastic fare.[1] The personal lives of his plants charmed

[1] [Erasmus Darwin], *The Botanic Garden, Part II, containing The Loves of the Plants* (Lichfield: J. Jackson, 1789). Although the "Part II" subtitle of the 1789 edition gestured toward the existence of a Part I in the same volume, Part II (*The Loves of the Plants*) appeared alone. Darwin wrote in the "Advertisement" for the 1789 edition

contemporary sensibility, which appreciated "something a little naughty," and his poem benefitted enormously from the fact that botanical study was all the rage among the genteel classes.[2]

The doctor's name was Erasmus Darwin (1731–1802). He had a flair for the saucy, a passion for the philosophical, and a radical social agenda. He was an animated, sociable man of wide scientific and literary interests, which he shared with a particularly productive network of philosophical friends in England's industrial north, including the radical dissenting chemist and preacher Joseph Priestley, the geologist John Whitehurst, Josiah Wedgwood of pottery fame, the manufacturer Matthew Boulton and his engineering partner James Watt, and the Quaker arms manufacturer Samuel Galton. Over time, these philosophical friends and their social satellites coalesced into a somewhat informal group known as the Lunar Society of Birmingham (later fondly referred to by its members as "the Lunartics"), which engaged in the study of natural philosophy and its application to industrial innovation.[3]

Erasmus Darwin's ideas concerning the transformation of organic species are still frequently characterized by academics and in popular culture as comprising a theory of evolution that in some sense anticipated his grandson Charles Darwin's evolutionary views.[4] Erasmus Darwin scholars, however, have repeatedly pointed out that this orientation obscures and biases our understanding of the elder Darwin's life and ideas.[5]

One consequence of approaching Erasmus Darwin through the lens of Charles Darwin is that it has oriented historical investigation of the elder Darwin's transformist ideas toward a more recent model of evolution defined by disciplinary boundaries: namely, toward studying Erasmus Darwin's evolutionary thought through the lens of the largely biological paradigm of his grandson.

Erasmus Darwin certainly believed that species transformed over time, acquiring new features and characteristics from confrontations with the environment and other creatures, the quest for food, and competition for mates. Such changes were perpetuated through what he called the "loves"—the reproductive capacities, which he understood as a cosmic power of Love writ

---

that he was holding back publication of Part I in order to complete a number of relevant experiments. In 1792, both parts of *The Botanic Garden* finally appeared together. Thus, despite comprising a single work typically bound together, most two-part copies of *The Botanic Garden* actually contain different sub-editions of *Part I: The Economy of Vegetation* and *Part II: The Loves of the Plants*. To make matters more confusing, though the title page on the first full edition (that is, the first full edition to contain both Part I and Part II) listed the date of publication as 1791, the full two-part book was not actually available until 1792.

2 Desmond King-Hele, *Erasmus Darwin* (London: Macmillan & Co., 1963), 116–17.

3 For an excellent account of the Lunar Society, see Jenny Uglow, *The Lunar Men: Five Friends Whose Curiosity Changed the World* (New York: Farrar, Straus and Giroux, 2003 (2002)).

4 Maureen McNeil observes of the tendency of some scholars to frame his achievements as anticipations of modern developments. Maureen McNeil, "Review: C.U.M. Smith and Robert Arnott, eds., The Genius of Erasmus Darwin," *Isis* 97:3 (2006): 562–63. Charles Darwin insisted that his grandfather's ideas had "anticipated" the "erroneous" views of Lamarck. Quoted in Ernst Krause, *Erasmus Darwin* (London: John Murray, 1879), 131. For a classic older example of the historiography of Erasmus anchored on his grandson Charles, see Bentley Glass, Owsei Temkin, William L. Straus, Jr., eds., *Forerunners of Darwin, 1745–1859* (Baltimore: The Johns Hopkins Press, 1968 (1959)).

5 This important point has been made in a number of contexts, including (but not limited to) Philip K. Wilson, "Erasmus Darwin on Human Reproductive Generation: Placing Heredity within Historical and *Zoonomian* Contexts," in C.U.M. Smith and Robert Arnott, eds., *The Genius of Erasmus Darwin* (Burlington, VT: Ashgate Publishing, 2005), 116; and Maurizio Valsania, "'Another and the Same': Nature and Human Beings in Erasmus Darwin's Doctrines of Love and Imagination," in C.U.M. Smith and Robert Arnott, eds., *The Genius of Erasmus Darwin* (Burlington, VT: Ashgate Publishing, 2005), 350.

small—of plants and animals. Darwin strongly alluded to the possibility of the transformation of organic species in his epic two-part poem of nature, *The Botanic Garden* (1792)—which combined *The Loves of the Plants* with a closely related poem titled *The Economy of Vegetation*—but it was in his major prose work *Zoonomia* (1794–96) that he made his theory of the transformation of living things absolutely explicit. His confidence in the transformation of organic species long predated these published works. As early as 1770 he found himself in hot water with the local canon at Lichfield, Thomas Seward, after he had a family coat of arms painted on the side of his carriage: three scallop shells flanked by the Latin words *e conchis omnia* ("everything from shells").[6]

Evaluating Erasmus Darwin in relation to his grandson's theory of the evolution of species obscures the shape of his transformist thought because it misses the intimate relationship between Erasmus Darwin's ideas concerning the transformation of species and those concerning transformation throughout nature as a whole. Many commentators have observed that Erasmus Darwin wrote about everything at the same time, but most without considering why he did so beyond eclecticism, polymathism, or a dedication to Enlightenment encyclopedism. The best treatment of the scope of Darwin's transformist thinking comes from Martin Priestman, who analyzes the connections between "the evolution of the earth and its living species" in Darwin's theory of nature (with particular emphasis on Darwin's Lucretian engagements), and observes the way in which Darwin presented "the story of matter as an unbroken line" from cosmology to species change—an "evolutionary story."[7] A number of other scholars have observed that there was something cosmic or universal about his view of nature.[8] None, to my knowledge, has offered a focused, extended analysis of it.

This essay demonstrates that one reason Erasmus Darwin wrote about everything at once was because his theory of transformation or transmutation was not simply biological in scope: it was a universal paradigm, both in the sense that it provided a transformist account of astronomical change in the universe, and in the broader sense of the word 'universal' in that he envisioned

---

6 Martin Priestman, *The Poetry of Erasmus Darwin: Enlightened Space, Romantic Times* (Burlington, VT: Ashgate, 2013), 110–11.

7 Priestman, *Poetry of Erasmus Darwin*, 103–17.

8 "In some ways, Darwin's evolutionary views are broader in scope than those of his grandson's generation, even though they are not as comprehensively articulated," writes Michael Page. "He not only speculates on the biological process, but has a keen understanding of cosmic, geological, social, and historical evolutionary processes." Michael R. Page, *The Literary Imagination from Erasmus Darwin to H.G. Wells: Science, Evolution, and Ecology* (New York: Routledge, 2016 (2012)), 20; see also 25–28, 33. Maurizio Valsania observes that the goal of Darwin's natural philosophy was to "emphasize nature's formative drive, in all its forms." Valsania, "'Another and the Same': Nature and Human Beings in Erasmus Darwin's Doctrines of Love and Imagination," in Smith and Arnott, eds., *Genius of Erasmus Darwin*, 349. Statements suggesting the universal scope of Erasmus Darwin's transformist ideas often appear without further comment in service of larger analyses of biological species change. James Harrison, for example, observed in passing: "Darwin is not only suggesting a possible evolutionary process at work throughout creation and time; he is within striking distance, in 1791, of the twin Lamarckian hypotheses of unused parts wasting and much used parts developing, especially in view of the strongly Lamarckian ring to 'attempts towards greater perfection.' [...] It is apparent from the above passages, and from other similar sources, that the idea that biological variation could be viewed as progressive in tendency, rather than merely bifurcating and spreading, was arrived at by analogy from other developmental processes, such as cosmic or geological or ontogenetic or historical and social evolution, all of which were at this time in process of being seen to have a markedly progressive character." James Harrison, "Erasmus Darwin's View of Evolution," *Journal of the History of Ideas*, Vol. 32, No. 2 (Apr.–Jun. 1971): 247–64, at 253. Harrison, notably, couldn't resist looking at Erasmus Darwin through the lens of Lamarck.

an interconnected universe of transmutation, from the microscopic to the macroscopic, encompassing inanimate and animate nature.

Through his universal, holistic theory of nature and nature's transformations, Erasmus Darwin endeavored to do nothing less than explain the entire history and progress of the universe, from the moment of creation out of a chaotic void, through the transformations of matter into suns, planets, and the geological features of the earth, life from the simple to the complex, and the development of human society, extending even into future history, particularly the marvelous inventions, improvements, and social reforms that Darwin saw as the logical continuation of this great arc.

The fact that Darwin first articulated elements of his universal transformist ideas for a wide audience in a work titled *The Botanic Garden* was in no way incongruous, because for Darwin the universe as a whole *was* a botanic garden, guided by an economy of life, in which entities great and small were interconnected and underwent processes of generation, growth, decay, death, renewal, and transformation. Darwin's universe was alive all over, guided by overarching natural principles that he viewed as akin to those that animated life on earth.

Theories of nature in which nature was seen as a generative entity capable of change from within, rather than as a passive mechanical entity capable of change only through the agency of an external, Divine Designer, were critical to the emergence of historical, transformist accounts of nature in the Enlightenment and their vibrant development and expanding popularity in the Romantic era.[9] Notably, organic, generative models of nature as a whole (encompassing living and non-living parts alike)—which were embraced with particular enthusiasm in the Romantic context—facilitated theories of transformation that extended across a breathtaking array of domains of inquiry, most of which are today considered quite distinct. Thus, Erasmus Darwin's transformism—like that of many other transformist thinkers across the late-eighteenth and nineteenth centuries—extended well beyond the biological boundaries of evolutionary theory as it is typically seen from the present day.[10]

Darwin's social and political commitments motivated and shaped his transformist vision. He positioned projects of reform and revolution within the cosmic scope of progressively transforming nature, suggesting that the fabric of the universe contained active, internal tendencies toward social progress, including the abolition of slavery, educational improvements, and revolutionary transformations of society and governance.

---

9 On transformism and internal versus external sources of agency, see Jessica Riskin's contribution to this volume: Jessica Riskin, "Evolution, the Science Napoleon Hated," *Republics of Letters* Vol. 6 No. 1 (Mar. 2018–Nov. 2020). Erasmus Darwin rejected *passive* mechanism, not all mechanistic concepts per se, nor did he reject the value of mechanical artifice, which he saw as essential to the progress and transformations of human society. Recent scholarship calls to question absolutist characterizations of mechanism and organicism as fundamentally irreconcilable conceptual frameworks coinciding with Enlightenment and Romantic periodizations, respectively. As John Tresch brilliantly demonstrates in the French context, in the first half of the nineteenth century many Romantics embraced and adapted mechanical interpretations of nature. These "mechanical Romantics" emphasized the transformative properties of machines as "technologies of conversion and transmutation," and saw technology as central to a larger law of human progress. For Tresch's Romantic subjects, organism and mechanism often merged. See John Tresch, *The Romantic Machine: Utopian Science and Technology After Napoleon* (Chicago: University of Chicago, 2012), 3–12. On mechanism, vitalism, and Lucretian materialism in Darwin's work, see Wilson, "Erasmus Darwin on Human Reproductive Generation," in Smith and Arnott, eds., *Genius of Erasmus Darwin*, full article, particularly 123–26.

10 Jennifer Pegg, "The Evolutionary Universe: Cosmology, Society, and Natural History in Britain, 1780–1860" (Ph.D. Dissertation, Stanford University, 2016).

His sense of the ubiquity of dynamic transformation was wrought by experiences in the medical, industrial, and philosophical worlds in which he moved, not to mention by the shared experiences of Brits around the tumultuous turn of the century. Social, political, religious, and philosophical ground was tilting beneath his (and his contemporaries') feet: everywhere people were confronted with a world in flux. Decades of revolution shook the political order, none more so than the French Revolution and its aftermath. In 1789, only a few years after the conclusion of the war of American Independence, chaos, riots, and looting broke out in Paris in response to the French public's perception that King Louis XVI was moving to quash the National Assembly—an uprising that soon developed into all-out revolution. The widespread violence of the French Revolution, not to mention the execution of the king in January 1793, created a profound sense of vulnerability and fear in Britain. Many radical social, political, religious, and natural-philosophical ideas came to be perceived by Darwin's countrymen as dangerous. Corn riots tore the nation. Factories and associated technologies, particularly those of Darwin's Lunar colleagues, began to reshape the landscape of the British working class.

The natural world itself seemed increasingly unstable and dynamic. In astronomy, the steady, hierarchical order of the universe was being newly shaken by the discoveries and ideas of the astronomer William Herschel (1738–1822), who argued that heavenly objects—including solar systems (stars and their planets), greater systems of solar systems, and other cosmic entities—were characterized by processes of birth, transformative growth, decay, and ultimately, celestial death.[11] Chemical experiments were calling to question the apparent rigidity of the physical world, particularly in light of innumerable examples of chemical reactions in which the product of two or more chemical entities displayed properties completely unlike its constituent parts. Sir Humphry Davy, a part of the Lunar Society's extended network, later defined chemistry as a field of inquiry that "relates to those operations by which the intimate nature of bodies is changed, or by which they acquire new properties."[12] In such chemical transformations many Romantics identified the action of living forces.[13] Theological orthodoxy was also challenged. In *Disquisitions relating to Matter and Spirit* (1777), Joseph Priestley, a friend of Darwin, constructed a theory of matter in which matter was inherently active, undermining traditional assumptions about the distinction between matter and spirit.[14] If spirit was material, what did this mean for concepts of God, angels, and an immortal soul? Was the soul now subject to the gaze of natural philosophers?

In the study of the earth, the discoveries of eighteenth-century geologists made the truth that the earth had gone through dramatic transformations virtually unavoidable.[15] The fossils

---

11 Herschel was not the first to propose temporal change in the universe, though his ideas were particularly influential. See Simon Schaffer, "The Phoenix of Nature: Fire and Evolutionary Cosmology in Wright and Kant," *Journal for the History of Astronomy* ix (1978): 180–200.

12 Sir Humphry Davy, "Dialogue V: The Chemical Philosopher," in *Consolations in Travel* (London: John Murray, 1830), 247. On Davy's connections to the Lunar Society—and his life and chemistry more generally—see Jan Golinski, *The Experimental Self: Humphry Davy and the Making of a Man of Science* (Chicago: University of Chicago Press, 2016), 21, 105.

13 David M. Knight, "Chemistry, Physiology, and Materialism in the Romantic Period," in David M. Knight, ed., *Science in the Romantic Era* (New York: Routledge, 2016 (1998)), 105.

14 Joseph Priestley, *Disquisitions Relating to Matter and Spirit* (London: J. Johnson, 1777).

15 See Martin J.S. Rudwick, *Bursting the Limits of Time: The Reconstruction of Geohistory in the Age of Revolution* (Chicago: University of Chicago Press, 2005) and *Earth's Deep History: How It Was Discovered and Why It Matters* (Chicago: University of Chicago Press, 2014).

of plants and animals nowhere known to still exist emerged from the strata, demanding explanation. In the study of living things, too, questions of transformation were unavoidable. How did plants transmute water and air into foliage, and how were plants transmuted by animals into flesh and blood? Questions about the difference between living and inanimate matter seemed newly pressing. What was the nature of life? Why, asked the natural philosopher John Hunter, did stomach juices in a living body break down foods but not the stomach itself,—while in a corpse they attacked food and stomach alike?[16] Then there were the unsettling results of "galvanizing" corpses—applying electrical current to parts of dead bodies, causing them to twitch and jump—which suggested that the animating principle of life might have something to do with electricity. The boundary between life and inanimate matter was challenged in other ways, as well, particularly by experiments that appeared to some (including Darwin) to point toward the possibility of the spontaneous generation of living things from inanimate matter. For Darwin and contemporaries, the decades around the turn of the century were years of chaos, change, and transformation across social, political, religious, and philosophical domains—a time of new questions about old certainties.

An alternative mode of inquiry emerged to wrestle with these issues: Romantic natural philosophy. Romanticism was anti-reductive, holistic, and universalist in its interpretative orientation, and Erasmus Darwin substantially represented this Romantic approach in both form and content.

Darwin's anti-reductive *form* was a fusion of poetry and prose. The poetic form in which Erasmus Darwin presented so much of his transformist philosophy was critical to his arguments, and indeed constitutive of it.[17] Through the poetic medium, interlaced with extensive prose footnotes and essays, Darwin gave license to imagination in the service of the speculative and analogical leaps required by his arguments for a history of natural transformation from the beginning of time. Most such transformations could not be directly observed, either because they were temporally inaccessible (taking place in the past or future, or over a time scale that stretched far beyond the life of a single human), too minute (chemical transformations), or too far away (the birth and transformations of heavenly bodies). Darwin used his poetic form to bring seemingly disparate phenomena into direct contrast, thereby highlighting the ways in which he believed that they were, as he said, "of one parent." Darwin also used the mythic figures of contemporary poetic conventions to imbue nature with vital energy and internal agency, arguing repeatedly that these myths captured actual natural philosophical truths. Analogy, perspective-taking, and imagination facilitated contemplation of the universe's unobserved and unobservable origins and transformations, proving essential to both Erasmus Darwin's transformism and the broader development of transformist thought.

Darwin's natural philosophy was also Romantic in *substance*: his universe was marked by an essential, organic unity, and was changed by a universal principle of generally progressive transformation. Darwin emphasized the unity of knowledge and of nature at a universal scale,

---

16 John Hunter, "On the digestion of the stomach after death," *Philosophical Transactions of the Royal Society* LXII (1772): 447–54.

17 On the entangled nature of Darwin's "loose poetic analogies" and "more strict, scientific or philosophic analogies," see Theresa M. Kelley, "Taking Chances," in Joel Faflak, ed., *Marking Time: Romanticism & Evolution* (Toronto: University of Toronto Press, 2017), 208–10. Kelley observes the way in which Darwin's "swinging analogies between the 'respiration' of plants and animals, among others [...] imagine a network of functional resemblances that travel across the kingdoms of nature." Ibid.

connecting macrocosm to microcosm. The whole cosmos was a living thing propelled by an internal vital force. Though such processes lay substantially outside human observation, the faculty of imagination facilitated their apprehension and potentially suffused nature herself with generative potential.

The Romantic form and content of Erasmus Darwin's natural philosophy does not preclude identifying him as an Enlightenment figure, too. He is productively analyzed as an individual in whom both Enlightenment and Romantic currents moved: recent scholarship of Romanticism has repeatedly identified ways in which commitments, perspectives, concerns and engagements from the Enlightenment continued in the Romantic period, and indeed the way in which Romantics can in some cases be seen as figures of both the Enlightenment and Romanticism. In Darwin's case, an excellent body of historical research demonstrates the ways in which major features of his life and work were typical of the Enlightenment. Indeed, certain aspects of Darwin's philosophy of nature come into focus when he is viewed as a citizen of *both* the Enlightenment and the Romantic era. In Erasmus we see Enlightenment concepts of organization, with its agential powers, metamorphosed into his transformist spirit of the universe: "Divine Love" or "Eros."[18] His enthusiasm for taxonomy, a common Enlightenment preoccupation, found an outlet in his poem *The Loves of the Plants*, in which Darwin championed Linnaeus' system of plant classification.[19] Darwin also blended the key Enlightenment concept of progress with Romantic ideas about nature's internal capacity for effecting changes toward perfection: a central element of his transformism. Enlightenment fascination with the possibility of universal systems of nature—including an increasing number of people who believed that living beings provided a better model for universal nature than passive machines—shaded into Romantic enthusiasm for anti-reductive, holistic, universalizing views of nature. While this essay focuses on what, in the aggregate, I view as the Romantic form and content of Darwin's natural philosophy, these temporal delineations, contested products of the historical profession, are both productive and appropriate lenses through which to analyze Darwin.

In sum, the story of Erasmus Darwin's generative universe of transformation changes the way we view the emergence of transmutationist and ultimately evolutionary ideas, opening a window onto the foundations of evolutionary thought across domains of inquiry—and through poetic, natural-philosophical, and historical imagination—in the eighteenth and nineteenth centuries. It also strongly supports the position of scholars of pre-Darwinian evolution who have argued that our understanding of the development of an evolutionary view of nature has been unduly subject to the gravitational pull of Charles Darwin.[20] Looking beyond the boundaries of evolutionary biology to apprehend the universalist orientation and the Enlightenment and Romantic engagements of powerful currents in earlier transformist thought is one of the important interpretive benefits of doing so.

---

18 Jessica Riskin, *The Restless Clock: A History of the Centuries-Long Argument over What Makes Living Things Tick* (Chicago: University of Chicago Press, 2016), 209–210.

19 Janet Browne, "Botany for Gentlemen: Erasmus Darwin and *The Loves of the Plants*," *Isis* 80, No. 4 (1989): 593–621.

20 See, importantly, Pietro Corsi, "Before Darwin: Transformist Concepts in European Natural History," *Journal of the History of Biology*, Vol. 38, No. 1 (Spring, 2005): 67–83; Adrian Desmond, *The Politics of Evolution: Morphology, Medicine, and Reform in Radical London* (Chicago: University of Chicago Press, 1989); and Bill Jenkins, *Evolution Before Darwin: Theories of the Transmutation of Species in Edinburgh: 1804–1834* (Edinburgh: Edinburgh University Press, 2019).

"THE WHOLE FAMILY IS OF ONE PARENT"

Erasmus Darwin opened all three of the major works in which he explored transformist ideas—*The Botanic Garden* (1792), *Zoonomia* (1794–96), and *The Temple of Nature* (1803)—with a cosmological perspective. Even the prose *Zoonomia*, a treatise on the nature of life and its connections to medical practice, opened with an epigraph emphasizing the unity of nature throughout the universe. There, Darwin connected the earth to the plurality of worlds (that is to say, the idea of a vast multitude of inhabited solar systems) through the action of one principle of mind or soul infusing the whole:

> Earth, on whose lap a thousand nations tread,
> And Ocean, brooding his prolific bed,
> Night's changeful orb, blue pole, and silvery zones,
> Where other worlds encircle other suns,
> One mind inhabits, one diffusive Soul
> Wields the large limbs, and mingles with the whole.[21]

This universal principle was the product of the "Creator of all things," who, Darwin wrote, "stamped a certain similitude on the features of nature, that demonstrates to us, that *the whole is one family of one parent*. On this similitude is founded all rational analogy; which, so long as it is concerned in comparing the essential properties of bodies, leads us to many and important discoveries."[22] This was as true for the practice of medicine as it was for the broader pursuit of natural philosophy: Darwin viewed the "laws of organic life" as essential to bringing together "the scattered facts of medical knowledge," thereby providing practitioners with a deeper understanding of their work.[23]

Published about ten years apart (with the *Zoonomia* appearing halfway between the two), both the transformist world view of *The Botanic Garden* and that of *The Temple of Nature* were constructed by Darwin on an organic theory of the transformations of the early universe. In *The Temple of Nature* he opened the poem by imploring Urania, goddess and muse of astronomy, to reveal the origin of life, and by extension, the origin of human society:

> First if you can, celestial Guide! disclose
> From what fair fountain mortal life arose,
> When the fine nerve to move and feel assign'd,
> Contractile fibre, and ethereal mind.[24]

Urania offered her answer: organic life began beneath the waves following the "birth" of the planet, which took place when bright spheres of matter were "from flaming Chaos hurl'd."[25] As

---

21 Erasmus Darwin, *Zoonomia; or, The Laws of Organic Life*, Vol. 1 (London: J. Johnson, 1794), title page.

22 Darwin, *Zoonomia*, Vol. 1, 1.

23 Darwin, *Zoonomia*, Vol. 1, Preface.

24 Erasmus Darwin, *The Temple of Nature; or the Origin of Society* (London: J. Johnson, 1803), Canto I, 18, lines 215–18.

25 Darwin, *Temple of Nature*, Canto I, 19, line 227. It was clear, he wrote in a footnote, that the earth was still young, because its "fluid parts are not yet all converted into solid ones." Additionally, he believed that some parts of the earth were younger than others, "the greater height of the mountains of America," for instance, suggested that the continent was "less ancient than Europe, Asia, and Africa." Similarly, the American animals

the initial chaos subsided into systems, atoms embraced, creating spheres and lines, which an "ethereal flame" lit into life.[26]

Darwin's choice of Urania, muse of Astronomy, to present the origin of life and of human society in the context of such transformations was significant. It emphasized the idea that life's spark originated in primordial fires and universal processes, and strengthened the natural-historical analogy between the transformations of the heavens and those of and on the earth. Darwin's readers would have recognized the transformative cosmological account from *The Botanic Garden*, where he connected it to the organic, natural-historical cosmology of his contemporary William Herschel.

In *The Botanic Garden*, like *The Temple of Nature*, Darwin imagined an infinite pre-creation space, the "Chaos," filled with pre-potent grains of matter akin to "gunpowder," which "exploded at the same time."[27] Creation was an astonishing moment. Suns, planets, and planetary satellites appeared nearly all at once, "filling in a moment the immensity of space with light and motion; a grander idea cannot be conceived by the mind of man."[28]

> 'Let there be light!' proclaim'd the Almighty Lord,
> Astonish'd Chaos heard the potent word; -
> Through all his realms the kindling Ether runs,
> And the mass starts into a million suns.[29]

It is clear from Darwin's meticulous footnotes that his concept of creation and the transformation of cosmic material was indebted to Herschel's papers "On the Construction of the Heavens" of 1784 and 1785, particularly Herschel's conclusion at the time that the so-called nebulae—smudges of light in space, whose true nature was unknown—were in fact large clusters of stars that had attracted one another and whose configurations transformed over time. "[O]n the supposition," Darwin noted, "that infinite space was at first equally sprinkled with them; as if it had at the beginning been filled with a fluid mass, which had coagulated."[30] (Herschel would later posit that at least some of the nebulae were in fact nebulous clouds of some type of refined matter.) Herschel was in the process of expanding catalogues of the nebulae and other novel celestial objects from several dozen specimens into the thousands. "There seems by the late discoveries to be as great a Variety of Genera and Species of Globes and Spheres in the Heavens as there are of animals and Vegetables upon Earth," wrote the American revolutionary John Adams, who was captivated by Herschel's discoveries and counted his visit to Herschel and his telescopes among his best experiences in England. "Clusters of Worlds, Groups of Systems, and

---

were "less perfect in respect to their size and strength; which would show them to be still in a state of infancy, or of progressive improvement." Darwin, *Temple of Nature*, Canto I, 19, note to line 224.

26 Darwin, *Temple of Nature*, Canto I, 21, line 245.

27 King-Hele, *Erasmus Darwin*, 21. Erasmus Darwin, *The Botanic Garden; A Poem, in Two Parts* (London: J. Johnson, 1792 (1791)), Part I, Canto I, 9, lines 104–5 and note to line 105. The copy of *The Botanic Garden* referenced for this article contains the first printing of Part I (*The Economy of Vegetation*) paired with the third edition of Part II (*The Loves of the Plants*), both published together as the full, two-part *Botanic Garden* in 1792.

28 Darwin, *Botanic Garden* (Part I), Canto I, 10, note to line 105.

29 Darwin, *Botanic Garden* (Part I), Canto I, 9, lines 103–106.

30 Darwin, *Botanic Garden* (Part), Canto I, 9, note to line 105. See also William Herschel, "Account of some Observations tending to investigate the Construction of the Heavens," *Philosophical Transactions of the Royal Society of London*, Vol. 74 (1784): 437–51; and William Herschel, "On the Construction of the Heavens," *Philosophical Transactions of the Royal Society of London*, Vol. 75 (1785): 213–66.

Clumps of combinations of Systems, as thick as of Groves and forests of Trees and shrubbs here below.—Variegated too in Colour as much as in magnitude, in decoration as much as in Use."[31]

Organic analogies were in fact the basis of Herschel's cosmological arguments.[32] He proposed that celestial objects, like trees, butterflies, and other living things, were dramatically transformed through time: they were born, experienced youth, matured, grew old, and even died. "This method of viewing the heavens seems to throw them into a new kind of light," he wrote. "They now are seen to resemble a luxuriant garden, which contains the greatest variety of productions, in different flourishing beds; and one advantage we may at least reap from it is, that we can, as it were, extend the range of our experience to an immense duration. For, to continue the simile I have borrowed from the vegetable kingdom, is it not almost the same thing, whether we live successively to witness the germination, blooming, foliage, fecundity, fading, withering, and corruption of a plant, or whether a vast number of specimens, selected from every stage through which the plant passes in the course of its existence, be brought at once to our view?"[33] In other words, the natural historical approach, and his analogy between the heavens and the living things of the earth, served not only to introduce the idea of time, but to justify a new type of astronomy, in which causal reasoning must depend on discrete snapshots of development rather than continuous observation. As a fellow FRS (Fellow of the Royal Society), Darwin most likely had opportunities to discuss these and related ideas with Herschel; the two were also extensively connected through their networks of philosophical friends, and Darwin later visited Herschel's observatory at Slough. What is beyond doubt is that Darwin enthusiastically embraced Herschel's natural historical cosmology. He saw a deep connection between Herschel's "luxuriant garden" in the heavens and the lives and loves of plants and animals on earth.[34]

THE EGG OF NIGHT

Darwin used the word "evolve" in the older sense of the term—to refer to an unfolding or unfurling—but he saw such evolutions as a driving force in the transmutations of organic and inorganic nature alike. The concept of a seed or egg unfurling its inner, vital potentialities was

---

31 John Adams, *The Adams Papers, Diary and Autobiography of John Adams, Volume 1, 1755–1770,* ed. L. H. Butterfield. (Cambridge, MA: Harvard University Press, 1961), 29–30.

32 An excellent analysis of William Herschel's natural historical approach to the heavens is Simon Schaffer, "Herschel in Bedlam: Natural History and Stellar Astronomy," *The British Journal for the History of Science* 13:3 (1980): 226; for general Herschel biography, see Michael Hoskin, *The Construction of the Heavens: William Herschel's Cosmology* (Cambridge: Cambridge University Press, 2012); and Michael Hoskin, *Discoverers of the Universe: William and Caroline Herschel* (Princeton: Princeton University Press, 2011).

33 William Herschel, "Catalogue of a second Thousand of new Nebulae and Clusters of Stars; with a few introductory Remarks on the Construction of the Heavens," *Phil. Trans.*, Vol. 79 (1789): 212–255, at 226.

34 Darwin was also embedded in the astronomical discussions of members of the Lunar Society. Fellow Lunartic Matthew Boulton, a friend of the astronomer John Michell, maintained his own observatory, and James Watt, who had studied with the telescope maker James Short as a young man, was in high demand among local observatories for his skill in repairing telescopes. Both Watt and Boulton corresponded with Herschel and exchanged visits, enthusiastically reporting on his discoveries to their friends. The Birmingham City Archives contain many letters and other manuscripts documenting the astronomical activities of Boulton and Watt, including visits to Sir William Herschel, Caroline Herschel, and their remarkable telescopes. "When your Sister & I returned from London we calld upon Mr. Hershall [sic] the Astronomer near Windsor," wrote Matthew Boulton to his son, "& saw his great Teliscopes [sic]. [. . .] He hath discoverd lately 2 Burning mountains or Vulcanos [sic] in the Moon & when the largest Teliscope [sic] is quite compleat [sic] he expects to make many other important discoveries & extend our ideas of the immensity of the Creation." Matthew Boulton to Matthew Boulton Jr., Letter, 30 July 1787. Birmingham City Archives, MS 3782/13/36/1–10.

particularly central to these arguments, with each seed or egg effecting dramatic, generative transformations. Nothing less than the entire universe was brought forth from what Darwin called the "egg of night." When Darwin described this creation as an act of Divine Love—"When Love Divine, with brooding wings unfurl'd, / Call'd from the rude abyss the living world"—it could only have been of temporary comfort to devout readers, who soon realized that by "Love Divine" Darwin meant Eros, patron of the loves of his plants, who brought the cosmos forth from the "egg of night."[35] The egg of night was an ancient concept of the origin of life: the egg (or "seed") of night contained within itself all future life. "This idea of the gradual generation of all things seems to have been as familiar to the ancient philosophers as to the modern ones;" he wrote, "and to have given rise to the beautiful hieroglyphic figure of the προτον ωον, or first great egg, produced by NIGHT, that is, whose origin is involved in obscurity, and animated by ερος, that is, by DIVINE LOVE; from whence proceeded all things which exist."[36]

Notably, Darwin was not simply positioning stars, planets, nebulae, and other astronomical objects as products of vital, fecund matter: he was arguing that the emergence and transformations of plants and animals were prepotent within the great egg and its first inorganic, cosmic productions, as well. The image of the egg of night reinforced several core features of Darwin's transformative universe, including its organicism and its internal, vital energy of creation, reproduction, and transformation. Darwin took care to emphasize that other of "Nature's births" originated in eggs and seeds, as well, including the "tall forest" and "lowly weed."[37] Organic and inorganic nature were filled with seeds and eggs, which differed substantively across domains even as they shared broad features in common—namely, their formative power, principles of activity, and capacity for generation. (Darwin's theory of cosmic and earthly seeds resonated with Lucretius' extended treatment of seeds and *semina* in *De rerum natura*.[38]) Through eggs and seeds the universe embodied principles of plant and animal, just as the boundaries between plant and animal were blurred in Darwin's *Loves of the Plants*.

---

35 Darwin, *Botanic Garden* (Part I), Canto I, 8, lines 101–2, and footnote to line 101.

36 Darwin, *Zoonomia*, Vol. 1, 529 ("Generation"). Darwin's religious views generally appear roughly deistic. Coleridge, however, later claimed that Darwin had rejected "the existence of God" in a conversation with Coleridge around January 1796. "He [Darwin] bantered me on the subject of religion. I heard all his arguments, and told him that it was infinitely consoling to me, to find that the arguments which so great a man adduced against the existence of God and the evidences of revealed religion were such as had startled me at fifteen, but had become the objects of my smile at twenty. Not one new objection—not even an ingenious one. He boasted that he had never read one book in favor of such stuff, but he had read all the works of Infidels! [...] Dr. Darwin would have been ashamed to have rejected Hutton's Theory of the earth without having minutely examined it; yet what is it to us *how* the earth was made, a thing impossible to be known, and useless if known? [...] but *all at once he makes up his mind* on such important subjects, as whether we be the outcasts of a blind idiot called Nature, or the children of an all-wise and infinitely good God; whether we spend a few miserable years on this earth, and then sink into a clod of the valley, or only endure the anxieties of mortal life in order to fit us for the enjoyment of immortal happiness. These subjects are unworthy a philosopher's investigation. He deems that there is a certain *self-evidence* in infidelity, and becomes an atheist by intuition." Samuel Taylor Coleridge to Josiah Wade, letter, 27 January 1796. In Ernest Hartley Coleridge, *Letters of Samuel Taylor Coleridge*, Vol. I (Boston and New York: Houghton, Mifflin, & Co., 1895), 151–54. On the basis of this Coleridge passage, James Harrison accused Darwin of "sheltering behind a conventional and unexceptionable deism." Harrison, "Erasmus Darwin's View of Evolution," 256.

37 Darwin, *Temple of Nature*, Canto I, 35, lines 385–86. On the long European fascination with seeds, see Pietro Corsi's article in this volume: Pietro Corsi, "Systèmes de la nature and *Theories of Life*: Bridging the Eighteenth and Nineteenth Centuries," *Republics of Letters* Vol. 6 Issue 1 (Mar. 2018–Nov. 2020), 3, 5, and 8.

38 Antonio Clericuzio, *Elements, Principles and Corpuscles: A Study of Atomism and Chemistry in the Seventeenth Century* (Springer Science, 2000), 13–15.

Darwin's concept of the egg of night, also known in the literature of his time as the world egg or cosmic egg, was inspired at least in part by Francis Bacon (1561–1626), who articulated a cosmology in which the egg of night produced Cupid (representing love), the initial motive force of attraction and creation in the universe.[39] Darwin may also have adapted this imagery from his contemporary Jacob Bryant's *A New System, or an Analysis of Ancient Mythology* (1773–74), which Darwin cited in *The Temple of Nature*, though Bryant seemed to lean toward the opinion that the idea of Cupid or Eros emerging from an egg of night was a reference to the chaos surrounding the biblical Deluge through which Noah's ark (the egg) emerged, giving forth life.[40]

Darwin's concept of chaos was not religiously orthodox much less Diluvian. He drew explicitly on the poet Ovid, whose *Metamorphoses* described chaos as a "rude and indigested mass," where all the elements were jumbled together in a heap.[41] Darwin frequently referenced Lucretius' *De rerum natura* (*On the Nature of Things*), drawing criticism because in the Lucretian universe life proceeds through chance encounters rather than the superintending guidance of deity.[42] Some deistic and atheistic Enlightenment figures had drawn on Lucretius to explain order and disorder in nature.[43] Lucretian engagements continued to reverberate in materialist counter-cultures in Romanticism.[44]

Though he enthusiastically embraced elements of Lucretius' theory of nature, Darwin ultimately rejected Lucretian chance and randomness as an explanation for the origin of the universe in its organic and inorganic parts alike, explicitly distinguishing his position from that of the classical atomists. In *The Temple of Nature* he wrote: "Had those ancient philosophers, who contended that the world was formed from atoms, ascribed their combinations to certain immutable properties received from the hand of the Creator, such as general gravitation, chemical affinity, or animal appetency, instead of ascribing them to a blind chance; the doctrine of atoms, as constituting or composing the material world by the variety of their combinations, so far from leading the mind to atheism, would strengthen the demonstration of the existence of a Deity, as the first cause of all things; because the analogy resulting from our perpetual experience of cause and effect would have thus been exemplified through universal nature."[45]

---

39 Francis Bacon, *Of the Principles and Origins of Nature*, in *The Works of Francis Bacon, Lord Chancellor of England*, edited by Basil Montagu, Vol. 15 (London: William Pickering, 1834), 46. Darwin himself cited Bacon, see Darwin, *Botanic Garden*, "Apology," vii.

40 Darwin, *Temple of Nature*, Canto I, 12–13, note to line 137. See also Jacob Bryant, *A New System, or, an Analysis of Ancient Mythology: Wherein an Attempt is made to divest Tradition of Fable; and to reduce the Truth to its Original Purity*, Vol. II (London: T. Payne, P. Elmsly, B. White, and J. Walter, 1774), 351–52.

41 Here quoted from a translation contemporary to Erasmus Darwin: Ovid [Publius Ovidius Naso], *Ovid's Metamorphoses translated into English Prose* (London: B. Law, J. Johnson, G.G. and J. Robinson, R. Baldwin, J. Cuthell, S. Hayes, J. Walker, W. Loundes, and W. Bent, 1797), 2–3.

42 Patricia Fara, *Erasmus Darwin: Sex, Science, and Serendipity* (New York: Oxford University Press, 2012), 152–3. Also, Lucretius, *On the Nature of the Universe*, translated by Ronald Melville (New York: Oxford World Classics, 2008 (1997).

43 Wilson, "Erasmus Darwin on Human Reproductive Generation," in Smith and Arnott, eds., *Genius of Erasmus Darwin*, 123–26.

44 Amanda Jo Goldstein, *Sweet Science: Romantic Materialism and the New Logics of Life* (Chicago: University of Chicago Press, 2017). Goldstein's book offers an insightful, in-depth analysis of materialism and a revival of interest in Lucretius' *De rerum natura* in Romantic circles. On Erasmus Darwin in particular, see pp. 56–62, 84, 139, 188–89, 218.

45 Darwin, *Temple of Nature*, Canto IV, 142, note to line 147.

Darwin's extensive and deliberate use of the figure of Eros, or Divine Love, as the catalyst of transformation implied that change was a consequence of agential action. Yet the libertine nature of Love or Eros, who represented reproductive love, also seemed to leave space in which to introduce a kind of chaotic, even random, coupling.

As the catalyst of change throughout Erasmus Darwin's universe, the figure of Eros or Divine Love—who, by bringing forth the universe from the egg or seed of night, effectively shared the role of first cause with God—occupied an ambiguous position between allegory and reality in his poems. In *The Temple of Nature*, Darwin imagined the beginning of the universe as a moment in which Love, before the beginning of time, hung sublimely over Chaos "On wings outstretch'd." Love "Warm'd into life the bursting egg of Night, / And gave young Nature to admiring Light!" Love's power drew together the planets as well, bringing together "drop to drop," and atom to atom.[46] Love was the power of attraction, reproduction, and transformative growth in the inorganic world—a power that Darwin generalized from the organic realm and from his infamous loves of the plants (and animals).[47]

Remarkably, Darwin suggested that the cosmic egg might still exist at the center of the universe. "According to the observations and opinion of Mr. Herschel the sun itself and all its planets are moving forwards round some other centre with an unknown velocity," Darwin wrote.[48] Even as Darwin put pen to paper he wondered if chaos itself still lay within this egg at the universe's center. Drawing on an idea advanced by his friend John Michell (1724–1793)—also a correspondent of Herschel—Darwin opined that the hypothetical center "may be of opake [sic] matter" which in fact corresponded with this "very antient [sic] and general idea of a chaos." If this was true, he reasoned, then in their cataclysmic birth from the chaos all suns "must have had a projectile force, as well as a centripetal one; and may thence be supposed to have emerged or been projected from the material, where they were produced."[49] As for the power that could "project a Sun out of Chaos," mankind remained ignorant, but Darwin thought it was very likely akin to earthquakes and explosions "owing to the sudden evolution of aqueous or of other more elastic vapours," and he repeatedly compared the moment to the explosion of gunpowder.[50]

For Darwin, astronomical objects shared fundamental features with living things. Praising Herschel's work on the clustering of stars (and borrowing Herschel's botanic terminology), Darwin described the stars' natural-historical trajectories as "flowers of the sky," which, once born, "exult in youthful prime," but ultimately "to age must yield / Frail as your silken sisters

---

46 Darwin, *Temple of Nature*, Canto I, 4, lines 15–26.

47 Maurizio Valsania analyzes the way in which Erasmus Darwin's natural philosophy "exalted nature's power of generation and nature's animality, everywhere in its parts," as manifest not only in Darwin's concept of cosmic Love, but in a kind of cosmic imaginative process. See Valsania, "'Another and the Same': Nature and Human Beings in Erasmus Darwin's Doctrines of Love and Imagination," in Smith and Arnott, eds., *Genius of Erasmus Darwin*, 349–52. In the same volume, David Knight describes *The Temple of Nature* as "a genuine evolutionary synthesis" in which one of the "really big ideas" was "[c]osmic and social evolution coupled with a struggle for existence in which 'sepulchral whales devour shoals at a gulp." David Knight, "Epilogue: 'One great Slaughter-house the warring world': Living in Revolutionary Times," in Smith and Arnott, eds., *Genius of Erasmus Darwin*, 357–58. Donald Hassler also observed in passing, "[F]or Darwin sex works not only on the small level of animal reproduction, but also on the cosmic level of creation—at least metaphorically." Donald M. Hassler, *The Comedian as the Letter D: Erasmus Darwin's Comic Materialism* (The Hague: Martinus Nijhoff, 1973), 57.

48 Darwin, *Additional Notes*, in *Botanic Garden*, 29, note XV ("Solar Volcanos"). NB: the *Additional Notes* were independently paginated and appeared between Parts I and II.

49 Darwin, *Botanic Garden* (Part I), Canto I, 9–10, note to line 105.

50 Darwin, *Botanic Garden* (Part I), Canto I, 9, note to line 105.

of the field."[51] Both Herschel and Darwin considered the possibility that entire systems of stars might perish. Many of their readers were no doubt aware of contemporary discussions regarding the stability of the solar system; this was a problem with which the French natural philosopher Pierre Simon Laplace (1749–1827) so long engaged himself, ultimately demonstrating that planetary drift in our own solar system appeared periodic and stable.

Was this the final word? Were solar systems in general stable over vast periods of time? Was the universe stable? Only somewhat in both cases, Darwin decided, because the essence of the universe was constant change. Darwin posited that the universe as a whole would not collapse in upon itself "if the whole of Chaos, like grains of gunpowder, was exploded at the same time, and dispersed through infinite space at once, or in quick succession, in every possible direction."[52] Nonetheless, citing Herschel, Darwin imagined that stars or system of stars might rush together in an act of destruction and renewal:

> Suns sink on suns, and systems systems crush,
> Headlong, extinct, to one dark centre fall,
> And Death and Night and Chaos mingle all!—
> Till o'er the wreck, emerging from the storm,
> Immortal Nature lifts her changeful form,
> Mounts from her funeral pyre on wings of flame,
> And soars and shines, another and the same.[53]

It was a strikingly violent image compared to the concept of a universe of order and stability that had so charmed the early Enlightenment. Thomas Wright (1711–1786) and Immanuel Kant (1724–1804) had already mounted midcentury challenges to the idea of an unchanging cosmos—both emphasized processes of phoenix-like renewal—and Herschel's discoveries and ideas were especially effective in changing public perception of the astronomical order.[54]

The idea that nature had regenerative, phoenix-like properties was one to which Darwin returned time and time again—it was another fundamental connection between organic and inorganic nature.[55] The phoenix was, he said, likely "an antient [sic] hieroglyphic emblem of the destruction and resuscitation of all things."[56] The death of inorganic celestial species was followed by renewal, a manifestation of the same principle of death and renewal experienced by plants and animals. The "decomposition and resuscitation of animal matter," he wrote in a parallel passage, was a sublime topic with roots in ancient Egyptian hieroglyphic "treasures."[57] Here again he evoked the concept of the egg or seed; of life born from the ashes of the old, renewed and, with time, transformed.

---

51 Darwin, *Botanic Garden* (Part I), Canto IV, 190. See also William Herschel, "Catalogue of a second Thousand of new Nebulae and Clusters of Stars; with a few introductory Remarks on the Construction of the Heavens," *Philosophical Transactions of the Royal Society of London*, Vol. 79 (1789): 212–55, at 226.

52 Darwin, *Botanic Garden* (Part I), Canto I, 9, note to line 105.

53 Darwin, *Botanic Garden* (Part I), Canto IV, 191, lines 374–80.

54 Schaffer, "Phoenix of Nature," 180–200.

55 See Schaffer, "Phoenix of Nature," 180–200.

56 Darwin, *Botanic Garden* (Part I), Canto IV, 191, lines 374–80.

57 Darwin, *Botanic Garden* (Part I), Canto II, 108, note to line 586.

"THE ACTIVITY OF ITS INHERENT PRINCIPLES": GENERATIVE PERSPECTIVES ON NATURE FACILITATED COSMIC TRANSFORMISM

Though the phoenix of nature had the potential to maintain a kind of overall order and balance in a universe of change, in Darwin's and Herschel's theories cycles of death and renewal generally inscribed not a circle but something more like a spiral. (The one obvious exception to this was Darwin's view of the fate of the universe as a whole.) For Darwin, reproduction and death were the instruments through which nature changed her forms. This perspective was present in Herschel's natural-historical cosmology as well. Herschel's argument for the transformations of celestial objects included an important role for the destruction or "death" of systems: such occurrences, Herschel argued, might serve as a kind of "laboratory" in which nature experimented with possible improvements and remedies.[58]

Notably, the concept of a "laboratory" of nature in which nature experimented and sought new ways of doing things placed agency and the capacity for change not directly in the hands of an external power—a Divine Designer—but within nature itself. This fact, alongside the idea that nature was in some way imperfect, challenged many eighteenth- and nineteenth-century concepts of God's omnipotence in relation to his natural creation. Why would nature have need of remedies? Why had deity not gotten it right in the first place? Could all the wonderful apparent adaptations of natural forms to their circumstances be ascribed to nature's own internal experimentation and agency, rather than to the external, omniscient care and design of a Divine Designer? These were the challenges raised by the transformist theories of Darwin, Herschel, and others. Denis Diderot, who articulated his own theory of transformation decades earlier, well recognized the radical consequences of this idea. "Look at this egg:" he wrote, "with it you can overthrow all the schools of theology and all the churches in the world."[59] If nature was organic and self-generative rather than passively mechanical, there was no obvious need for an external creator.

David Hume (1711–1776) was a source of inspiration for Darwin in his account of the generative, organic, transforming universe, and the earth within it. "The late Mr. David Hume, in his posthumous works, places the powers of generation much above those of our boasted reason; and adds, that reason can only make a machine, as a clock or a ship, but the power of generation makes the maker of the machine; and probably from having observed, that the greatest part of the earth has been formed out of organic recrements [...] all of which have been first produced by generation, or by the secretions of organic life; he concludes, that the world itself might have been generated, rather than created." Darwin continued, triumphantly, "that is, it might have been gradually produced from very small beginnings, increasing by the activity of its inherent principles, rather than by a sudden evolution of the whole by the Almighty fiat." This sentiment was an obvious threat to God's creative preeminence and the argument from design, so Darwin reframed the situation as a tribute to divine power: "What a magnificent idea of the infinite

---

58 Herschel, "Catalogue of a Second Thousand of New Nebulae and Clusters of Stars," 222.

59 Denis Diderot, *D'Alembert's Dream* (1769) in Leonard Tancock, ed. and trans., *Rameau's Nephew and D'Alembert's Dream* (New York: Penguin Books, 1966), 158. Alarmed—particularly by Erasmus Darwin's natural philosophy—William Paley rushed into the breach with his blockbuster *Natural Theology* of 1802, seeking to place agency firmly within the omniscient, omnipotent hands of a Divine Watchmaker. See William Paley, *Natural Theology: Or, Evidence of the Existence and Attributes of Deity, Collected from the Appearances of Nature* (London: R. Faulder, 1802).

power of THE GREAT ARCHITECT! THE CAUSE OF CAUSES! PARENT OF PARENTS! ENS ENTIUM!"[60]

The generative universe appeared in Hume's *Dialogues Concerning Natural Religion* (1779) in the mouth of a character named Philo. As with most dialogues, it is difficult to say with absolute certainty that any given aspect of Philo's arguments mapped perfectly onto Hume's own, but Hume's argumentation appears powerfully sympathetic to Philo's positions. Darwin's conclusion that these represented Hume's own beliefs is understandable. In response to the argument that nature appeared to be a machine-like contrivance of a thinking, divine Designer, the character of Philo objected. "[T]here are other parts of the universe (besides the machines of human invention) which bear still a greater resemblance to the fabric of the world, and which therefore afford a better conjecture concerning the universal origin of this system," said Philo. "These parts are animals and vegetables. The world plainly resembles more an animal or a vegetable, than it does a watch or a knitting-loom. Its cause, therefore, it is more probable, resembles the cause of the former. The cause of the former is generation or vegetation. The cause, therefore, of the world, we may infer to be something similar or analogous to generation or vegetation."[61] This was precisely the way in which Darwin interpreted the origin of the universe and its cosmological transformations, which in turn explains why he so enthusiastically embraced Herschel's natural historical approach to the heavens. For Hume, the burden of proof was on those who championed the idea of organization from design: they would need to prove that order in nature necessarily proceeded from thought. Further, they would have to show that matter itself, absent a designing thinker, was incapable of embodying order. Such a proof, he thought, was impossible.[62]

Hume's concept of a generating, vegetating universe resonated with William Herschel's natural historical approach to the heavens, which in turn was (as we've seen) central to Darwin's own account of the transformations of heavenly objects like nebulae, stars, and planets. "In like manner as a tree sheds its seed into the neighbouring fields, and produces other trees; so the great vegetable, the world, or this planetary system, produces within itself certain seeds, which, being scattered into the surrounding chaos, vegetate into new worlds," Philo declared in Hume's *Dialogues*. "A comet, for instance, is the seed of a world; and after it has been fully ripened, by passing from sun to sun, and star to star, it is at last tossed into the unformed elements which every where surround this universe, and immediately sprouts up into a new system."[63] Darwin's concept of the universe and our world system as seed-like clearly found support and perhaps inspiration in this passage from Hume. Herschel, while a young musician in his early twenties, had first made the acquaintance of Hume in 1761, when the elder philosopher hosted a dinner in

---

60 Darwin, *Zoonomia*, Vol. 1, Section XXXIX ("Generation"), 509. It is worth noticing here the way in which Darwin positioned the "evolution" of nature in the older sense of the term (akin to the unfolding of a pre-existing, scroll-like entity) in opposition to his (and Hume's) generative model of nature as an entity possessing its own, internal agency. Here he appears to specifically object to the passive mechanistic aspect of preformationist applications of "evolution." Yet "evolution" in this older sense was clearly important to his own philosophy—he was practically obsessed with the idea of "seeds" and "eggs" as apt representations of the generation and transformations of multiple phenomena in the history of nature. He wished to drop the role of "Almighty fiat" and "sudden" change while retaining the word's generative association and sense of momentum in progressive transformation.

61 David Hume, *Dialogues Concerning Natural Religion*, 2nd ed. (London: 1779), 130–31.

62 Riskin, *Restless Clock*, 180.

63 Hume, *Dialogues Concerning Natural Religion*, 132.

Edinburgh in honor of Herschel's musical accomplishments.[64] By that point in time Hume had already written his *Dialogues*, though they remained unpublished until 1779, three years after his death in 1776, due to the work's radical content.[65]

TRANSMUTATIONS CHEMIC

Darwin's fascination with hieroglyphic truths, and likely his concept of the progressive transformations of organic and inorganic nature, were shaped by his experience as a mason. The idea of phoenix-like death, renewal, and transformation was central to the Masonic tradition and often associated with Egyptian mysteries and the mason's own personal transformations as he progressed upward in degrees. The lodge itself was often understood to represent the macrocosm in microcosm. Darwin was initiated into Masonry (along with the chemist James Keir) on September 11, 1754 at St. David's Lodge, No. 36, in Edinburgh. Next to his name was written "student and poet."[66]

Core elements of Neoplatonism, Hermeticism, and the Renaissance alchemical tradition ran through Masonry, and in Darwin's work—inflected by the radical French chemistry of Lavoisier, as well as ideas from Darwin's friend Joseph Priestley—the chemic world was part of the "whole family" of one parent: the interconnected organic universe of Divine Love.

---

64 At the time of their first acquaintance Herschel was employed as a musician; his astronomical interests developed later. "On my arrival there [in Edinburgh] I was introduced to Mr. Hume, the Metaphysician [...] Mr. Hume, who patronized my [musical] performance, asked me to dine with him, and accepting his infitation [sic] I met a considerable company, all of whom were pleased to express their approbation of my musical talents..." Quoted in Constance Lubbock, *The Herschel Chronicle* (Cambridge: Cambridge University Press, 2013 (1933)), 18. Unfortunately, letters written *during* Herschel's stay in Edinburgh are now absent from the surviving collection of the exchange (those missing are pages 61–64 of his numbered manuscript correspondence with his brother Jacob in the William-Jacob correspondence held by the Herschel Family Archive, UK). In the late 1770s Herschel briefly referenced Hume's *A Treatise of Human Nature* (1739–40) as a work of interest in the last few pages of a surviving commonplace book. It is likely he knew Hume's *Dialogues* as well. William Herschel, Commonplace Book on Astronomy, Linda Hall Library manuscript QB42.H47 1759 quarto, page 86, digital resource http://lhldigital.lindahall.org/cdm/compoundobject/collection/astro_early/id/402. Herschel first formally presented his natural-historical approach to the stars and nebulae in 1784. See William Herschel, "Account of some Observations tending to investigate the Construction of the Heavens," *Philosophical Transactions of the Royal Society of London*, Vol. 74 (1784), 437–51. He seems to have been thinking in this mode at least as early as 1781, however, when he wrote to Sir Joseph Banks that he believed that the object he, Herschel, had recently discovered in distant orbit around the sun (we know it today as the planet Uranus), might be "either a new Planet or perhaps a star that may partake both of the nature of Comets & Planets, & be, as it were, a Link between the Cometary and Planetary Systems, uniting them together by that admirable connection already discover'd in so many other parts of the creation." William Herschel to Joseph Banks, Letter (Memorandum), 19 November 1781. British Museum of Natural History, Joseph Banks Collection DTC 2, pp. 64–69. On Herschel's theory of comets, including his relationship to other, prior theories concerning a relationship between comets and planets, see Woodruff T. Sullivan III, "William Herschel and Comets," in Clifford J. Cunningham, ed., *The Scientific Legacy of William Herschel* (New York: Springer, 2018).

65 J.C.A. Gaskin, "Hume on Religion," in *The Cambridge Companion to Hume*, edited by David Fate Norton and Jacqueline Taylor, 2nd edition (Cambridge: Cambridge University Press, 2009), 484.

66 Neville Cryer, "Erasmus Darwin: a Little Known Mason of Derby," typescript of lecture delivered at Tyrian Lodge no. 253 (Derby, 2000), in the Erasmus Darwin House Collection, Lichfield, UK. Some initiate masons were symbolically reborn through an allegorical ritual involving the cosmic egg. For a marvelous analysis of Darwin's mythic and masonic engagements, see Priestman, *Poetry of Erasmus Darwin*, 139–67.

Chemical "transmutations" (Darwin's term) played an important role in transforming inert earth into animated life, he argued.[67] It was a process that he framed, even in its inorganic stages, in vital terms and in the language of organic nature transformed through attraction, excitement, flight, and embrace:

> First Heat from chemic dissolution springs,
> And gives to matter its eccentric wings;
> With strong Repulsion parts the exploding mass,
> Melts into lymph, or kindles into gas.
> Attraction next, as earth or air subsides,
> The ponderous atoms from the light divides,
> Approaching parts with quick embrace combines,
> Swells into spheres, and lengthens into lines.
> Last, as fine goads the gluten-threads excite,
> Cords grapple cords, and webs with webs unite;
> And quick Contraction with ethereal flame
> Lights into life the fibre-woven frame.—
> Hence without parent by spontaneous birth
> Rise the first specks of animated earth . . .[68]

Inanimate matter gave rise to life, but life also transformed inanimate matter. Darwin observed that "the powers of life" facilitated the transmutations of inanimate matter, transforming "much of the aerial and liquid parts of the terraqueous globe . . . into solid matter," such as limestone.[69] The transformations of organic and inorganic nature were not only connected by a similitude of vital essence and operations; they were also interconnected insofar as their transformations were interdependent.[70]

For Darwin, the vital power of Love drove the transformations of chemical entities, just as it did those of celestial and organic beings. Influenced by Humphry Davy's chemical work, Darwin conceived of two ethers, "the masculine and the feminine ethers." Masculine ethers repelled each other, as did feminine ethers, but masculine and feminine attracted one another.[71] In the inorganic realm, Darwin identified gravity as "the general attractive ether," and heat as "the general repulsive ether" which, he concluded, "constitute the two great agents in the changes" of that domain.[72] By "attraction" in his passage on the emergence of life, Darwin meant both gravity and "particular attraction" aka "chemical affinity," which he positioned within the larger, unifying framework of Eros or Divine (reproductive) Love.[73] Even the natural philosopher's relationship with nature was romantic. Through Darwin's poetic imagery the reader witnesses Joseph

---

67 Darwin himself used the word "transmutation" to refer to chemical transformations. See Darwin, *Botanic Garden* (Part I), Canto II, 93–94, note to line 398.

68 Darwin, *Temple of Nature*, Canto I, 20–22, lines 235–248.

69 Darwin, *Temple of Nature*, Canto II, 46, note to line 39.

70 On the relationship between the transformations of the earth and those of living things, see also Priestman, *Poetry of Erasmus Darwin*, 106–15.

71 Darwin, *Temple of Nature*, Additional Notes, 78.

72 Darwin, *Temple of Nature*, Canto I, 21, note to line 239.

73 Darwin, *Temple of Nature*, Canto I, 21, note to line 239.

Priestley as he "woos" the "airy powers" of the "sylphs" (his experiments on airs), who appear before him "in gay undress," whispering "secrets" into "his raptured ear."[74]

The poetic form played an important role in the arguments that Darwin wished to make by facilitating comparisons and connections across natural domains, and by allowing the reader to witness otherwise unobservable phenomena through the faculty of imagination. Through poetic analogy, the "loves" of the microscopic chemical world, like those of the macroscopic, could be virtually witnessed by the reader through the eyes of mythic characters. Sylphs "wed the enamour'd Oxygene to Light," which clung together "with unabating love," serving as both witness to, and agents of, dynamic change.[75] (The connection between chemical and romantic attraction was explored a few years later by Goethe, whose novel *Elective Affinities* (1809) was structured around the idea of chemical attraction.[76]) Across earth's surface, Nymphs "with chemic eyes" witnessed the ascension of "pure air" (oxygen) and "inflammable air" (hydrogen), which combined together with calorique (heat) to form clouds of water.[77]

Poetic form was also a constitutive element of Darwin's theory of a universe in which objects celestial, chemical, earthly, organic, and social grew, decayed, renewed, and were ultimately transformed precisely because, he repeatedly argued, the ancient myths, hieroglyphics, and mystery traditions on which his poetry drew had captured these natural philosophical truths. The figure of Eros or Divine Love was one such figure, whose poetic role in *The Botanic Garden* and *The Temple of Nature* was to reveal real, analogous connections across natural domains, and to lend certain vital, even anthropomorphic, features to these universal natural phenomena.

In the context of chemistry, Darwin believed that Francis Bacon (1561–1626) had identified in the ancient myth of Proserpine a representation of the real relationship between living things and the chemical world. "The fable of Proserpine's being seized by Pluto as she was gathering flowers," Darwin wrote, "is explained by Lord Bacon to signify the combination or marriage of ethereal spirit with earthly materials. [...] This allusion is still more curiously exact, from the late discovery of pure air being given up from vegetables, and that then in its unmixed state it more readily combines with metallic or inflammable bodies. From these fables, which were probably taken from antient [sic] hieroglyphics, there is frequently reason to believe that the Egyptians possessed much chemical knowledge, which for want of alphabetical writing perished with their philosophers."[78]

Even as he argued that chemical and organic transformations shared a universal family character, Darwin distinguished between their immediate modes of operating. Here again he found myth instructive, approvingly observing that Ovid's story of animals spontaneously generated from the mud of the Nile suggested that they did so in a fashion similar to "chemical combinations" but not identical to them. The products of spontaneous generation technically differed from antecedent chemical combinations in that its productions "were distinguished . . . by their perpetual improvement by the power of reproduction . . . whereas the products of natural chemistry are only enlarged by accretion, or purified by filtration."[79]

---

74 Darwin, *Botanic Garden* (Part I), Canto IV, 175–77, lines 165–194.

75 Darwin, *Botanic Garden* (Part I), Canto IV, 163–64, lines 34–36.

76 Johann Wolfgang von Goethe, *Chemical Affinities* (Berlin: J. G. Cottaische Buchhandlung, 1809).

77 Darwin, *Botanic Garden* (Part I), Canto III, 132–33, lines 201–210, note to line 204.

78 Darwin, *Botanic Garden* (Part I), Canto IV, 176–77, note to line 178.

79 Darwin, *Temple of Nature*, Canto I, 38, note to line 417.

Life, in Darwin's view, was special and distinct, even as aspects of its essence permeated nature as a whole. On the very first page of the *Zoonomia*, Darwin emphatically dismissed those who considered "the body as a hydraulic machine [...] forgetting animation [is] its essential characteristic."[80] The *Zoonomia* was in great part a treatise to theorize the nature of this "essential characteristic."[81]

In the circular process of material manifestations (that is to say, the way in which inert matter became part of a living being, before returning to its inert state upon that being's death, to eventually rise in life again) the "appetencies and propensities" of organic matter governed life; when these failed in death, "chemical affinities of attraction ... and of repulsion" took over, which "reduce much of the solid matters back to the condition of elements" through the action of heat via "fermentation, putrefaction, sublimation, and calcination"; "solidity" then emerged as a consequence of the loss of heat (i.e., steam into water, water into ice) *or* "by the combination of heat with bodies" like "the materials of gun-powder before its explosion."[82] This was a significant choice of words with which to describe matter's pre-potent state before life emerged once more: the explosion of gunpowder was one of Darwin's favorite ways to describe transformative moments in nature, such as the transformation from void to material universe and, as we shall see, the revolutionary transformation of human society.

Though Darwin's most explicit formulations of his theory of transformation in nature appeared in the *Zoonomia* and *The Temple of Nature*, he alluded to transformist possibilities repeatedly in *The Botanic Garden*, using tentative language and the cover of long footnotes and endnotes. The poem's possibilities did not escape the chemist James Keir, who teased Darwin: "You are such an infidel in religion that you cannot believe in transubstantiation, yet you can believe that apples and pears, hay and oats, bread and wine, sugar, oil, and vinegar, are nothing but water and charcoal, and that it is a great improvement in language to call all these things by one word, oxyde hydro-carbonneux." Keir was offering a pointed criticism of Darwin's embrace of Lavoisier and his new chemical system, which Keir considered far from established, but he was also pointing out that Darwin was replacing spiritual powers of transformation with a materialist's chemical transubstantiation.[83]

DARWIN'S UNIVERSAL BRAIN AND NATURE'S IMMUTABLE PROPERTIES

Darwin painted an electrifying image of the relationship between each part of the universe through time and space by comparing it to the operation of the human brain and nervous system: a divine impulse set innumerable chains of cause and effect into motion, all sharing a family similitude (a shared organic identity and operation, the nervous system), all of one parent (the divine mind), yet distinct in their particular operations. The first link of this "perpetual chain of causes and effects," he explained, was "rivetted [sic] to the throne of God," whence it "divides itself into innumerable diverging branches, which, like the nerves arising from the brain, permeate the

80 Darwin, *Zoonomia*, Vol. 1, 1.

81 C.U.M. Smith, "All from Fibres: Erasmus Darwin's Evolutionary Psychobiology," in Smith and Arnott, eds., *Genius of Erasmus Darwin*, 135.

82 Darwin, *Temple of Nature*, Canto II, 46, note to line 39.

83 James Keir to Erasmus Darwin, Letter, 15 March 1790. Reproduced in Amelia Keir Moilliet and James Keir Moilliet, eds., *Sketch of the Life of James Keir, F.R.S., with a Selection from his Correspondence* (London: Robert Edmund Taylor, 1868), 108–11.

most minute and most remote extremities of the system, diffusing motion and sensation to the whole."[84] Thus, there were many interrelated yet distinct chains of being, all of which could be traced back to a divine source—though not, as we've seen, a religiously orthodox one. The universal brain and nervous system were not a completed, static entity, but rather a living system still changing generatively over time.

Darwin's metaphor of the divine, universal brain arguably chafed with his insistence elsewhere that agency lay within nature herself—a problem that he tried to overcome by presenting deity as a law-giver rather than a designer. His theological views were unambiguously unorthodox, and the extent to which he himself genuinely identified his divine First Cause with contemporary understandings of an omnipotent creator God is ambiguous. The metaphor of the universal brain was useful to Darwin because he could use it to support an argument about the way in which historical natural causes and effects were governed by unchanging properties of nature. He connected this idea to a point he later argued in *The Temple of Nature*, namely, that ancient atomists had erred by attributing the combinations of atoms to chance rather than to "immutable properties" endowed by a divine First Cause (e.g. laws of gravitation, chemical affinity, animal appetency). "Hence the modern discoveries in chemistry and in geology, by having traced the causes of the combinations of bodies to remoter origins, as well as those in astronomy, which dignify the present age, contribute to enlarge and amplify our ideas of the power of the Great first Cause," he wrote. With this adjustment, the doctrine of atoms could lead to a demonstration of the existence of deity, rather than to atheism, "because the analogy resulting from our perpetual experience of cause and effect would have thus been exemplified through universal nature."[85]

The image of the First Cause as the cosmic brain, in tandem with Darwin's argument that nature was animated by some kind of "Love Divine," could easily be interpreted by readers to suggest a kind of pantheism. A similar idea appeared in the work of German Romantics like Goethe and Schelling, who rejected mind-nature dualism and staked out a position closer to that of Spinoza: God and nature were one and the same. In a universe everywhere enlivened by the same divine agency, who could be surprised to find similar ideas at work throughout?

EARTH, THE GREAT SEED

Darwin depicted the historical formation of the earth as a "birth" from the sun, and framed the process that transformed matter into planets and comets in much the same vitalistic language as the chemical and celestial realms.[86] Following the French natural philosopher Buffon, Darwin asserted that the earth had been ejected by the sun, although contrary to Buffon he argued that this occurred by virtue of the vital explosive potential already latent *within* that body rather than the external intervention (in Buffon's telling) of a colliding comet: "The whirling Sun this ponderous planet hurl'd, / And gave the astonished void another world," Darwin wrote.[87]

Darwin's theory of the earth was shaped by his extensive natural historical engagements. The geologist John Whitehurst (1713–1788) was a friend and source of geological news, as was the Edinburgh geologist James Hutton (1726–1797), who visited Darwin at Lichfield around 1775.

---

84 Darwin, *Zoonomia*, Vol. 1, 532–33.
85 Darwin, *Zoonomia*, Vol. 1, 533.
86 Darwin, *Botanic Garden* (Part I), Canto II, 60, lines 11–12.
87 Darwin, *Botanic Garden* (Part I), Canto II, 60, lines 15–16.

Hutton's *Theory of the Earth*, developed over the course of 25 or 30 years, was first presented to the Royal Society of Edinburgh in the spring of 1785. Darwin embraced his gradualist account of geological change.[88] Darwin may also have discussed geology with Herschel's neighbor, the geologist Jean André De Luc (1727–1817), who was friends with Boulton, Watt, and other Darwin associates. Meanwhile, Darwin and Whitehurst enjoyed geologic walks together; in the 1760s they collected rock specimens on expeditions to the Peak District caves, which Darwin later reflected upon in his correspondence with Hutton.[89] Features of Derbyshire's geology were made visually accessible by the area's mining enterprises and by its varied landscape.[90] Darwin amassed a collection of rocks, fossils, and mine borings.[91]

Darwin was also involved in seeing construction of the Trent and Mersey Canal (also known as the Grand Trunk Canal) through to completion. The project's massive earthworks revealed many strata and fossils.[92] In the summer of 1767, Darwin's friend Josiah Wedgwood reported to his business partner Thomas Bentley the discovery of "wonderfull & surprising curiositys," including "a prodigious rib, with the vertebre of the backbone of a monstrous sized Fish."[93] Fossils of plants were found sixty to one hundred English yards deep. Accompanied by Whitehurst, Darwin went to see them in person. "I have been into the Bowels of old Mother Earth, and seen Wonders and learnt much curious Knowledge in the Regions of Darkness," he announced to a friend triumphantly.[94] The wonders of the earth impressed him deeply. By 1770 (and possibly earlier) he had arrived at the conclusion that all life had progressed from more primitive states. The local canon Thomas Seward wrote a sarcastic verse in response to Darwin's decision, in 1770, to have the motto *E conchis omnia* ("everything from shells") painted on his carriage. "He too renounces his Creator / And forms all sense from senseless matter / Great wizard, he by magic spells / Can all things raise from cockle shells." Darwin was pressured into painting over his motto. Nonetheless, his progressive natural-historical narrative featured prominently in *The Botanic Garden*, the *Zoonomia*, and *The Temple of Nature*.[95] Of course, the amount of time necessary for such transformations in nature was immense, a conclusion that Darwin may have arrived at while accompanying Whitehurst on the latter's geological surveys.[96]

In his theory of the origin of the earth, Darwin departed significantly from Herschel. According to Darwin, when the body of the earth—a mass of solar lava—was ejected from the sun it carried with it a surrounding cloud of hot, vaporous air. As the mass cooled and took on the shape of a sphere, the surrounding vapor also cooled and condensed, drawn by gravity to the surface of the lava-earth, where it formed oceans and other bodies of water. Meanwhile, the newborn earth was pulled into orbit around the sun, as "fierce attraction with relentless force / Bent the reluctant wanderer to its course."[97] This, he explained in an endnote to a footnote, was in fact

---

88 Desmond King-Hele, *The Collected Letters of Erasmus Darwin* (Cambridge: Cambridge University Press, 2007), 90.

89 Desmond King-Hele, *Erasmus Darwin and the Romantic Poets* (London: Macmillan, 1986), 19.

90 H.S. Torrens, "Erasmus Darwin's Contributions to the Geological Sciences," in Smith and Arnott, eds., *Genius of Erasmus Darwin*, 259–272, at 264.

91 King-Hele, *Letters of Erasmus Darwin*, 176.

92 Torrens, "Erasmus Darwin's Contributions to the Geological Sciences," 261–3.

93 Quoted in Torrens, "Erasmus Darwin's Contributions to the Geological Sciences," 259–272 (261).

94 Erasmus Darwin to Matthew Boulton, Letter, 29 July 1767. In King-Hele, *Letters of Erasmus Darwin*, 44.

95 Uglow, *Lunar Society*, 257–59.

96 Page, *Literary Imagination*, 26.

97 Darwin, *Botanic Garden* (Part I), Canto II, 61, lines 19–20.

the likely genesis of all the solar system's planets and comets, which were perhaps ejected from the sun by solar volcanoes with craters as large as "4000 miles deep and many times as wide."[98]

The terms in which Darwin explored the earth and earth's natural history highlighted its systems and its similarities to an animate being. The earth's cycles were like those of a living creature, he said, with liquids, airs, and electrical impulses coursing through the planet's body like the circulatory and nervous systems of an animal. The water, falling as rain, filled the rivers and streams, and gave life to plants, circulating just as "blood circulates through the body and returns to the heart."[99] Both the plants and the action of the sun on the surface of waters broke water back down into its constituent parts, which then rose to repeat the cycle.[100] Lighter airs, meanwhile, congregated around the earth's equator, heavier airs at its poles. Some part of these would form from the decomposition of dead life on earth, rising through the atmosphere, where at certain times and places they would intermix with other airs, forming the northern lights and other phenomena. The eerie shifting lights of the north were thus the airy vestiges of departed men and beasts, passed up into ethereal dancing lights.[101]

Echoing his account of the origin of the universe in a primeval egg or seed, Darwin also referred to the earth as a "Great Seed" whose axial rotation, with its corresponding seasons, produced new life in a manner analogous to the unfurling, or evolving, of individual plant seeds:

> And the Great Seed evolves, disclosing All;
> Life *buds* or *breathes* from Indus to the Poles,
> And the vast surface kindles, as it rolls![102]

For Darwin, the evolving (revolving) planetary body—a *seed* unfurling through time —revealed nature's secrets: as it evolved it produced new life, and new physical conditions that shaped life. The "mutations" of the globe, in other words, were intimately connected to the transformation of living species.[103] The path of both was one of mutual change. Solid ground emerged from the sea in tandem with the transformation of organic species beneath the waves. Life must have begun beneath the sea, he argued, because even the highest mountains "consist of shells," and because humans and quadrupeds began their embryo state as "aquatic animals." Even the oxygenation of a human fetus by the placenta, he observed, operated "exactly" as the gills of a fish.[104]

His description of the earth as a seed that "evolves" (in the sense of an unfurling) had preformationist connotations. Darwin, however, associated the sense of continuity and potentiality in this metaphor not with static continuity via a pre-ordained series of events, but with nature's tendency to progress through transformation in a manner more contingent and open-ended than the trajectory of an individual organism's lifespan. The metaphor of the seed or egg emphasized that this was a *generative*, not passively mechanical, universe, whose transformations came from within nature rather than from the external hand of a Divine Designer (see §"The Activity of Its Inherent Principles"). While aspects of his discussion of natural reproduction in *The Botanic*

---

98 Darwin, *Botanic Garden* (Additional Notes: Note XV ("Solar Volcanos")), 29.
99 Darwin, *Botanic Garden* (Part I), "Argument of the Third Canto," 111.
100 Darwin, *Botanic Garden* (Part I), Canto III, 130–33, lines 169–210.
101 Darwin, *Botanic Garden* (Part I), Canto I, 11–12, lines 123–134.
102 Darwin, *Botanic Garden* (Part I), Canto IV, 193, lines 406–8.
103 Darwin, *Temple of Nature*, Canto III, 119, note to line 411.
104 Darwin, *Temple of Nature*, Canto I, 26, note to line 295. Also Canto I, 35–36, lines 388–394.

Garden hit potentially (though not conclusively) preformationist notes,[105] in the *Zoonomia* he explicitly and vigorously rejected preformationism, while still championing the idea of a kind of line or extension running from parent to child through generations (a continuity essential to his theory of the inheritance of "acquired habits or propensities").[106]

The earth's strata formed from the ocean sediments, its limestone layers composed of the fine-ground husks of sea creatures long gone—an idea for which Darwin referred his readers to his Lunar colleague John Whitehurst's "ingenious Treatise on the Theory of the Earth," *An Inquiry into the Original State and Formation of the Earth* (1778).[107] As the earth circled, Darwin wrote, its "sweet vicissitudes of day and clime / Mark'd the new annals of enascent Time."[108] The oceanic strata, made of "immense quantities of shells and coralloids," began to approach the surface. The life and death of oceanic creatures continued producing new layers until islands at last rose from beneath the water. Here again ancient thinkers had captured a natural philosophical truth in classical imagery of Venus rising from the sea supported by the Tritons. "It is probable that this beautiful allegory was originally an hieroglyphic picture (before the invention of letters)," he wrote, "descriptive of the formation of the earth from the ocean, which seems to have been an opinion of many of the most antient philosophers."[109]

As land animals deceased, their remains gradually formed strata, as well, for three types of strata in total: the lava nucleus, the strata of oceanic life, and the strata of land life, which in turn could mix and form other types of earths.[110] A new state in the earth's transmutations developed: fires began to kindle deep inside the planet, leading to earthquakes, volcanoes, and tumultuous movements of land, including the creation of continents, mountains, chasms, and all manner of features, "the vestiges of which all over the world excite our admiration and our study."[111] All the while, organic species lived, died, were renewed and—over vast periods of time—transformed altogether, seeding strata with the bones of species that no longer walked the earth or plied its waters.

---

105 Darwin observed that some plants contained their successors within themselves, citing Bonnet. "Mr. Bonnet saw four generations of successive plants in the bulb of a hyacinth," he noted in a footnote, alongside half a dozen other examples of miniatures found within the seeds or buds of mature plants, including the oak. Darwin, *Botanic Garden* (Part I), Canto IV, 192, note to line 383. "Grain within grain successive harvests dwell, / And boundless forests slumber in a shell." Darwin, *Botanic Garden* (Part I), Canto IV, 192, lines 393–94.

106 "Many ingenious philosophers have found so great difficulty in conceiving the manner of the reproduction of animals, that they have supposed all the numerous progeny to have existed in miniature in the animal originally created; and that these infinitely minute forms are only evolved or distended, as the embryon increased in the womb. This idea, besides its being unsupported by any analogy we are acquainted with, ascribes a greater tenuity to organized matter than we can readily admit…" Darwin, *Zoonomia*, Vol. 1, 489–90. In his *Zoonomia* chapter on generation, Darwin offered an epigenetic explanation for the generation of life in which he associated the power of forming embryos with the male, and the power of nourishing (and thereby influencing) the embryo with the female. On the inheritance of "acquired habits or propensities," "acquired forms or propensities," and acquired "animal appetencies," see Darwin, *Zoonomia*, 480, 503, and 522, respectively.

107 Darwin, *Botanic Garden* (Part I), Canto II, 61, note to line 17. Whitehurst postulated the formation of the "habitable world" from a "chaotic mass" through material affinities. John Whitehurst, *An Inquiry into the Original State and Formation of the Earth* (London: J. Cooper, 1778), 23 ("habitable world…chaotic mass") and 10–26 for chemical discussion.

108 Darwin, *Botanic Garden* (Part I), Canto II, 61, lines 31–32.

109 Darwin, *Botanic Garden* (Part I), Canto II, 63, note to line 47.

110 Darwin, *Botanic Garden* (Part I), Canto II, 62.

111 Darwin, *Botanic Garden* (Part I), Canto II, 65, note to line 68.

LIFE FROM WATER AND EARTH, FROM FILAMENT TO PHILOSOPHER

Erasmus Darwin's argument for the natural origin and transformation of organic species is, of course, the idea that renders him interesting to many people today. Yet encountering the idea of organic species change within the dramatic spatial and temporal span of his organic, transmuting universe, his theory appears quite distinct from the strictly biological view of evolution defined by Charles Darwin as disciplinary boundaries crystallized in the mid-to-late nineteenth century.

For Erasmus Darwin, in contrast to Charles Darwin, the emergence and transformation of life was explicitly bound to the emergence and transformation of the universe as a whole. The universe—and each solar system within it—had had its ultimate origin in an "Ens Entium," or ultimate ens.[112] In *The Temple of Nature,* Darwin connected the "transmigrating Ens" of living things to his vital, cosmic life force originating in the Ens Entium. This transmigrating Ens was in the first living "filament" of life on earth. Even "[I]mperious man" had arisen "from rudiments of form and sense, / An embryon point, or microscopic ens!"[113] The original embryon point(s), ens, or filament(s) had begun existence bobbing in comforting, womb-like oceanic caves, warmed by the sun.[114] The emergence of a filament or embryon point from inorganic nature was the product of chemical transmutation—of chemical entities who in the midst of their "loves" were transformed through excitement, attraction, embrace, flight, and repulsion.[115] Even the ens of what he called "organic" nature had *its* origin in an inorganic "chemic Ens."[116]

In *The Botanic Garden*, Darwin cited an unnamed philosopher's argument that "the first insects were the anthers and stigmas of flowers, which had by some means loosened themselves from the parent plant, like the male flowers of vallisneria, and that other insects in the process of time had been formed from these, some acquiring wings, others fins, and others claws, from their ceaseless efforts to procure food or to secure themselves from injury" (for *Vallisneria*, see **FIGURE 1**). Darwin reported that the anonymous philosopher had argued that such transformations were no more "incomprehensible than the transformation of caterpillars into butterflies."[117] He presented this account in both *The Botanic Garden* and *The Temple of Nature*, attributing it to the same unnamed "philosopher" or "naturalist" in both.[118] The idea was almost

---

112 Darwin, *Temple of Nature*, Canto IV, 167, note to line 453.

113 Darwin, *Temple of Nature*, Canto I, 28, lines 309–314.

114 Darwin, *Temple of Nature*, Canto I, 28–31, lines 315–42.

115 Darwin, *Temple of Nature*, Canto I, 20–21, lines 235–246.

116 "But Reproduction, when the perfect Elf / Forms from fine glands another like itself, / Gives the true character of life and sense, / And parts the organic from the chemic Ens.—" Darwin, *Temple of Nature*, Canto II, 45, lines 27–30.

117 Darwin, *Temple of Nature*, Canto II, 66–67, note to line 302.

118 Compare Darwin, *Botanic Garden* (Additional Notes: Note XXIX ("Vegetable Glandulation")), 109 and Darwin, *Temple of Nature*, Canto II, 66–67, note to line 302. Darwin's attribution of the concept of the inheritance of acquired habits or propensities to this unnamed individual goes curiously unexamined in the secondary source literature. In his reference to the unnamed philosopher in *The Botanic Garden*, Darwin observed that this acquaintance also drew a comparison with the transformation of tadpoles into frogs. It is hard to say what Darwin meant by an acquaintance: it may have been a British friend or natural philosophical colleague in one of the societies to which Darwin belonged, a foreign correspondent, or simply someone with whose ideas Darwin was familiar. If it was a friend or colleague, the individual may not have wanted his or her name publicly associated with such a radical idea (Darwin was unusually thorough in attributing ideas to others in his footnotes). It is also possible that Darwin was referring obliquely to himself, since he clearly gestured toward—but stopped short of making an explicit argument regarding—organic species change in *The Botanic Garden*. Beyond the lack of a name, the specificity of Darwin's description of this naturalist's ideas, and Darwin's shift in verb tense between his two references to the same, lead me to hypothesize that the

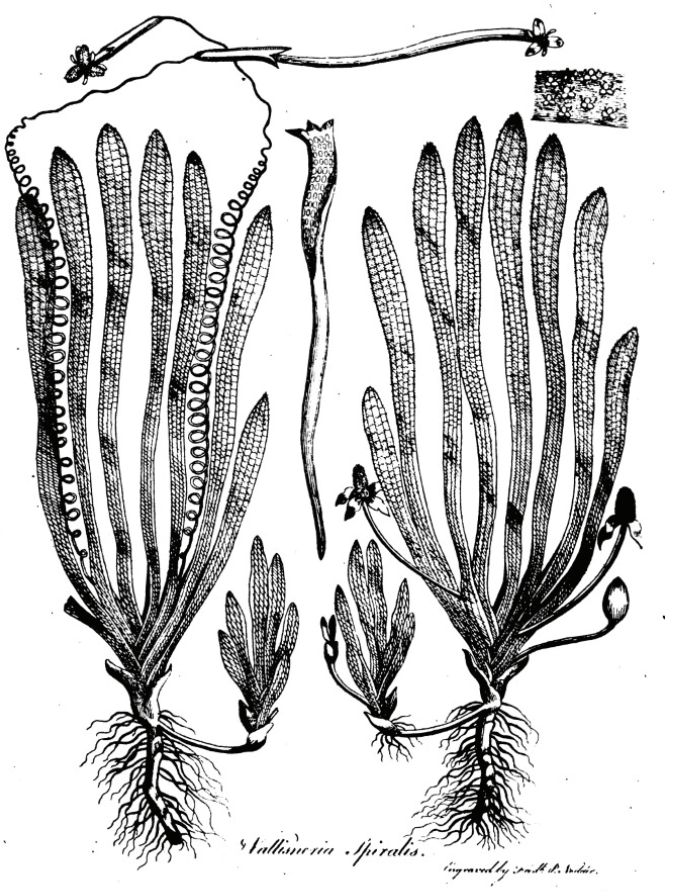

FIGURE 1. Sketch of the aquatic plant Vallisneria. From Erasmus Darwin, Botanic Garden (Part II, 1792), plate between pages 40 and 41. Darwin approvingly cited the argument—made by an unnamed "Philosopher" or "Naturalist"—that *Vallisneria's* ability to detach reproductive parts from the host plant suggested one possible path of the transformation of species from plant to animal. In this image of *Vallisneria* the female plant sends its flowers to the surface of the water by extending spiral stems. In the smaller upper right-hand corner vignette, the artist appears to show the males, spurred by their need to find females, detached from their host plant and floating on the water. Darwin's language implied that he agreed with the unnamed philosopher's suggestions that "the first insects were the anthers and stigmas of flowers; which had by some means loosed themselves from their parent plant, like the male flowers of Vallisneria; and that many other insects have gradually in long process of time been formed from these; some acquiring wings, others fins, and others claws, from their ceaseless efforts to procure their food, or to secure themselves from injury." Darwin, *Botanic Garden* (Additional Notes: Note XXXIX ("Vegetable Glandulation")), 109.

certainly on his mind years earlier, however: he observed in *The Loves of the Plants* in 1789 that *Vallisneria* resembled "those tribes of insects, where the males at certain seasons acquire wings, but not the females, as ants," and that the plant *Osyris* "resemble[s] some insects, as the ants, and cochineal insect, of which the males have wings, but not the female."[119]

Two years later in 1794, Darwin made his enthusiasm for organic transformation far more explicit in the *Zoonomia*. "Would it be too bold to imagine," Darwin wrote, "that in the great length of time since the earth began to exist, perhaps millions of ages before the commencement of the history of mankind, would it be too bold to imagine, that all warm-blooded animals have arisen from one living filament…"[120] (The term "millions of ages" implied an astonishing time span of many tens of millions of years—perhaps as many as a billion.[121]) On the pages following, Darwin extended the argument to include all living things, down to the lowliest worm.

---

unnamed "naturalist" / "philosopher" was a real third party, either British or French, in direct contact with Darwin to one degree or another, who was alive in 1792 but had died by 1803. Circumstantially, one strong possibility is the surgeon and natural philosopher John Hunter (1728–1793).

119 Darwin, *Botanic Garden* (Part II, 1789), 33, note to line 335, and 9, note to line 75.

120 Darwin, *Zoonomia*, Vol. 1, 505. See also Darwin, *Temple of Nature*, 39.

121 King-Hele, *Erasmus Darwin*, 72.

He also developed in far greater detail an explanation for why organic species change takes place, which he had only briefly glossed in *The Botanic Garden*. Darwin argued that through sexual reproduction, "acquired habits or propensities peculiar to the parent" (the father) could be impressed upon the embryon and thus inherited by the offspring.[122] For this reason animals, including humans, looked like their parents—but much more so the father, since he believed that the embryon filament came from him, while the mother largely influenced the embryo through the effects of nutriment.

Darwin identified the demands and limitations of climate and "three great objects of desire"—lust, hunger, and security—as the spurs largely (but not exclusively) responsible for the transformation of species through the agency of every individual's "exertions to gratify" these objects. The reproductive drive, he argued, led males to "want" and "acquire" in their physical forms "weapons to combat each other." The horns of stags, for example, were acquired through the transformation of predecessor species "for the purpose of combating other stags for the exclusive possession of the females." The "final cause" of this phenomenon, he wrote, was "that the strongest and most active animal should propagate the species, which should thence be improved." The "want" of obtaining food likewise led to transformations. The trunk of the elephant, for example, was a nose that had elongated "for the purpose of pulling down the branches of trees for his food, and for taking up water without bending his knees." All such transformations were "gradually produced during many generations by the perpetual endeavor of the creatures to supply the want of food, and to have been delivered to their posterity with constant improvement of them for the purposes required." Many of the most dramatic changes in physical form, however, were a consequence of living things' desire for security. "Hence some animals have acquired wings instead of legs," he wrote, "as the smaller birds, for the purpose of escape." Particular swiftness of leg and fin were similar innovations, as were shells and other physical fortifications against threats to life or resources. In all cases, the physical features of a living being could be understood by the naturalist in terms of their purpose—their ability to meet the animal's needs. Any given adaptation was not the design of a Divine Creator, however, but rather that of the living creatures themselves.[123]

Evidence of such processes of transformation were visible in the natural world. The presence of rudimentary pairs of extra wings in some insects, as well as "new stamina or filaments without anthers on them" in flowers was evidence of "the apparent progress of many animals to greater perfection."[124] Though obviously quite dedicated to Linnean taxonomy, in his analogies Darwin moved promiscuously across the boundaries of entire kingdoms, from plants to animals and from animals to plants, identifying a dense tapestry of what Theresa Kelley aptly calls

---

122 Darwin, *Zoonomia*, Vol. 1, 480. "Owing to the imperfection of language the offspring is termed a new animal, but is in truth a branch or elongation of the parent, since a part of the embryon-animal is, or was, a part of the parent, and therefore in strict language, cannot be said to be entirely new at the time of its production; and, therefore, it may retain some of the habits of the parent system." Ibid., Vol. 1, 480. Darwin gave other examples of "acquired habits" in a footnote to the 1789 edition of *The Loves of the Plants*, but did not make his associated transformist argument explicit at that time: "The times however of the appearance of vegetables in the spring seem occasionally to be influenced by their acquired habits [...] The grains and roots brought from more southern latitudes germinate here sooner than those which are brought from more northern ones, owing to their acquired habits," he wrote. Darwin, *Botanic Garden* (Part II, 1789), 26–28, note to line 268.

123 Darwin, *Zoonomia*, 503–505. Lust, food, and security were not the only spurs to transformation. Plants, he argued, transformed themselves in response to climate, and through "their perpetual contest for light and air above ground, and for food or moisture beneath the soil." Ibid., 507.

124 Darwin, *Temple of Nature*, Canto II, 53, note to line 122.

"functional resemblances."[125] Earlier (historical), less perfect states were indicated by useless organs and appendages: the "paps of male animals," for example, or "stamens without anthers, and styles without stigmas" in plants. These earlier states of organic being served, in turn, to mark past geological states of the earth: its crust had its origin in the "shells of fishes, the decomposition of vegetables, and the recrements of other animal materials, and must therefore have been formed progressively from small beginnings." Monstrous births, meanwhile, might be remains of former states—or they might be nature's "attempts" to progress in perfection.[126] His choice of the word "attempts" implied that nature was not always successful, and that there was an element of trial and error rather than an inexorable teleological path. Darwin's interpretation of the monstrous as an "attempt" toward progress pointed to the radical consequences of a vision of life as a manifestation of nature's vital power. Denise Gigante identifies such consequences in her excellent analysis of the dynamics of power in the Romantic view of life: "Because what could grow and generate living form could also change," she writes, "it ran the risk of going 'wrong' in the developmental process—or at least of going its own way."[127]

Darwin's experience as a doctor significantly shaped his view of the mutability of living things.[128] Habits of life, he believed, could cause disease, which in turn could become hereditary. Not all changes, therefore, were progressive. He understood diseases themselves as dynamic, changing things, not static taxonomic entities as they had been for many Enlightenment medical theorists. Darwin interpreted hereditary disease as a hereditary *susceptibility* to disease (as opposed to fated hereditary development of disease), which could be triggered by environmental exposures or exciting causes. Such diseases, he believed, had inhibited the progressive transformation of mankind.[129] Life's vital principle or power drove an organism's physical transformations over its own individual lifespan, as well as the transformation of species into other species more generally. As we've seen, Darwin identified this vital principle with sexual love, particularly as embodied in the myth of Eros and Psyche. Sexual love rendered organic nature hale and vigorous. By contrast, Darwin believed that so-called "solitary reproduction" (reproduction in the absence of sexual congress) had a tendency to degenerate into illness and death.

Darwin tried to soften his argument that sexual love was the vital essence driving the progressive transformations of living things by suggesting to his readers that it was the "First Great Cause" who had given each organic "filament" both "life and certain powers," which in turn allowed the living filament to "improve by its own inherent activity, and . . . [to deliver] down those improvements by generation to its posterity, world without end."[130] But this language pointed back to the argument that improvements attained during the course of an organism's own life could be inherited by its offspring: progress through reproduction, rather than from the intervention of a designing Creator.

---

125 Kelley, "Taking Chances," in Faflak, ed., *Marking Time*, 208–210.

126 "Perhaps all the supposed monstrous births of Nature are remains of their habits of production in their former less perfect state, or attempts towards greater perfection," he wrote. Darwin, *Botanic Garden* (Part I), Canto I, 8, note to line 101. See also Darwin, *The Botanic Garden* (Part II, 1789), 7, note to line 65.

127 Denise Gigante, *Life: Organic Form and Romanticism* (New Haven: Yale University Press, 2009), 6.

128 Roy Porter, "Erasmus Darwin: Doctor of evolution?" in James Richard Moore, ed., *History, Humanity and Evolution: Essays for John C. Greene* (Cambridge: Cambridge University Press, 2002).

129 Wilson, "Erasmus Darwin on Human Reproductive Generation," in Smith and Arnott, eds., *Genius of Erasmus Darwin*, 126–29.

130 Darwin, *Zoonomia*, Vol. 1, 505.

That humanity itself was the product of such a process of transformation was not in doubt. Darwin encouraged his reader to look with tenderness upon his "brother-emmets, and his sister worms."[131] Mushrooms and human monarchs alike were material for nature to transform into some other living being, and unlike the phylogenic process of species transformation, it was no step up for the individual monarch, whose body in the near term became, within hours or years, the material of plants and "panting" insects.[132]

FROM THE GREAT CHAIN OF BEING, TO CHAINS OF BEING *AND* BECOMING

If the relationship between monarchs and mushrooms struck some as a stretch, similarities between monarchs and primates were not so hard to see. The idea that all of nature's productions could be arranged in order of goodness and complexity from lowest to highest, such that no possible order of being was left vacant—an idea known to contemporaries as the Great Chain of Being—was almost universally accepted by eighteenth-century contemporaries, and bore the imprimatur of extremely influential figures like John Locke. "[W]hen we consider the infinite power and wisdom of the Maker," wrote Locke, "we have reason to think, that it is suitable to the magnificent harmony of the universe, and the great design and infinite goodness of the architect, that the species of creatures should also, by gentle degrees, ascend upwards from us towards his infinite perfection, as we see they gradually descend from us downwards."[133]

The Great Chain of Being included, in its lower reaches, the inorganic realm of minerals and other earthy productions. As the chain rose, the inorganic shaded into the simplest forms of life, which rose upward from plants to animals, from animals to humans, and from humans upward into the spiritual realm of angels and other eminences referenced in the Bible, with God himself occupying the highest position. Forms intermediate, partaking of both essences at points of transition in the chain—such as an entity connecting minerals and plants (lichens were one possibility), plants and animals (the polyp, and for Darwin *Vallisneria*), animals and reasoning man (certain primates, particularly the so-called ourang-outang), and man and higher beings (sometimes hypothesized to be extraterrestrials on other planets)—were a popular subject of discussion. A conversation about points of similarity between humans and primates had been underway for decades.

In the late eighteenth century, however, the eccentric Scottish philosopher James Burnet, Lord Monboddo (1714–99) caused a stir by arguing that the ourang-outang might be taught to speak and do housework. Monboddo believed that language was an acquired rather than innate feature of humanity. Only when humans were forced from a solitary state of nature into societies was there need for vocal communication and ultimately language. In short, major features of humanity's social and linguistic world were not, as many of Monboddo's contemporaries claimed, unique to humans at all. Since language was central to accounts of human reason as a gift endowed by the Creator—a feature critical to humanity's position above all other known animals on the Great Chain of Being—this was perceived by some contemporaries as a threatening argument. Relying largely on travelers' accounts, Monboddo posited that the ourang-outang

---

131 Darwin, *Temple of Nature*, Canto IV, 163, line 428.

132 Darwin, *Temple of Nature*, Canto IV, 160, lines 383–392.

133 John Locke, *An Essay Concerning Human Understanding*, Book 3 (London: Awnsham and John Churchill, 1700 [1690]), 262.

represented an earlier state of humanity, somewhere between man in a pure, solitary state of nature and man in contemporary British society. The eighteenth-century British gentleman was not even humanity's ultimate destination. "[I]f it be true [...] that this scene of man is to have an end, as well as the present system of nature, and that man is to appear again in some other form, as we are told the heavens and the earth will do," wrote Monboddo, "it is according to the order of nature that this change of this state should not happen at once, but should come by degrees, and, consequently, that the species should decline, degenerate, and become old, as we see the individual does, before its extinction."[134]

This was all a manifestation of a more general capacity for transformation—Monboddo called it progressive "becoming"—that he identified as a "law of nature." There was a crucial distinction between *being* and *becoming*, he argued, which "runs through all nature, in which there is a perpetual progress from the one state to the other, and that nothing *is* at first what it afterwards *becomes*."[135]

Darwin was familiar with Monboddo's ideas, and took the similarities between human and primate further than Monboddo himself had done in order to suggest species transformation all the way from first living filament, to quadruped, to primate, to man. Darwin approvingly observed that it had "been supposed by some, that mankind were formerly quadrupeds as well as hermaphrodites ... these philosophers, with Buffon and Helvetius, seem to imagine, that mankind arose from one family of monkeys on the banks of the Mediterranean; who accidentally had learned to use the adductor pollicis, or that strong muscle which constitutes the ball of the thumb, and draws the point of it to meet the points of the fingers" thus improving monkey's perception of touch to the degree that "monkeys acquired clear ideas, and gradually became men." Darwin liked the idea that touch was central to the transformist emergence of ever more intelligent species and ultimately humanity itself. This was perhaps, he wrote, further evidence not simply that plants and animals transformed progressively over time, but that "all the productions of nature are in their progress to greater perfection! an idea countenanced by modern discoveries and deductions concerning the progressive formation of the solid parts of the terraqueous globe, and consonant to the dignity of the Creator of all things."[136]

---

134 James Burnet, Lord Monboddo, *Antient Metaphysics, or, The Science of Universals*, Vol. III (London: T. Cadell, 1784), 69–70.

135 James Burnet, Lord Monboddo, *Of the Origin and Progress of Language*, Vol. I (Edinburgh: J. Balfour, 1774), 437–38. It is interesting to observe that Monboddo, like Darwin, was a mason—an initiate of the sometimes radical but socially diverse Edinburgh lodge Canongate Kilwinning. See Murray G.H. Pittock, *Material Culture and Sedition, 1688–1760: Treacherous Objects, Secret Places* (London: Palgrave Macmillan, 2013), 110.

136 Darwin, *Temple of Nature*, Canto II, 54, note to line 122. Notably, Darwin first floated the idea that "all the products of nature are in their progress to greater perfection" in a footnote on the apparently rudimentary filaments, anthers, and stamens of *Curcuma* (Turmeric) in *The Loves of the Plants* in 1789, which he saw as evidence that the plant was physically transforming itself toward a better state of being. There, too, he argued that the idea was "countenanced by the modern discoveries and deductions concerning the progressive formation of the solid parts of the terraqueous globe." Darwin, *Botanic Garden* (Part II, 1789), 7, note to line 65. On the centrality of touch to developing reason, see also Darwin, *Temple of Nature*, Canto III, 117, note to line 401: "The facility of the use of the voluntary power, which is owing to the possession of the clear ideas acquired by our superior sense of touch, and afterwards of vision, distinguishes man from brutes, and has given him the empire of the world, with the power of improving nature by the exertions of art." Darwin also argued that "it is the greater energy and activity of the power of volition, that marks mankind, and has given them the empire of the world." Voluntary acts were future-oriented: those in which humans concerned themselves with *the means* of achieving pleasurable ends or avoiding painful ones. Darwin, *Temple of Nature*, Canto III, 120, note to line 435.

For most of Darwin's contemporaries, one of the most important features of the Great Chain of Being was that its individual links remained fixed in place by deity, occupying the place in the chain for which their Creator molded them. By contrast, in Darwin's universe, as we've seen, "all the productions of nature are in their progress to greater perfection" through physical transformation. Darwin's admittedly more complicated hierarchy of life was vibrant, its constituents constantly changing and transforming, and it was permeated by a vital principle throughout.

There was also, for Darwin, no single chain of being. As we've seen, he compared the whole of nature to a nervous system, propagated through time as a "perpetual chain of causes and effects," its first link "rivetted to the throne of God," from whence it "divides itself into innumerable diverging branches, which, like the nerves arising from the brain, permeate the most minute and most remote extremities of the system, diffusing motion and sensation to the whole."[137] Nature was thus characterized by many distinct chains of being, the sum of which formed a cohesive, organic whole, and which maintained a "family" resemblance and coherence. This interconnected, unitary, organic, dynamically transforming universe was the Romantic substance of Darwin's natural philosophy.

Though he certainly believed that life tended to improve over time, the trajectory of transformation was not perfectly linear nor always successful. Nature sometimes reached dead ends. Some species went extinct, while vestigial parts lingered pointlessly on in others.[138] Even the physical location of the emergence of life was not identical in each case. If no primeval ocean was to be had, life could take another route into being: spontaneous generation in wet conditions on land. This was an ongoing process in which "new microscopic animalcules" emerged from "wherever there was warmth and moisture" alongside organic matter giving rise to "putridity." From this formula, simple life forms emerged that sometimes slowly acquired "new powers to preserve their existence." Such changes, continuing over "thousands, or perhaps millions of ages, may at length have produced many of the vegetable and animal inhabitants which now people the earth."[139] The Nile River, Darwin observed, was one likely hotspot for such activity.

Citing reports from "ancient song" as well as Ovid's account of the emergence of animals from the Nile mud (a story "of Egyptian origin") Darwin speculated that simple life forms "were spontaneously produced like chemical combinations" and were thereupon improved by the power of reproduction.[140] In *Phytologia* (1800), a prose work "on the philosophy of agriculture and gardening," Darwin revisited the idea of spontaneous generation from mud in a humorous depiction of such generation as a version of the cosmic "chaos" of ethereal material that gave birth to the universe, writ small: "An ingenious observer of nature," he wrote, "conveyed water on a dunghill in the summer months in such quantity, as to make a kind of semi-fluid chaos, for the purpose of animating the whole mass. It became full of insects, and was used in the autumn as manure, and he believed with much greater powers, than it would have otherwise possessed."[141] In support of the idea that the history of life had many paths, Darwin cited what he took to be Linneaus' endorsement of the idea that all plant species developed from about 60 original

---

137 Darwin, *Zoonomia*, Vol. 1, 532–33.

138 Priestman, *Poetry of Erasmus Darwin*, 119–20.

139 Darwin, *Temple of Nature*, Canto I, 29, note to line 327.

140 Darwin, *Temple of Nature*, Canto I, 38, note to line 417.

141 Erasmus Darwin, *Phytologia; or the Philosophy of Agriculture and Gardening* (London: J. Johnson, 1800), 240.

vegetables.[142] In his own account of the transformation of plant species, he imagined a branching effect, whereby one plant lineage might find it most efficacious to obtain air by transforming through many generations into a tree, while another might achieve the same end by extending itself into a vine.[143]

For Darwin, life also took many possible paths because the universe was a space of many possible worlds around vast numbers of suns. The earth was far from the only place that life emerged and transformed through time. Like most of his contemporaries, Darwin was a so-called "pluralist": he believed that life existed throughout the universe on a plurality of worlds.[144] His vivid depiction of the vital, explosive generation and transformation of planets from their parent stars painted a universe teeming with innumerable solar systems and inhabitable worlds ("earths" plural) and potentially inhabitable "secondary planets" (satellite moons): "Through all his realms the kindling Ether runs, / And the mass starts into a million suns," he wrote, "Earths round each sun with quick explosions burst, / And secondary planets issue from the first."[145]

In the *Zoonomia* (subtitled "*or, The Laws of Organic Life*"), Darwin took pains to present his theory of life—including the spontaneous generation and transformation of organic species—as a set of universal laws in the Newtonian tradition.[146] Under such universal laws, the spontaneous generation of inorganic into organic matter took place on any globe that had reached a sufficient state of planetary development. Darwin chose a Virgilian epigraph to the *Zoonomia* that emphasized the connection between the earth and other worlds: "Earth, on whose lap a thousand nations tread, / And Ocean, brooding his prolific bed, / Night's changeful orb, blue pole, and silvery zones, / Where other worlds encircle other suns, / One Mind inhabits, one diffusive Soul / Wields the large limbs, and mingles with the whole."[147] Though in light of its apparent lack of an atmosphere the moon was probably lifeless at *present*, he was optimistic that if an atmosphere developed, life was sure to follow.[148] In 1807 the teenage Lord Byron played with the idea in a poem satirizing itinerant lecturers, lovers, and overweening philosophers (particularly Erasmus Darwin): "Others declare, when first this World, / In dark, promiscuous Chaos hurl'd [...] Produced *this Earth* we draw the light in, / And hence in fable allegorical, / The Bards of Yore most Metaphorical, / Have drawn (The simile must strike Ye) / The *Pretty* tale of *Love* and *Psyche* [...] That we are under obligation / To *Those,* Who first produced *Creation*, / For had they never given Birth, / To This our general parent Earth, / We might have trod some other Sphere, / Or been just now, *The Lord knows where*!—"[149]

---

142 Darwin, *Temple of Nature*, Canto I, 29–30, note to line 327.

143 Darwin, *Zoonomia*, 507.

144 Michael Crowe, *The Extraterrestrial Life Debate* (New York: Dover Publications, 1999 (1986)), 170.

145 Darwin, *Botanic Garden* (Part I), Canto I, 9, lines 105–8.

146 Darwin, *Zoonomia*, Section I ("Of Motion"), 5–6.

147 Darwin, *Zoonomia*, title page epigraph.

148 Darwin, *Botanic Garden* (Part I), Canto II, 66, note to line 82.

149 Lord Byron, "Reply to the Edinburgh Ladies Petition to Dr. Moyes," printed in Guy Steffan, "An Early Byron MS in the Pierpont Morgan Library: 'The Edinburgh Ladies Petition,'" *Studies in English*, Vol. 27, No. 1 (June 1948): 146–76. Byron himself believed in life on other worlds, and had the pleasure of visiting Herschel and viewing the heavens through his telescope more than once. "The night is also a religious concern," Byron later wrote, "and even more so when I viewed the moon and stars through Herschell's [sic] telescope, and saw that they were worlds." Lord Byron, journal excerpt, reproduced in Thomas Moore, ed., *Letters and Journals of Lord Byron* (Frankfurt: H.L. Brönner, 1830), 628.

HUMAN HISTORY AND PROTEAN TIME

Darwin's humming universe of sensation—with its Divine brain from which nervous strands emanated through time, encompassing inorganic and organic nature in one vital whole—clearly drew upon yet did not map neatly onto the Great Chain of Being. Even so, his transformist view of nature, rooted so firmly in the idea of progress, was powerfully shaped by the teleology of the Great Chain and by the idea that higher and lower forms of beings existed in some hierarchical relation to one another.

Time had a direction in Darwin's universe: in general, it moved the universal system toward greater perfection. He believed ancient myth had captured essential truths about the nature of time, which he identified with the figure of Proteus. Proteus was the early Greek god of bodies of water, particularly the ocean. He was fluid and capable of assuming innumerable forms; his very essence was mutability. Proteus could prophecy the future and provide profound and otherwise inaccessible perspectives on the present, but would change his shape to avoid being held in one place long enough to do so. Those who sought his oracular powers had to find a way to bind Proteus long enough to force him to answer their query (in Homer's *Odyssey*, Menelaus succeeded in doing so, even as Proteus transformed between water, tree, serpent, pig, leopard, and lion forms).

Through Masonry, which drew on Hermetic and Neoplatonic traditions (in early modern alchemical circles, Proteus had been associated with mercury), Darwin may also have encountered the idea of Proteus as a kind of *anima mundi*, or soul of the world. For Plato the universe was a body with a soul, a living being. "[I]t follows that we're bound to think that this world of ours was made in truth by god [the Demiurge] as a living being, endowed [...] with soul and intelligence," wrote Plato in *Timaeus* (c. 360 BC) in the voice of its titular character. "For by choosing as his model the most beautiful of intelligible beings, perfect and complete," he explained, the Demiurge had "made the world a single, visible, living being, containing within itself all living beings that are naturally akin to it."[150] In *Timaeus* Plato placed the Demiurge and the world soul into different ontological categories—being, and becoming, respectively. Darwin's image of the Divine brain and nervous system connecting nature's body through time resonated with this Platonic view.

Darwin played with the idea of Proteus by embodying nature's generative substances and changeful creatures and features within the Protean mythos. The Greek word *protos* ("first") suggested Proteus' primordial or firstborn ("protogonos") nature, and Darwin argued that, historically speaking, it was from an ocean of one kind or another (Proteus' medium) that both the universe of stars and planets, and the first forms of life, had emerged. Darwin also returned repeatedly to the idea of Proteus embodied by changeful living forms. He described transforming "insect Proteus" that "sports with changeful form / Through the bright tide, a globe, a cube, a worm."[151] Darwin was likely making an allusion to both his concept of species transformation and to the constantly shape-shifting, water-loving protozoan discovered by August Johann Rösel von Rosenhof in 1755, which von Rosenhof called "little Proteus," and which Linneaus crowned "Chaos protheus" not long after (Linnaeus' *chaos* genus encompassed species that seemed to transmute between animal and vegetable forms, and the genus was characterized by great difficulty in, and indeed frequently the impossibility of, determining the morphological

150 Plato, *Timaeus*, translated by Robin Waterfield (New York: Oxford University Press, 2008), 19.

151 Darwin, *Temple of Nature*, Canto I, 26, Section IV, l. 291–92.

characteristics of its occupants).[152] Today little Proteus is known as *Amoeba proteus*. In his draft poem *The Progress of Society*, an unpublished manuscript precursor to *The Temple of Nature*, Darwin made mythic Proteus the embodiment of a historical lineage of living forms as they transformed from a watery beginning into life on land and in the air: "So erst, when *Proteus* on the briny shore, / New forms assumed of eagle, pard, or boar…"[153] Here again the essence of nature through time, as embodied by Proteus, was transformation.

Changeful Proteus appeared again in Darwin's accounts of the emergence and transformations of human society—each historical age was a Protean "birth"—which he explored to varying degrees in *The Botanic Garden*, *Zoonomia*, and *The Temple of Nature*. The full title of the latter was *The Temple of Nature; or, the Origin of Society*. Tellingly, in this work he chose to position the origin of human society not simply within the context of the transformation of organic species, but within his much broader, universal vision of transformation. He anchored the first canto in the origin of the universe and the genesis of life, guided by Urania, goddess and muse of astronomy. "First, if you can, celestial Guide! disclose / From what fair fountain mortal life arose," the poet implored Urania, who responded that Nature was the child of "God the First cause," who first generated from "flaming Chaos" innumerable suns and planets, on which "whilst the sea at their coeval birth, / Surge over surge, involv'd the shoreless earth; / nurs'd by warm sun-beams in primeval caves / Organic Life began beneath the waves." Here again Darwin's poetic phrasing left open the possibility that the emergence of life was a phenomenon found on planets across the universe wherever appropriate conditions were to be had. From such conditions, Urania said, chemic transformations gave "matter its eccentric wings," and driven by vital internal properties, transformed inert matter into simple life.[154] This life, in turn, improved and transformed through time, ultimately giving rise to humankind.

What was humanity before it was human? Darwin, as we've seen, approvingly cited the idea that "mankind were formerly quadrupeds as well as hermaphrodites," and perhaps at one time "monkeys on the banks of the Mediterranean," observing that "some parts of the body are not yet so convenient to an erect attitude as to a horizontal one," including the location of the bladder, whose more horizontal-friendly posture gave men urinary tract stones. Perhaps, Darwin continued, over time monkeys "acquired clear ideas, and gradually became men."[155] (If so, this progressive, transformist account of mankind implied that there was hope yet for the philosopher's (urinary) stone.)

Darwin adapted one of the central arguments of social contract theorists concerning man's core preoccupations in the so-called "state of nature"—namely, compassion for others and a

---

152 Marc J. Ratcliff, *The Quest for the Invisible: Microscopy in the Enlightenment* (New York: Routledge Publishing, 2016), 184, 191. See also August Johann Rösel von Rosenhof, "Die Historie der Polypen der süssen Wasser und anderer kleiner Wasserinsecten heisiges Landes," in *Der monatlich-herausgegebenen Insecten-Belüstigung*, 3 (1755): 433–624. Proteus also appeared in the name of a European, cave-dwelling amphibian, *Proteus anguinus*, which some naturalists theorized might occupy a place on the Chain of Being linking fish and reptiles. For an interesting look at the history of *Proteus anguinus*, see Johannes Mattes, "Traveling Olms: Local and Global Perspectives on the Research on Proteus anguinus (1700–1930)," in *The scientific dialogue linking America, Asia and Europe between the 12th and the 20th Century*, edited by Fabio D'Angelo (Naples: Associazione culturale Viaggiatori, 2018).

153 See Darwin, *Progress of Society* (draft poem, ca. 1798/99), Canto I, lines 83–84, printed in Priestman, *Poetry of Erasmus Darwin*, Appendix A, 264.

154 Darwin, *Temple of Nature*, Canto I, 18–38, lines 219–420.

155 Darwin, *Temple of Nature*, Canto II, 53–54, note to line 122.

concern for self-preservation—to suggest that something like his universal principle of divine Love was the catalyst for the emergence of human society, just as it catalyzed couplings, births, and ultimately transformations in other natural domains. "Love and Sympathy," he wrote, motivated man through a desire for pleasure and an aversion to pain, thus ultimately serving to "weave the social plan, / And charm the listening Savage into Man."[156] The development of sentimental love, personified by Eros (the same figure of Divine Love who vivified Darwin's accounts of the transformations of the inorganic world and of the loves of plants and animals), played a central role in the formation of the first basic human societies. "O'er female hearts with chaste seduction reigns," wrote Darwin, "And binds SOCIETY in silken chains."[157] Here he specifically invoked Adam Smith's explanation of human sympathy.[158] From spontaneous vocalizations of strong, passionate emotion, language emerged—an argument reminiscent of Rousseau, whose acquaintance Darwin pursued.[159] (His grandson Charles Darwin asserted that Rousseau and Erasmus Darwin had corresponded for a time, but that none of the letters survived.[160]) Sympathy for others balanced man's "selfish heart," giving rise to morality and to human society ("From heaven, [Sympathy] cried, descends the moral plan, / And gives Society to savage man").[161]

In *The Temple of Nature* Darwin divided human history into five ages—four gone, one incipient—each of the first four in certain (but not all) regards better than what came before: an age of hunting, an age of pasturage, an age of agriculture, and an age of commerce.[162] A stadial historical account of human society was of course not unique to Darwin. His first four "ages" were very similar to those of other eighteenth-century authors, including Turgot (*Plan of Two Discourses on Universal History* and "On Political Geography," 1750s), Rousseau (*Discourse on Inequality*, 1755) and Adam Smith (*On the Wealth of Nations*, 1776; Smith had already been lecturing on the subject for decades). Darwin's fifth, incipient age was an age of philosophy, peace, and the fruits of social reform, in which the problems of the previous ages were finally resolved.

Darwin presented each new age of human history as a birth of Protean Time, placing its changes within his universal framework of transformation.[163] He did not delve further into the nature of each age and the transformations between them in *The Temple of Nature*, however. His failing health (he died in 1802) may have influenced the length and content of the poem, which was published posthumously from his manuscripts in 1803. The political and social climate of fear in Britain in the wake of the French Revolution may also have figured into his calculus. He was known as a supporter of revolutions, which he presented in *The Botanic Garden* as an oft-necessary spur to social transformation. An unpublished partial draft poem by Darwin—*The Temple of*

156 Darwin, *Temple of Nature*, Canto I, 18, lines 219–22.

157 Darwin, *Temple of Nature*, Canto III, 98–100, lines 176–206.

158 Darwin, *Temple of Nature*, Canto III, 122–23, note to line 466.

159 Darwin, *Temple of Nature*, Canto III, 112–15, lines 339–80 and footnotes to lines 342 and 371.

160 Desmond King-Hele, ed., *Charles Darwin's 'The Life of Erasmus Darwin'* (Cambridge: Cambridge University Press, 2003), 47.

161 Darwin, *Temple of Nature*, Canto III, 123–24, lines 467–84.

162 See Darwin, *Temple of Nature*, Table of Contents ("Four past Ages, a fifth beginning"); Preface ("as in the ages of hunting, pasturage, and agriculture"); and p. 3 Canto I, lines 9–10 ("Four past eventful Ages then recite, / And give the fifth, new-born of Time, to light").

163 "Four past eventful Ages then recite, / And give the fifth, new-born of Time, to light; / The silken tissue of their joys disclose, / Swell with deep chords the murmur of their woes; / Their laws, their labours, and their loves proclaim, / And chant their virtues to the trump of Fame." From Darwin, *Temple of Nature*, Canto I, 3–4, lines 9–14.

Nature, or, The Progress of Society, A Poem in Five Cantos (c. 1798/99)—overlaps significantly with the beginning of the published *Temple of Nature*, and may indicate that Darwin initially intended to pen a comprehensive account of humanity's origins *and* its progressive, stadial history, with each age corresponding to a canto.[164]

The completed fragments of the earlier draft poem suggest that he viewed the progressive development of human knowledge and skill, particularly as manifest in discoveries (such as fire) and technologies (such as the ax), as a significant driving factor in the transformations of human society.[165] Social needs, like an organism's needs for survival, thereby served as a mechanism of change. Yet it is also clear that he saw in each age's moral transformations a litany of deepening sins—slavery in the age of agriculture becoming the slave trade in the age of commerce, for example, or the tools of the former becoming the manufactures, wealth, and luxury of the latter, where "gold triumphant rules the world enslaved"—thus complicating his progressive world view *and* the potential argument that improvements in knowledge and technology were driving a thoroughly progressive process of transformation.[166] True resolution of these moral and social woes was only achieved in his fifth Age of Philosophy. This was a world of "science," philosophy, peace, "no crime," liberty, and "Elements subdued," a "Moral world" in which humanity "Love each other."[167] Darwin placed the Age of Philosophy at the center of a physical Temple of Nature in the poem outline. This decision, as Martin Priestman observes, suggests that Darwin viewed the first four ages as painful steps toward the realization of natural laws that were only truly manifest in human society through natural philosophical progress culminating in the Age of Philosophy.[168]

WHY BEGIN AT THE BEGINNING?

Why did Darwin feel he needed to reach back to the beginning of time to present an argument for the origins of human society? To be sure, in the context of the narrative structure of *The Temple of Nature* the birth of the universe was, technically speaking, the ultimate origin of society. Darwin wrote that part of the purpose of *The Temple of Nature* was to bring "distinctly to the imagination the beautiful and sublime images of the operations of Nature in the order, as the Author believes, in which the progressive course of time presented them."[169] A cosmic approach made

---

164 Thanks to the scholarship of Martin Priestman, Darwin's draft poem and related manuscript content are available to scholars in print, with annotations. Priestman, *Poetry of Erasmus Darwin*, Appendix A, 259–82. Priestman speculates that Darwin may have abandoned the draft poem due to uncertainty as to how to handle the increasingly dark side of each of his ages. Priestman, *Poetry of Erasmus Darwin*, 275, footnote 61.

165 These fragments are quite incomplete, briefly covering the age of hunting (which he associated with the discovery of fire and the development of skills in making nets, canoes, clubs, and jasper-axes), part of a canto on the age of pasturage (animal husbandry, tent societies, and the invention of writing, music, astronomy, love poems, wheeled carriages, government, religion, property, clothing, war, famine), and outline fragments on the ages of agriculture (iron, tools, cities, spinning, weaving, slavery, literature), commerce (money, manufactures, glass, printing, compass, navigation, luxury, sugar, the slave trade, and the "spirit of wine"), and philosophy (knowledge, science, peace, "love each other," a moral world, "no crime," liberty, "elements subdued," and "Every man under his fig tree."). Erasmus Darwin, "The Progress of Society" (draft poem fragments and poem outline, c. 1798/99), in Priestman, *Poetry of Erasmus Darwin*, 267–82.

166 See Martin Priestman's excellent editorial analysis of "The Progress of Society" in Priestman, *Poetry of Erasmus Darwin*, 259–82.

167 Erasmus Darwin, "The Progress of Society" (draft poem, c. 1798/99), in Martin Priestman, *Poetry of Erasmus Darwin*, 281–82.

168 See Priestman, *Poetry of Erasmus Darwin*, 282, footnote 89.

169 Darwin, *Temple of Nature*, Preface, 1.

sense in light of the way in which he understood the universe as an organic entity, and nature's history, including human history, as a kind of nervous system of transformations through time: to understand one such phenomenon required understanding its relationship to the origins of all such impulses in the cosmic brain.[170] As this essay demonstrates, Darwin also used the juxtaposition of the origin and transformations of the universe, of its inorganic and organic parts, and the origin and transformations of humanity itself to highlight the interconnected nature of phenomena (see § "The Whole Family is of One Parent") and the way in which his concept of "Divine Love" or Eros catalyzed all of its transformations.

Critically, Darwin's universal transformist schema also served to render his own social reform agenda, including his support for the tumultuous transformations of the French and American Revolutions, in terms of a universal natural order.[171] By imbuing revolution and radical reform with the vital, transformist energy of the universe writ large, they became seemingly inevitable products of the passage of Protean Time. Nature was everywhere transitioning toward a future form, and the social world was no exception.

Darwin took advantage of the possibilities of poetry to position his political commitments within the progressive arc of this changeful universe. Parallel constructions in poetic passages on cosmos and politics suggested that the political order mirrored the cosmic one. Just as the heavenly "systems systems crush," so too, in the image of one bloody desert battle, did "nations nations crush" ("Swords clash with swords, on horses horses rush, / Man tramples man, and nations nations crush…"[172]). In both cases, death led to transformation into new life from the chaotic, elemental ashes of the old. Darwin juxtaposed the destruction of nations with the violence of the wolf or eagle, the shark, the wars of the vegetable kingdom, and the violent actions of the earth itself, such as volcanos, earthquakes, and famines.[173] These were no mere abstractions: Darwin made his support for the American and French Revolutions clear on both the pages of his books and those of his personal correspondence. "I find myself becoming all french in politics and chemistry," he wrote to his friend James Watt (1736–1819) in 1790.[174]

In *The Botanic Garden*, Darwin connected the American revolutionary Benjamin Franklin's command of the electrical fluid—which Darwin associated with the vital essence of the universe and of life within it—to the American statesman's revolutionary activities and the spread of liberty on earth. "The patriot-flame with quick contagion ran, / Hill lighted hill, and man electrified man; / Her heroes slain awhile COLUMBIA mourn'd, / And crown'd with laurels Liberty returned," he wrote.[175] This electric impulse of liberty, argued Darwin, had also stirred a slumbering Giant on Gallia's plains (France), whose calls to rouse "the Good and Brave" to battle (the

---

170 It was an alternative to the religiously orthodox story of the origin of society beginning with Eve and Adam in the Garden of Eden, one that still grounded humanity's origin story in the original agency of a Divine Mind. See Priestman, *Poetry of Erasmus Darwin*, 263, footnote 12.

171 Eileen McGinnis observes the way in which a progressive evolutionary theory, such as those preceding Charles Darwin, "traces a movement from simplicity to ever-greater complexity, based on the unfolding of natural law. As such, it is considerably more expansive than species evolution, also incorporating hypotheses about cosmic change, embryonic development, and even political and social reform." Eileen McGinnis, "'Change Irreverent': Evolution and Faith in 'The Encantadas' and *Clarel*," in Jonathan A. Cook and Brian Yothers, eds., *Visionary of the World: Melville and Religion* (Evanston, IL: Northwestern University Press, 2017), 72.

172 Darwin, *Temple of Nature*, Canto IV, 130, lines 13–14.

173 Darwin, *Botanic Garden* (Part I), Canto IV, 191, line 374 and Canto II, 101, line 492.

174 Erasmus Darwin to James Watt, Letter, 19 January 1790. In King-Hele, *Letters of Erasmus Darwin*, 358–9.

175 Darwin, *Botanic Garden* (Part I), Canto II, 91, 367–70.

French Revolution) reverberated "Like Heaven's own thunder," a consequence of and counterpart to Franklin's mastery of the lightning of nature and of liberty. To Franklin himself Darwin wrote with complete sincerity, "I am also writing to the greatest Statesman of the present, or perhaps of any century, who spread the happy contagion of Liberty among his countrymen; and like the greatest Man of all antiquity, the Leader of the Jews, deliver'd them from the house of bondage, and the scourge of oppression."[176]

When *The Botanic Garden* first appeared in 1792, it initially met with a rapturous public response and rapidly became the most popular poem in England.[177] Horace Walpole, Whig politician and doyen of literary taste, declared Darwin a sublime poet, praising *The Botanic Garden* as a work of exceptional beauty. Walpole found "the twelve verses that by miracle describe and comprehend the creation of the universe out of chaos" to be "the most sublime passage in any author, or in any of the few languages with which I am acquainted."[178] Darwin's time atop the British literary establishment was dazzling but brief, however. The years following publication of *The Botanic Garden* corresponded to the bloodiest developments of the French Revolution, the French declaration of war with Britain in 1793, and the early Napoleonic period, with dire consequences for the public reception of Darwin's poetry and ideas.

It didn't help his cause that his political engagement extended firmly beyond the pages of his poetry and prose. Darwin co-founded the Derby Society for Political Information, which presented a document to the French National Assembly that demanded the vote for all adult males. When it was reprinted by the editors of London's *Morning Chronicle*, a scandal ensued, and Darwin narrowly escaped more serious consequences.[179] His publisher, Joseph Johnson, was not so lucky. He went to prison for publishing radical material in 1799.[180]

In light of such developments, Darwin's arguments in favor of revolution and reform now struck some apprehensive countrymen as the words of a possible British revolutionary. Darwin felt the pressure of critical political and religious forces intensifying. "I have a profess'd spy shoulders us on the right, and another on the opposite side of the street, both attornies!" he wrote to Richard Edgeworth, a member of the Lunar Society, in 1795, "and I hear every name supposed to think different from the minister is put in alphabetical order in Mr Reeve's doomsday book, and that if the French should land these recorded gentlemen are to be all imprison'd to prevent them from committing crimes of a deeper dye. Poor Wedgwood told me he heard his name stood high in the list."[181] Mr. Reeve was John Reeves, FRS, who a couple years earlier had organized the Association for Preserving Liberty and Property against Levellers and Republicans, which maintained a network of informants.

It is no surprise that Darwin attracted the attention of Reeves and his ilk. In his writings Darwin seemed to openly champion violence in service of the public good gained by overthrowing unjust governments. The discovery of gunpowder, he wrote in a footnote to *The Botanic Garden*, was "of public utility, by weakening the tyranny of the few over the many."[182] Indeed,

---

176 Erasmus Darwin to Benjamin Franklin, Letter, 29 May 1787. In King-Hele, *Letters of Erasmus Darwin*, 166.

177 King-Hele, *Erasmus Darwin and the Romantic Poets*, 19.

178 Horace Walpole to Thomas Barrett, Letter, 14 May 1792. In *Private Correspondence of Horace Walpole, Earl of Orford,* Vol. 4 (London: Rodwell and Martin, 1820), 519.

179 Fara, *Erasmus Darwin*, 14.

180 Carol Hall, 'Johnson, Joseph (1738–1809),' *Oxford Dictionary of National Biography* (Oxford University Press, 2004).

181 Erasmus Darwin to Richard Edgeworth, Letter, 15 March 1795. In King-Hele, *Letters of Erasmus Darwin*, 279.

182 Darwin, *Botanic Garden* (Part I), Canto I, 25, note to line 242.

gunpowder appeared throughout *The Botanic Garden* as the great leveler of men and an explosive catalyst of social reform, capable of toppling monarchs from their blood-soaked thrones.

Darwin used gunpowder in his poetry to suggest that the explosive transformations wrought by revolution and reform were analogous to, and therefore sanctioned by, the larger order of progressively transforming nature. Darwin compared gunpowder to the seed of stars and worlds, and to the moment of creation itself, when Darwin believed that "the whole of Chaos, like grains of gunpowder, was exploded at the same time."[183] Both the universe and revolutions proceeded from explosive chaos.

Political upheaval, particularly revolution, was understood by many of Darwin's contemporaries who lived through or were the product of revolutionary times as a kind of chaos charged with internal creative or transformative possibilities—for better or for worse. "On the 4th of July, 1776, a phenomenon in politics appeared, which challenges a parallel in the annals of the world," the American Federalist John Lathrop Jr. declared, "A nation by her own *fiat* sprang from chaos and night, into the full vigor of life, and the unbounded splendor of the day." Lathrop Jr., the son of the American Revolutionary patriot John Lathrop Sr., delivered his message on the internally driven generation of the United States from revolutionary chaos to "boundless applause" from a pro-federalist crowd assembled in Dedham, Massachusetts, in 1798.[184] Though a supporter of the American Revolution, Edmund Burke framed the French Revolution in negative terms as a set of political transformations taking place through "chaos and darkness," through and from which the essence of the French people was transmigrating into a new form. "The French may be yet to go through more transmigrations," he wrote to a young French correspondent. "They may pass, as one of our poets says, 'through many varieties of untried being', before their state obtains its final form."[185]

In the public mind in Britain the potentially explosive chaos of violent revolution, particularly as embodied by gunpowder, was connected to a perceived threat to British liberty and society in an even more specific way. Gunpowder was associated with Darwin's friend Joseph Priestley's non-conformist religious agenda and political radicalism thanks to Priestley's publication of *The Importance and Extent of Free Enquiry* under their shared publisher Joseph Johnson's imprint in 1785. In an infamous passage, Priestley claimed that the Protestant Reformation had failed in its efforts at reform, and suggested that nonconformists might lay seeds of gunpowder for the explosive destruction of the religious status quo:

> The present silent propagation of truth [Unitarianism] may even be compared to those causes in nature, which lie dormant for a time, but which, in proper circumstances, act with the greatest violence. We are, as it were, laying gunpowder, grain by grain, under the old building of error and superstition, which a single spark may hereafter inflame, so as to produce an

---

183 Darwin, *Botanic Garden* (Part I), Canto I, 9, note to line 105.

184 John Lathrop, Jr., *An Oration, pronounced on the 4th day of July, 1798, at the request of a number of the inhabitants of Dedham and its Vicinity, in Commemoration of the Anniversary of American Independence* (Dedham: Minerva Press, 1798), 6. On the reaction to the speech, which championed federalism, see quotations from *The Columbian Centinel* of July 7, 1798 in Charles Warren, "Fourth of July Myths," *The William and Mary Quarterly* No. 3 (July 1945): 237–72, at 262.

185 Edmund Burke to Pierre Gaëton Dupont, letter, October 1789. From the Electronic Enlightenment Scholarly Edition of Correspondence, ed. Robert McNamee et al. Vers. 3.0. Oxford: University of Oxford, 2018. Web. 7 Dec. 2019. <https://doi.org/10.13051/ee:doc/burkedOU0010266a1c>. The "poet" in question was very likely Joseph Addison, in whose play *Cato: A Tragedy* the titular character sat with a copy of Plato's *Book on the Immortality of the Soul* in hand, contemplating mortality and asking "Through what Variety of untry'd Being" the human soul must pass. Joseph Addison, *Cato: A Tragedy* Act V, Scene 1 (London: J. & R. Tonson, 1765 (1712)), 66.

> instantaneous explosion; in consequence of which that edifice, the erection of which has been the work of ages, may be overturned in a moment, and so effectually as that the same foundation can never be built upon again.[186]

It was this threatening idea that the satirist Isaac Cruikshank portrayed in his cartoon "The Friends of the People" in 1792 (**FIGURE 2**). Priestley became known as "Gunpowder Joe," and many, including William Pitt's government, took his gunpowder statement as evidence that he and other dissenters wished to overthrow the government.

Where for Priestley the potential for religious reform was embedded like grains of gunpowder in the fabric of society, for Darwin, the vital essence of the cosmos itself behaved like gunpowder at critical junctures of transformation, powering the reproductive potential of the seed or egg and the reforming potential of human societies within the progressive arc of the cosmological system as a whole. It was from this perspective that Darwin's argument implied that reformers—indeed, political radicals like himself—were secure in their inevitable triumph, and in a real sense more advanced than their counterparts.

FIGURE 2. Isaac Cruikshank, "The Friends of the People" (London, 1792). Courtesy of the Science History Institute. Here, Joseph Priestley (L) and Thomas Paine (R) conspire under the watchful eye of a demon. A noose, knives, and guns (one labeled "Royal Electric fluid") litter the table; beneath are casks of gunpowder and packets of brimstone. The plotters are buttressed by select reading in "rebellion," "villany [sic] triumphant," "downfall of royalty," Paine's "Common Sense," "plots," "treasons," "conspiracys" [sic], "Revolutions," and other dastardly designs.

186 Joseph Priestley, *The importance and extent of free inquiry in matters of religion: A sermon, preached before the Congregations of the Old and New Meeting of Protestant Dissenters at Birmingham. November 5, 1785* (Birmingham: M. Swinney; for J. Johnson, 1785), 40–1.

As a member of the Lunar Society of Birmingham, and a close friend of many prominent industrialists, Darwin was immersed in a swirl of new discoveries in natural philosophy, new advances in industry, and new projects of social reform, all of which created a sense that *progress* was indeed an inherent principle in the order of nature. Darwin viewed industrial progress as another example of nature's tendency toward progress more generally, rendering invisible the human labor and suffering associated with industry.[187] His friend Josiah Wedgwood, for example, was a notorious disciplinarian, who declared that he wanted to "make such *machines* of the *Men* as cannot err," and who bragged that his workers were "frighten'd out of their wits when they hear of Mr W. coming to town, & I perceive upon our first meeting they look as if they saw the Devil."[188] In *The Botanic Garden*, however, Wedgwood appeared in heroic form, presiding benevolently over the fire-nymphs.[189] Darwin's blindness to suffering in the factories of his friends is particularly striking in light of his work as a doctor and the association he made in *The Botanic Garden* and his draft poem *The Progress of Society* between commerce, manufacture, luxury, and the evils of slavery and colonialism.

Natural philosophical discoveries, technical innovations, and explosive revolutions were not the only transformative processes at work in human society: projects of reform, the products of enlightened philosophy, were transmuting the social world as well. Darwin actively championed anti-slavery reforms, using his narrative of stadial historical transformation to present slavery as a human practice condemned to the middle ages of man, particularly the current commercial age, whose corrosive wealth and luxury encouraged and built itself upon the slave trade: "The whip, the sting, the spur, the fiery brand, / And, cursed Slavery! thy iron hand; / And led by Luxury Disease's trains, / Load human life with unextinguish'd pains."[190] The destruction of the institution of slavery, he believed, would be a consequence of the progressive transformation of human society into an age of enlightened philosophy. Nevertheless, this development required individuals to *act* deliberately on knowledge and conscience. Darwin addressed lawmakers directly, invoking the voice of "Inexorable Conscience" to speak "in thunder" to them. "*Hear him*, ye Senates! hear this truth sublime, / 'HE, WHO ALLOWS OPPRESSION, SHARES THE CRIME.'"[191]

The acid effects of avarice in the Age of Commerce had also unleashed brutal regimes of colonialism. Spain's "deathless shame" was its colonial presence in the Americas. "When Avarice, shrouded in Religion's robe, / Sail'd to the West, and slaughter'd half the globe; / While Superstition, stalking by his side, / Mock'd the loud groans, and lap'd the bloody tide." Britain, "potent Queen of isles," was no less complicit: "Now Afric's coasts thy craftier sons invade / With murder, rapine, theft,—and call it Trade!" Darwin juxtaposed this injustice—the pain of the enslaved, the violence of their circumstances—with an image of the justice of heaven smiting "the blood-nursed Tyrant on his purple throne," thus connecting Darwin's revolutionary rhetoric to his call for anti-colonial and anti-slavery reforms.[192]

---

187 Page, *Literary Imagination*, 32.

188 As quoted in Neil McKendrick, "Josiah Wedgwood and Factory Discipline," *The Historical Journal*, Vol. 4 No. 1 (1961): 30–55, at 34; and Alfred Rupert Hall, "Homo Fabricator: A New Species," *History and Philosophy of the Life Sciences*, Vol. 2 No. 2 (1980): 193-214, at 201.

189 Darwin, *Botanic Garden* (Part I), Canto II, 86–89.

190 Darwin, *Temple of Nature*, Canto IV, 136, lines 73–76.

191 Darwin, *Botanic Garden* (Part II, 1789), Canto III, 117, lines 387–88.

192 Darwin, *Botanic Garden* (Part I), Canto II, 95–96, lines 413–34.

From humanity's relationship with primates, to the dawn of a new age of human history in which monarchs were leveled to the stature of ordinary men, Darwin's natural system clearly pointed to the idea that a kind of ultimate existential equality was part of the basic order of nature. In nature even mushrooms and monarchs were, as we've seen, ultimately equal in their material essence: both were eventually the food of insects and plants. Darwin chastised his reader to regard with tenderness his "brother-emmets, and his sister worms."[193] Emmets, worms, mushrooms, monarchs, and every other living being were leveled, in a sense, by their common obedience to natural law. Even human society was no unique thing. Other living creatures also formed societies, Darwin suggested, and progressed through improvements in arts and the increase of knowledge. Accordingly, he observed that "many insects" had "wonderful ingenuity so as to equal or even excel mankind in some of their arts and discoveries; many of which may have been acquired in situations previous to their present ones, as the great globe itself, and all that it inhabit, appear to be in a perpetual state of mutation and improvement."[194]

A UNIVERSE OF DEATH AND LIFE: THE VIRTUOUS SPIRAL

In Darwin's account, both human history and natural history were bloody arenas of conflict and death. His own experience as a doctor was saturated with the material realities of the human body and its disorders, degeneration, and death. Decay, suffering, and violence appeared to be part of the order of the universe. But how to reconcile these facts with his vision of a universe of overall progress and felicity? He turned to this problem in the fourth canto of *The Temple of Nature*, where he described predators mercilessly consuming their prey, males fiercely competing with other males for mates, while "in the waves beneath" swam "the grim monarch of insatiate Death," the shark, who preyed on schools of fish, even as his colleagues the whales devoured "shoals at a gulp." Humans, too, participated in a struggle for existence, as he had amply illustrated in the bloody human battles of *The Botanic Garden*. "Eat or be eaten," he warned his medical patients.[195] Just as death inevitably came for plants, animals, humans, and nations, in the heavens starry systems withered and died. There was something disturbing about Herschel's dynamic theories of nebulae, stars, and planets, especially in Darwin's telling: celestial systems seemed ultimately bent on mutual destruction.

The earth itself would not escape a similar fate. The size of the globe and the number of living things upon it would keep increasing in a feedback loop, Darwin wrote in a footnote to the fourth canto of *The Temple of Nature*, until someday "the whole terraqueous sphere, and all that inhabit it shall dissolve by a general conflagration, and be again reduced to their elements. Thus all the suns, and the planets, which circle round them, may again sink into one central chaos; and may again by explosions produce a new world; which in process of time may resemble the present one, and at length again undergo the same catastrophe! these great events may be the result of the immutable laws impressed on matter by the Great Cause of Causes, Parent of Parents, Ens Entium!"[196] In the poem, Darwin turned once again to his muse Urania. Proceeding to the temple of nature, Urania and those assembled once more raised their voices, renewing the story with which *The Temple of Nature* began, of how Love kindled suns from chaos, produced planets,

---

193 Darwin, *Temple of Nature*, Canto IV, 163, line 428.

194 Darwin, *Temple of Nature*, Canto III, 118–19, note to line 411. See also Additional Notes, 39–41.

195 King-Hele, *Erasmus Darwin*, 91.

196 Darwin, *Temple of Nature*, Canto IV, 166–67, note to line 453.

developed the earth, and propelled the emergence of life upon its surface. The cycle of death and phoenix-like renewal applied to the universe as a whole. Their song concluded with celestial love, the rewards awaiting man after death, and the toppling, on earth, of tyrannical governance.[197] This marked the end of *The Temple of Nature*.

In the big picture, Darwin argued, nature's violent competitions and even death itself played an important role in maintaining the progress and felicity of the whole. He countered the horror of death by framing every death as a step toward renewal and progressive transformation. "When we reflect on the perpetual destruction of organic life," he wrote in a footnote, "we should also recollect, that it is perpetually renewed in other forms by the same materials, and thus the sum total of the happiness of the world continues undiminished; and that a philosopher may thus smile again on turning his eyes from the coffins of nature to her cradles."[198] Death, for Darwin as for many Romantics, was a phase in the grander, constant becoming of life.[199] Over long periods of time death made way for life's overall progressive transformations. The death of weaker, less successful creatures paved the way for the improvement and transformation of species. His Urania concluded with the idea that Love, as represented by Eros or reproduction, "conquers Time," the ever-changeful Proteus.[200]

It was a paradoxical image: in Darwin's view, Love conquered time by effecting the phoenix-like renewal of dead nature into new life through reproduction, and yet it was precisely the process of renewal that he argued served as the driving force behind nature's transformations through changeful Time. Darwin recruited the Apostle Paul's triumphant speech ("oh death where is thy sting") as an ode to nature's phoenix-like renovations; probably not exactly what Paul had in mind, yet it spoke to the spiritually transformist principle at the heart of Christianity.[201]

Indeed, death was not simply central to Darwin's account of the transformations of the heavens and life on earth: its spiritual possibilities were a source of inspiration for his concept of the transformation of species through the action of "acquired habits or propensities."[202] Contemporary Christianity already had a model of transformation in place, namely the transformation of each human from a gross physical body into some kind of refined spiritual existence

---

197 Darwin, *Temple of Nature*, Canto IV, 167–171.

198 Darwin, *Temple of Nature*, Canto I, 12, note to line 126. See also *Temple of Nature*, Canto II, 46, lines 41–44. Darwin was fascinated by the "perpetual mutability of the forms of matter," and he was careful to note in both the poem's text and a footnote that ancient philosophers were struck by the same fact. He cited Pythagoras' transmigration, and Pythagoras' conclusion that a "vivifying spirit" attended organic matter. See *Temple of Nature*, Canto II, 46, note to line 43, and page 47, lines 45–47. For the circular fortunes of matter, see also Canto II, 47, note to line 47, where Darwin discusses Egyptian myths of revival, and even observes that the "fable of Adonis seems to have given origin to the first religion promising a resurrection from the dead" (Ibid.).

199 "Romantic nature is a cultural account of the biological order of things," observes Jerome McGann. "The 'meaning' it ascribes to this order is perpetual development and growth: in Wordsworth's classic formulation, 'something evermore about to be.' Such a vision translates 'death' back into a phase or moment of a benevolent or splendid process of life." Jerome McGann, "Rethinking Romanticism," *ELH* Vol. 59, No. 3 (Autumn, 1992): 735–54, at 747.

200 On love conquering time, see Darwin, *Temple of Nature*, Canto I, 39, lines 443–50. Of Proteus, Darwin wrote that his primary feature was that his "form was perpetually changing," and that he "could discover the past events of the world, and predict the future." Darwin, *Temple of Nature*, Canto I, 9, lines 80–88 and note to line 83.

201 Darwin, *Temple of Nature*, Canto IV, 161, lines 403–4.

202 Darwin, *Zoonomia*, Vol. 1, 480. "Owing to the imperfection of language the offspring is termed a new animal, but is in truth a branch or elongation of the parent, since a part of the embryon-animal is, or was, a part of the parent, and therefore in strict language, cannot be said to be entirely new at the time of its production; and, therefore, it may retain some of the habits of the parent system." Ibid.

after death. In the eighteenth century this phenomenon was usually considered a one-time event—a single catastrophe known as death, rather than a stage in a gradual movement of species up a chain of existence. As a transformation from the material to the immaterial, many natural philosophers considered its mysteries outside the scope of natural philosophy. This attitude was not universal, however. One of the exceptions was David Hartley, who advanced the idea that there was continuity between matter (both inert and living) and spirit.[203] (Similar concepts appeared in d'Holbach's *Système de la Nature, ou des lois du monde physique et du monde morale* (1770) and in Darwin's friend Joseph Priestley's *Disquisition Relating to Matter and Spirit* (1777).[204]) Darwin specifically cited Hartley's idea of spiritual and material continuity as a source of inspiration for his theory of the transformation of species through so-called acquired habits or propensities. "The ingenious Dr. Hartley in his work on man, and some other philosophers, have been of opinion, that our immortal part acquires during this life certain habits of action or of sentiment, which become for ever indissoluble, continuing after death in a future state of existence; and add, that if these habits are of the malevolent kind, they must render the possessor miserable even in Heaven," Darwin wrote. "I would apply this ingenious idea to the generation or production of the embryon, or new animal, which partakes so much of the form and propensities of the parent."[205] Over time, small changes acquired by the parent and inherited by the offspring could culminate in the transformation of species, just as Hartley's human soul was fundamentally altered by its time on earth.[206]

ERASMUS DARWIN, ENLIGHTENED ROMANTIC

Erasmus Darwin's fall from public favor is often explained not only by the increase in political suspicion associated with the violent turn of the French Revolution, but also by the rise of the English Romantics, who brushed aside Darwin's flowery poetry in favor of fresher words by Coleridge, Wordsworth, and others. "I absolutely nauseate Darwin's poem," Samuel Taylor Coleridge (1772–1834) famously sniffed.[207] Coleridge and Wordsworth took particular aim at the "gaudiness and inane phraseology" of contemporary writers (including, and perhaps particularly, Darwin) in the "Advertisement" to their *Lyrical Ballads* (1798), which is taken by many literary scholars to mark the beginning of English Romanticism.[208]

Because the rise of Romanticism in this framing is almost mechanically connected to Darwin's descent—and because Romanticism is most strongly associated with a much younger generation of poets—Darwin himself sometimes seems definitionally excluded. Though many scholars have illuminated the extent to which he was an important source for central figures

---

203 David Hartley, *Observations on Man, His Frame, His Duty, and His Expectations*, Vol. I (London: S. Richardson, 1749), 294–95.

204 See Valsania, "'Another and the Same': Nature and Human Beings in Erasmus Darwin's Doctrines of Love and Imagination," in Smith and Arnott, *The Genius of Erasmus Darwin*, 342.

205 Darwin, *Zoonomia*, Vol. 1, Section XXXIX ("Generation"), 480.

206 For Darwin's extended discussion of the small but cumulatively substantial changes wrought by inheritance, see Darwin, *Zoonomia*, Vol. 1, Section XXXIX ("Generation").

207 Samuel Taylor Coleridge to John Thelwall, Letter, 13 May 1796. From Earl Leslie Griggs, ed., *The Collected Letters of Samuel Taylor Coleridge*, Vol. I (London: Oxford University Press, 1956), 215–16.

208 [Samuel Taylor Coleridge and William Wordsworth], *Lyrical Ballads* (London: J. & A. Arch, 1798), i–ii. Wordsworth and Coleridge held generally positive views of Darwin in the early 1790s, but later cooled toward him. See Desmond King-Hele, Chapter 3 ("Prologue: Catching Up with Erasmus Darwin in the New Century") in Smith and Arnott, eds., *The Genius of Erasmus Darwin*, 22.

of English Romanticism, many nonetheless still position Darwin as a precursor or foil to Romanticism rather than a figure Romantic in his own right. "Darwin's work precisely coincides with the time-frame of early Romanticism," notes Martin Priestman, "which has only been able to absorb it negatively, as a dreadful example of how not to write."[209] As this observation suggests, Darwin's poetic style has played a central role in the way in which he has been interpreted relative to Romanticism. Darwin's style was memorably dismissed by Romantics from the devastatingly satirical Byron ("in flimsy Darwin's pompous chime, / That mighty master of unmeaning rhyme") to dismissive Goethe (a "pile-up of textual features").[210] Furthermore, harsh criticisms of Darwin by English Romantics like Coleridge have helped to exclude Darwin from their ranks in our retrospective view, relegating him to the status of precursor or inspiration at best. Yet criticism of Darwin's poetry is not sufficiently diagnostic, and certainly not so for any consideration of Romanticism beyond the boundaries of literary style. After all, even as Coleridge found significant ideas to embrace in German philosophy, he also acrimoniously declared much of the work of German Romantic philosophers "unintelligible" and "more unsatisfactory."[211]

Central elements of Darwin's perspective on nature were unmistakably oriented toward preoccupations that historians associate with the Enlightenment, including—but not limited to—his enthusiasm for taxonomy, easy-going Deism, features of his aesthetic, and his ornate and neoclassical style of poetry.[212] Yet an association with Enlightenment currents does not preclude a strong association with Romanticism, as well.[213] A curious but not altogether surprising division along Enlightenment and Romantic lines emerges from the corpus of Erasmus Darwin scholarship. Romantic scholars, particularly in literary fields, increasingly (though by no means universally) see him as a Romantic figure: an idea considered so unremarkable in the most recent such texts as to occasion no argument defending his identification as such. In Enlightenment scholarship, by contrast, scholars have tended to associate him with the Enlightenment (indeed, for some, Darwin's identification as such is important to the argument that there was a British Enlightenment).[214] The range of viewpoints on Erasmus Darwin's position relative to these categories by superb scholars across fields points toward the value of taking both perspectives on

---

209 Priestman, *The Poetry of Erasmus Darwin*, 12.

210 On Goethe's reaction to, and inspiration from, Erasmus Darwin, see Ann Shteir, "'She comes! – the GODDESS!': Narrating Nature in Erasmus Darwin's *The Botanic Garden*," in Christine Lehleiter, ed., *Fact and Fiction: Literary and Scientific Cultures in Germany and Britain* (Toronto: University of Toronto Press, 2016), 15. On Byron, see George Gordon, Lord Byron, *Poetical Works*, 3rd ed., F. Page, ed., corrected by J. Jump (London: Oxford University Press, 1970), 891–903.

211 Samuel Taylor Coleridge to J.H. Green, Letter, 13 December 1817. From Ernest Hartley Coleridge, *Letters of Samuel Taylor Coleridge*, Vol. II (London: William Heinemann, 1895), 681.

212 For an engaging analysis of Darwin as an Enlightenment figure—indeed, as a figure critical to bolstering the idea that there was a British Enlightenment to begin with—see Priestman, *Poetry of Erasmus Darwin*, 7–10.

213 For an analysis of the relationship between Erasmus Darwin and the Romantic poets, see King-Hele, *Erasmus Darwin and the Romantic Poets*.

214 For perspectives on Erasmus Darwin as an **Enlightenment** figure, see, for example, Fara, *Erasmus Darwin: Sex, Science, and Serendipity*; Catherine Packham, *Eighteenth-Century Vitalism: Bodies, Culture, Politics* (Basingstoke: Palgrave Macmillan, 2012); Roy Porter, *The Creation of the Modern World: The Untold Story of the British Enlightenment* (New York: W.W. Norton & Company, 2001 (2000)), particularly 443–45; and Priestman, *Poetry of Erasmus Darwin*. For perspectives on Erasmus Darwin as a **Romantic** figure, see Hermione de Almeida, *Romantic Medicine and John Keats* (New York: Oxford University Press, 1990), 3; Alan Bewell, *Natures in Translation: Romanticism and Colonial Natural History* (Baltimore: Johns Hopkins University Press, 2017), 53–86, particularly 54–55, 79; Noah Heringman, *Romantic Rocks, Aesthetic Geology;* Alan Richardson, *British Romanticism and the Science of the Mind* (Cambridge: Cambridge University Press,

Darwin seriously, as well as to the many substantial lines of continuity connecting these two periods, and the inevitable limitations of periodization. Though this article focuses on the Romantic form and content of his natural philosophy, I see Darwin as a figure of both the Enlightenment and Romanticism, in the sense that his theory of nature—and the manner in which he presented his views—reflected both (1) ways of thinking and (2) social, political, and religious concerns and commitments associated with both historiographies. It would be surprising not to find that this is true, to greater or lesser degrees, of Darwin and indeed of many contemporaries through the decades around the turn of the century.[215] As explorations of Romantic thought continue to extend beyond the field's origins in focused studies of its most famous literary representatives—as it has begun to extend in the history of science—the complex dynamics of these historical categories in the messy, shaded, and uncategorized lived experience of turn-of-the-century lives will continue to yield valuable historical insights.[216]

We can better perceive what was Romantic about Erasmus Darwin's mode of natural philosophy by stepping back from a focus on poetic style as Darwin's most salient feature in relation to the Romantics, or on his status as the author of an early theory of the evolution of organic species evaluated with an eye toward Charles Darwin. Considering Erasmus Darwin's theory of nature more broadly very clearly reveals the ways in which his worldview bore striking similarities to those articulated by both British and German Romantic figures: it was a universe of essential unity and interconnection, not a passive mechanistic cosmos but rather one of unceasing, restless, organic change, driven by a vital principle from within (a principle of a kind of divine love, which shared features with contemporary accounts of an animating electrical fluid), and characterized by the dialectical processes of opposites such as expansion and contraction, good and evil, life and death. Interrogating the nature of life and of a living principle of power was a central concern for Darwin as it was for other Romantics.[217] The transformations of the universe and all of nature within it had both cyclical and linear elements, effectively tracing a spiral through time (in which the system returns to the same place, but at a different level: in other words, the spiral is the fusion of "the idea of the circular return with the idea of linear progress"; see § *"The Activity of*

2004), 5–6; Dahlia Porter, *Science, Form, and the Problem of Induction in British Romanticism* (Cambridge: Cambridge University Press, 2018), 73–112; Riskin, *The Restless Clock*, 214 and 227.

215 There was—and still to a certain degree is—as Desmond King-Hele aptly observed, "the myth that there is a high wall about the year 1797, dangerous to jump over." "The idea of such a wall is absurd," he continued, "and no one defends it: yet many critics behave as if it exists – to the detriment of Darwin, who is sometimes called the last (and by implication the worst) of the Augustans, best kept hidden behind the wall." King-Hele, *Erasmus Darwin and the Romantic Poets*, 275. Pietro Corsi, in his contribution to this volume, argues that there were significant lines of continuity between eighteenth- and nineteenth-century systems of nature and theories of transformism. See Corsi, "Systèmes de la nature and *Theories of Life*."

216 Valuable works exploring Romantic philosophy and the history of science—some interrogating the relationship between Enlightenment and Romanticism—include (but are not limited to) Andrew Cunningham and Nicholas Jardine, eds., *Romanticism and the Sciences* (Cambridge: Cambridge University Press, 1990); Joel Faflak, ed., *Marking Time: Romanticism & Evolution* (Toronto: University of Toronto Press, 2017); Denise Gigante, *Life: Organic Form and Romanticism* (New Haven: Yale University Press, 2009); Amanda Jo Goldstein, *Sweet Science: Romantic Materialism and the New Logics of Life* (Chicago: University of Chicago Press, 2017); Robert Richards, *The Romantic Conception of Life: Science and Philosophy in the Age of Goethe* (Chicago: University of Chicago Press, 2002); and John Tresch, *The Romantic Machine: Utopian Science and Technology After Napoleon* (Chicago: University of Chicago Press, 2017).

217 Gigante, *Life: Organic Form and Romanticism*, 1–6.

Its Inherent Principles" and § *A Universe of Death and Life: The Virtuous Spiral*).[218] What was more, for Darwin, imagination, poetry, and feeling were critical to apprehending these natural truths.

To explore these shared perspectives on the interpretation of nature, it is useful to look at two of Darwin's Romantic critics: Samuel Taylor Coleridge (1772–1834) and Friedrich Wilhelm Schelling (1775–1854). Thanks to the young Englishman Henry Crabb Robinson (1775–1867), who studied in Jena with Schelling and others between 1802 and 1805, we can visit Schelling's lecture hall. Robinson was invigorated by Schelling's teaching, but, he wrote to a friend, "I may be, perhaps, a little touched now and then by his contemptuous treatment of our English writers, as last Wednesday I was by his abuse of Darwin and Locke. I may hear Johnson called thick-skinned, and Priestley shallow. I may hear it insinuated that science is not to be expected in a country where mathematics are valued only as they may help to make spinning-jennies and machines for weaving stockings."[219]

Despite the insults, Schelling engaged formatively with Darwin's philosophy of nature, particularly in developing his theory of the organic.[220] Their accounts of change in the universe, though different in important particulars, also bore a number of striking resemblances. Like Darwin, Schelling imagined the universe's origins in a "chaotic creating" through a chemical, electrical process.[221] The origin of the world system, Schelling suggested, "ought to be thought more *organically* than mechanically, through an alternation of expansion and contraction, as happens with all organic formation," Schelling wrote. "One could suppose that through one contraction the first beginning of formation happens, departing from *one* point, at once stretching through an immeasurably large part of space wherein the primal material of the world was prepared…"[222]

Like Darwin, Schelling was inspired by William Herschel's natural historical account of celestial transformations.[223] The universe was always transforming, Schelling argued, through the continuation of processes of expansion and contraction. Schelling thought that the repellent force was, in fact, magnetism. If this were so, he wrote, "it should be shown how the constant *organic metamorphosis* of the universe becomes explicable on this theory, since the universe really only endures in a continual alternation of expansion and contraction (for what is our duration compared to the periods that one solar system needs for its condensation?)."[224] Perpetual change was in Nature's very essence. "[I]n this way," he wrote, "the universe is conceived in infinite becoming (because a completed infinity is a contradiction)."[225] Schelling rejected, however, the

218 See M.H. Abram's discussion of the spiral in Romantic thought in the classic study *Natural Supernaturalism: Tradition and Revolution in Romantic Literature* (New York: W.W. Norton & Co., 1971), 183–85. Goethe described "spiral" development in terms of alchemical enhancement ("Steigerung"). "The two great drive-wheels of all nature," he wrote, were "the concept of polarity and of enhancement." Ibid.

219 Henry Crabb Robinson, *Diary, Reminiscences, and Correspondence of Henry Crabb Robinson*, Vol. I (London: Macmillan & Co., 1869), 128.

220 On the multiple influences in the development of Schelling's concept of the organic, including Erasmus Darwin, see Richards, *Romantic Conception of Life*, 210.

221 See Tilottama Rajan, "Excitability: The (Dis)Organization of Knowledge from Schelling's First *Outline* (1799) to *Ages of the World* (1815)," in Thomas Pfau and Robert Mitchell, eds., *Romanticism and Modernity* (New York: Routledge, 2012), 47–64, at 60–61.

222 F.W.J. Schelling, *First Outline of a System of the Philosophy of Nature* (Albany, NY: SUNY Press, 2012 (1799)), 84, 93.

223 Schelling, *Philosophy of Nature*, 84, 93.

224 Schelling, *Philosophy of Nature*, 84, 93.

225 Schelling, *Philosophy of Nature*, 84, 93.

idea of a vital, self-forming power like *Lebenskraft* (life force) in favor of the idea of *Geist* (spirit) moving nature teleologically toward its *Urbild* (original image).[226]

Following Herschel, Schelling, like Darwin, characterized the lives of stellar systems as cyclical or phoenix-like, "If we suppose such a universal reversion of each system into its center, then according to the same law by which this system organized itself into one system at its first formation, each system will, revitalized, proceed again from its ruins; and so we have deduced at once the eternal metamorphosis running through the whole universe and the continuous *return of Nature into itself* (which is its genuine character)."[227] Immanuel Kant had also articulated a cosmology of transformation and phoenix-like return in his *Universal Natural History* of 1755; the work did not reach a wider audience, however, until decades later.[228] Schelling devised what one commentator calls an "epigenetic" concept of the universe's change over time, an idea that he may have drawn from Jean Baptiste Robinet's post-Spinozist *De la Nature* (1761–65). What was more, nature revealed the "inner-most thoughts of God"—though their respective concepts of the divine differed, it is hard not to call to mind resonances with Darwin's universal brain and his idea that nature, by extension, continuously manifest a kind of divine agency, or soul.[229] "One and the same principle," wrote Schelling, "unites organic and inorganic nature." For Schelling, as for Darwin, that principle was a principle of dynamic transformation.[230]

Like Darwin, Schelling dismissed the idea that "organization and life cannot be explained from natural principles."[231] Though Schelling differed from Darwin in important respects in his idealistic understanding of the nature of species and their relationships to one another and to an archetypal ideal form (not to mention Schelling's rejection of what *he* perceived as Darwin's overly mechanical derivation of living creatures from an original filament[232]), Darwin's account of the transformation of species—and the idea that these transformations were integrally related to the nature of transformation in the universe more generally—was a source of inspiration for Schelling's development of his views on the subject.[233] Darwin, for his part, saw the project of his *Zoonomia* as a much-needed attack upon and corrective to mechanistic accounts of life. He attacked the idea of the body as a "hydraulic machine" on the very first page of the *Zoonomia*, criticizing efforts to "explain the laws of life by those of mechanism and chemistry"—animation, he said, was life's "essential characteristic"—and in his chapter on generation he enthusiastically cited Hume's memorable observation that "reason can only make a machine, as a clock or ship, but the power of generation makes the maker of the machine" (see § "*The Activity of Its Inherent Principles*").[234]

In the British context, criticisms of Darwin were spiked with critiques of style similar to those of the German-speakers. Coleridge's infamous put-down ("I absolutely nauseate Darwin's

226 Gigante, *Life: Organic Form and Romanticism*, 21.

227 Schelling, *Philosophy of Nature*, 84, 93.

228 Schaffer, "Phoenix of Nature," 180–200.

229 Tilottama Rajan, "Excitability: The (Dis)Organization of Knowledge from Schelling's *First Outline* (1799) to *Ages of the World* (1815)," in Pfau and Mitchell, eds., *Romanticism and Modernity*, 47–64, at 55–56.

230 On Schelling, see Richards, *Romantic Conception of Life*, 298–99.

231 As quoted in Richards, *Romantic Conception of Life*, 298.

232 Robert J. Richards, "Did Goethe and Schelling Endorse Species Evolution?," in Faflak, ed., *Marking Time*, 230.

233 The *Zoonomia* soon appeared in German translation: Erasmus Darwin, *Zoonomie, oder Gesetze des organischen Lebens*, trans. J.D. Brandis, 3 vols. in 5 (Hanover: Gebrüder Hahn, 1795–99). On the relationship between Schelling's transformism and Darwin, see Richards, *Romantic Conception of Life*, chapter 8 ("Schelling's Dynamic Evolutionism"), 289–306.

234 Darwin, *Zoonomia*, 1 and 509.

poems") appeared in a letter to John Thelwall in which Coleridge also accused Darwin of deliberately trying to conceal his atheism from the public, of seeing "insincerity [as] a necessary virtue."[235] Coleridge's nausea was significantly spiritual, and partly a stylistic reaction to Darwin's saccharine tone: in his *Biographia Literaria* of 1817 he asserted that Darwin's style was characterized by "seductive faults" and *dulcia vitia*: sweet corruption.[236]

Yet these comments appeared in a particular context; his relationship with Darwin was more nuanced and changed over the course of his life.[237] Both Darwin and Coleridge embraced organism as a "dominant metaphor" for their view of nature and its transformations through time.[238] Coleridge, who was well aware of the natural-historical cosmologies of Herschel and Darwin, wondered "whether Reason does not command us to judge of these astronomical & geophysical necessities by the contrivances of the organized world, & not vice versa."[239] Coleridge embraced the idea that a vital principle of constant change worked throughout nature, including humanity, and that in this power was "above all the Spirit of Love."[240] For Coleridge, writes Kathleen Coburn, "The universe was therefore not static, but in process, and man was not a despairing cog in the Newtonian machine. Therefore all that is, is not necessarily right, but changing, and man participates actively, not passively, and by imagination and love. God was not arbitrary, but continually creating the universe out of material and spiritual force, a fountain of fire, energy, and light."[241] Coleridge's vital, holistic view of nature bore striking similarities to that of the English doctor.

---

235 Samuel Taylor Coleridge to John Thelwall, Letter, 13 May 1796. From Ernest Hartley Coleridge, ed., *Letters of Samuel Taylor Coleridge*, Vol. I (Boston: Houghton, Mifflin & Co. and Cambridge: The Riverside Press, 1895), 159–64.

236 Samuel Taylor Coleridge, *Biographiae Litteraria; Or Biographical Sketches of My Literary Life and Opinions*, Vol. I (London: Rest Fenner, 1817), 78.

237 See Desmond King-Hele, *Erasmus Darwin and the Romantic Poets*, chapters 5 and 6.

238 On organism as a dominant metaphor in Coleridge, see Trevor Levere, *Poetry Realized in Nature: Samuel Taylor Coleridge and Early Nineteenth-Century Science* (Cambridge: Cambridge University Press, 2002), 141. On Coleridge's understanding of the British state as an organic, evolving entity, see Anne Frey, *British State Romanticism, Authorship, Agency, and Bureaucratic Nationalism* (Stanford: Stanford University Press, 2009), 37.

239 Ibid. The full quotation from Coleridge's notebooks reads: "N.B. I must bring into clearer conceptions that business of the *necessity* which at length ~~appears~~ shews itself in all the apparent final causes of Nature—the Land & Sea Breezes for instance, the great Spiracles made by earthquakes & volcanos, (Volcanos themselves vast Breathing-holes) which are then the great Antidote, Preventive & often & always palliative, of Earthquakes—See Kant's Himmels' System &c—Now I must minutely compare this with the convictions forced on us by the reciprocity of end & means (i.e. every part a mean to every part, ergo, an end) as in the eye, I. its constituent parts, then the optic nerve—<2—> then the brain, then life, then understanding, then reason—and then I shall be able to determine whether Reason does not command us to judge of these astronomical & geophysical necessities by the contrivances of the organized world, & not vice versâ." Samuel Taylor Coleridge, Notebook, May 1810, from Kathleen Coburn, ed., *The Notebooks of Samuel Taylor Coleridge*, Vol. 3: 1808–1819 (New York: Routledge, 2002 (1973)), 3802 18.206.

240 Kathleen Coburn, *Experience Into Thought: Perspectives on the Coleridge Notebooks* (Toronto: University of Toronto Press, 1979), Lecture 2. Coleridge's comments appeared in the context of his discussion of Jacob Böhme or Behmen (1575–1624), a German theosophist philosopher, whose works appeared in an English edition in the late 1700s. "Coleridge's marginalia helped me to grasp that Behmen viewed the life of man and the whole cosmos in one and the same pattern," wrote Coburn. "Hence the sudden leaps of thought, from one plane to another, the curious allegorical way of writing, using strange terms and terms with more than one meaning…" Ibid.

241 Coburn, *Experience Into Thought*, Lecture 2.

Coleridge was unwilling to extend the possibilities of such a changeful universe to the transformation of organic species, however. He made several statements hostile to the idea, which he associated with Darwin. In 1815, spurred by Edward Tyson's arguments concerning similarities between human and "orang-outang" brains, Coleridge wrote to Wordsworth: "Next, I understood that you would take the human race in the concrete, having exploded the absurd notion of Pope's *Essay on Man*, Darwin, and all the countless believers even (strange to say) among Christians of man's having progressed from an orang-outang state—so contrary to all history, to all religion, nay, to all possibility."[242] Elsewhere, Coleridge offered sharp comments on a passage of Sir Walter Raleigh: "What! did Sir Walter Raleigh believe that a male and female once (and, if so, why not two tigers and lions, etc?) would have produced, in course of generations, a cat, or a cat a lion? This is Darwinizing with a vengeance. By this mode of reasoning he might have reduced Noah's stowage to at most half-a-dozen, so beautiful is the gradation of the species and genera of animals from men to mice."[243] Coleridge's position on the subject may have shifted by the late 1820s. In an oration on the death of Coleridge presented at the Russell Institution on August 8, 1834, John Heraud relayed "abridged" elements of a conversation he claimed to have had with Coleridge in February 1827: "Nature is rather an appetence to be," Coleridge reportedly said, "than Being itself. Nature is essentially imperfect, and all her tendencies are, (so to speak) 'to supersede herself.' Thus the fin of a fish is a hand, but without the uses, it only serves as a fan; but there it shows that an imperfection has begun to be *felt*; and which imperfection is removed more or less, in a higher scale of creatures."[244] Such a statement *could* be consistent with the possibility that Coleridge came to believe in some sort of transformation of living species, but it is not necessarily indicative of it. In English Romantic terms, as in the language of German *Naturphilosophie*, development did not necessarily imply the physical transformation of entities like species through time. It could also indicate a logical progression, such as a geometric sequence, or the linear gradation of an otherwise static Great Chain of Being.

Romantic accounts of nature as an organic, vital, self-developing, holistic, interconnected entity did not send denizens of the Romantic era billiard-ball-like into the bracing arms of an obvious theory of the (Charles) Darwinian-esque evolution of species. The Romantic view of the universe did, however, offer an extremely productive space of dynamic possibilities in which many transformist thinkers found ideas that they believed pointed toward the transformation not only of organic species, but of many different types and forms in nature: from the transformations of celestial objects on a macroscopic scale, to chemical transformations on the microscopic, to those of human societies, and even (particularly for some nineteenth-century figures) the transformations of human souls in this life and in a life after death (a return to life but, as in the spiral, on a more advanced plane of existence). The idea of transformation in each domain of knowledge shaped the idea of transformation in others, both challenging and spurring the emergence of disciplinary boundaries in the nineteenth century. Most critically, concepts of nature as an organic, *generative* being—an idea that found particular purchase in the Romantic era—rather than a passively mechanical entity were essential to the development of theories

---

242 Samuel Taylor Coleridge to William Wordsworth, Letter, 30 May 1815, reproduced in full in William Knight, ed., *The Life of William Wordsworth*, Vol. II (Edinburgh: William Paterson, 1889), 255–60.

243 H.J. Jackson, ed., *The Collected Works of Samuel Taylor Coleridge: Marginalia*, Vol. 12 (Princeton, NJ: Princeton University Press, 2000), 387–88.

244 John A. Heraud, *An Oration on the Death of Samuel Taylor Coleridge* (London: James Fraser, 1834), 4.

of transformation and ultimately evolution because they placed the capacity for change within nature itself. In the passive mechanical models of nature that Erasmus Darwin rejected, by contrast, people tended to place changeful agency entirely outside of nature, in the person of a Divine Designer. (Darwin's own attitudes toward the possible role of divinity in his generative universe were, as we've seen, deeply ambivalent.)

WHY DARWIN'S POETIC FORM WAS SIGNIFICANT

Darwin's decision to present so many of his ideas concerning agential nature and its holistic, transformative possibilities in the form of epic poems with extensive footnotes was significant in no small part because it allowed him to suggest and explore interconnections and resonances in nature that were otherwise hidden or obscured—a feature of the relationship between Romantic natural philosophy and poetry more generally. Poetic analogies could highlight potential connections that might otherwise go unnoticed, and indeed could make complicated ideas more accessible. Darwin's footnotes, in turn, connected them to the material results and (mostly) socially accepted discourses of contemporary natural philosophy.[245]

This approach comprised his Romantic, anti-reductive method, which was both humanistic and natural-philosophical. Darwin recognized this connection. "The general design of the following sheets is to inlist Imagination under the banner of science," Erasmus announced in the first line of his preface to *The Botanic Garden*, "and to lead her votaries from the looser analogies, which dress out the imagery of poetry, to the stricter ones, which form the ratiocination of philosophy."[246] By "ratiocination" Darwin meant a process of careful rational thinking. His introductory claim—indeed, the poem's central methodological premise—was that analogies were not only a path to understanding for the neophyte, but also a path to understanding for the natural philosopher. Analogies could guide the imagination in a disciplined fashion to true knowledge of nature. Indeed, for Darwin the availability of what he took to be analogous phenomena served as a test for the plausibility of a given theory—a feature of his unifying view of nature in which all things shared family resemblances.[247]

What did Darwin mean by "stricter" analogy? In his view, Linneaus' admirable system to classify all the earth's plants and animals was itself governed and structured by analogies, particularly the similarities between the form and function of various plants and animals. Furthermore, since all natural objects were "allied to each other by many affinities," theoretical investigation of one added to knowledge of the others by "developing some of their analogies."[248] As I have demonstrated, Darwin saw analogies between atoms, airs, plants, animals, planets, stars, and the birth and behavior of the universe as a whole. The flexible, spatializing possibilities of the poem allowed him to place seemingly unrelated objects, phenomena, and concepts in contrast, comparison, and/or conversation with one another.

---

245 Gigante, *Life: Organic Form and Romanticism*, 42. Over the past decade plus, scholars of Romanticism have identified, in the words of Noah Heringman, a "deep structural identity between scientific and aesthetic principles" in Erasmus Darwin's work. Noah Heringman, *Romantic Rocks, Aesthetic Geology* (Ithaca: Cornell University Press, 2004), 199.

246 Darwin, *Botanic Garden*, "Advertisement," v.

247 See for example, Darwin, *Zoonomia*, 489 ("From all these analogies I conclude…"), 492 ("Many objections might be adduced…"), 464–65 ("This way of accounting for…"). By the same token, analogies could lead to future discoveries: see Darwin, *Zoonomia*, 1 ("On this similitude…"), 512 ("In this intricate subject…").

248 Darwin, *Botanic Garden*, "Apology," vii.

Poetic imagination facilitated perspectives on nature's otherwise unobservable phenomena, particularly historical changes through time. Poetry's "looser" analogies (such as mythological and other poetic representations of natural phenomena) could make natural philosophy's "stricter" ones (the phenomena themselves) more accessible to the novice, and because Darwin believed that poetry was a naturally visual medium, it was uniquely capable of evoking actual images of otherwise unobservable phenomena in the mind's eye. No human could personally witness and collect observations of the birth of the universe, the titanic transformations of nebulae and solar systems, the minute transmutations of chemicals, spontaneous generations giving rise to transformations of living forms into a dizzying array of life forms on this and other planets, or the full span of human history, but it was possible to *virtually* witness these hypothesized events in the imagination.[249] In his poetry, Darwin often employed mythic creatures like sylphs and gnomes—or anthropomorphized natural phenomena—as virtual witnesses to unobservable or imperfectly observable events and phenomena.[250] Readers encountered the creation of their own world, for example, from the perspective of both the "astonish'd void" and an ensemble of gnomes.[251] Without imagination, historical accounts of nature through deep time were impossible. No wonder a literary form with imagination at its heart was so useful to the articulation of transformist accounts of the history of nature.

The looser analogies of poetry were also particularly useful in allowing Darwin to trace universal phenomena, such as the power of Divine or Immortal Love (Eros), linking nebula, star, planet, plant, animal, human, and society.

> *Immortal Love!* Whose golden fetters, hurl'd
> Round Nature's frame, connect the whirling world;
> Whether you roll the sun's attractive throne
> Or gird the planets in your silver zone;
> With crystal cords to atom atom bind,
> Link sex to sex, or marry mind to mind;
> Attend my song!—with rosy lips rehearse
> And with your silver arrows write my verse![252]

---

249 Darwin's nymphs, sylphs, gnomes, and a host of anthropomorphized entities served as virtual observers of the normally unobservable, creating the possibility of the very definition of nothing, a void, serving as witness to the creation of the world. The void's astonishment reflects the inherently vital and agential nature of Darwin's organic universe. The observers thus served to assist the reader in producing the visual images in the reader's imagination that Darwin believed poetry alone so powerfully created.

250 Noah Heringman points out that Darwin's gnomes, for example, "mak[e] it possible to visualize geological agency"—in this case the magnitude of natural forces such as the heat and pressure of the subterranean realm. Noah Heringman, *Romantic Rocks, Aesthetic Geology*, 223.

251 Darwin, *Botanic Garden* (Part I), Canto II, 60, lines 11–16.

252 Erasmus Darwin, *The Progress of Society*, Canto I, lines 35–42, in Priestman, *Poetry of Erasmus Darwin*, Appendix A, 262–63. In *The Temple of Nature*, this passage became: "Immortal Love! Who ere the morn of Time, / On wings outstretch'd, o'er Chaos hung sublime; Warm'd into life the bursting egg of Night, / And gave young Nature to admiring Light! - / You! Whose wide arms, in soft embraces hurl'd / Round the vast frame, connect the whirling world! / Whether immers'd in day, the Sun your throne, / You gird the planets in your silver zone; / Or warm, descending on ethereal wing, / The Earth's cold bosom with the beams of spring; / Press drop to drop, to atom atom bind, / Link sex to sex, or rivet mind to mind; / Attend my song!—With rosy lips rehearse, / And with your polish'd arrows write my verse!—" Darwin, *Temple of Nature*, Canto I, 4, lines 15–28.

Finally, as we've seen, some of the "looser" analogies also signified more to Darwin than casual readers (those who did not venture into the footnotes, front matter, and auxiliary thematic notes) may have suspected, since he believed that Greek, Roman, and Egyptian myths and images, especially hieroglyphics, captured philosophical truths. They were, in effect, historical reports, which the careful, properly initiated (perhaps even Masonic) philosopher could decode.[253]

In connecting loose poetic analogy to strict philosophical analogy, Darwin signaled his intention to traverse what some contemporaries viewed as an important boundary between poetry and natural philosophy.[254] His approach did not meet with universal applause: as attitudes turned against Darwin in the late 1790s, Pitt's foreign undersecretary George Canning and his literary collaborators sarcastically lambasted Darwin for approaching natural philosophy through the "*heavy* artillery of a Didactic Poem," and for the presumption that the poem could do a better job of exploring human nature than encyclopedias, periodicals, novels, and other types of prose works.[255] The context was a satire of Darwin's work titled *The Loves of the Triangles*, which appeared in Canning's *Anti-Jacobin; or, Weekly Examiner* of 1797–98. The periodical's *raison d'être* was to attack subversive religious and political ideas.

The *Anti-Jacobin*'s successor, titled the *Anti-Jacobin Review*, echoed the sentiment: "It becomes every lover of the Muse to watch the inroads of science [...] to check her influence, lest the intermixture of scientific discovery with poetic invention should become fashionable, and every spark of poetry at length be quenched in the phlegm of philosophy." ("Many a tolerable poet has been *spoiled* already," complained the reviewer in a satirical footnote, "by an injudicious imitation, or rather mimicry of Darwin.")[256] The *Critical Review* chimed in, "In direct contradiction to what has uniformly occurred to us in antiquity . . . poetry and philosophy appear throughout the whole of his compositions to be sworn and irreconcilable foes," which produced "indeterminate, discordant, and oftentimes incomprehensible" results. "Had he been less of the poet, his philosophy would have been more accurate," the reviewer concluded, and "had he been less of the philosopher, his poetry would have been more admirable."[257]

Some of Darwin's critics, including Canning and his collaborators, found Darwin's transformism (and the literary form that carried it) threatening precisely because it connected transformations in organic and inorganic nature to the transformations of human society. The

---

253 See Martin Priestman's valuable analyses of the role of myth and Freemasonry in Darwin's life and work in Priestman, *Poetry of Erasmus Darwin*.

254 Packham, *Eighteenth-Century Vitalism*, 169. Dahlia Porter asserts, by contrast, that the structure of Darwin's poems reflected his desire to formally demarcate boundaries between natural philosophy and experimental science in the footnotes on the one hand, and unstable, figurative ambiguities and potentialities of poetic verse on the other. "Analogy," Porter writes, "even as it held out the possibility of synthesizing an ever-growing heap of facts, simultaneously cast doubt on the epistemological ground of induction, the fundamental first step of observation. Lodged firmly in the mind's capacity to forge associations, analogy brought the truth claims of experimental science uncomfortably close to the rhetorical techniques—metaphor, simile, allegory, personification—by which art deceives the senses." Nonetheless, "Darwin's text ultimately broadcasts the impossibility of sustaining this opposition." Dahlia Porter, *Science, Form, and the Problem of Induction in British Romanticism* (Cambridge: Cambridge University Press, 2018), 73–76.

255 [George Canning, George Ellis, and John Hookham Frere], "The Loves of the Triangles," *The Anti-Jacobin, or, Weekly Examiner*, Vol. 2 No. 23 (Apr. 1798), 162–174, at 163.

256 "Art. I. *T. Lucretii Cari De rerum Natura Libros*," *The Anti-Jacobin Review and Magazine* (March 1800), 241–258, at 255.

257 "Art. I.—*The Temple of Nature; or, the Origin of Society*," *The Critical Review: or, Annals of Literature* (Aug. 1803), 361–370, at 361.

universalism of Darwin's understanding of natural transformation suggested that at its very core the order of nature was the impetus behind revolution and reform. Canning and his associates attacked Darwin's cosmological account of the creation, its natural historical basis, and the concept of an internal driving force of erotic energy linking the creation of the universe to the creation of life. They painted his cosmic transformism in a devastatingly absurd light by considering whether a theory of triangles might account for the same phenomena: "*Quare*—Whether a practical application of this Theory [of the loves of triangles] would not enable us to account for the Genesis, or original formation of Space itself, in the same manner in which Dr. Darwin has traced the whole of the organized creation to his Six Filaments—Vide Zoonomia."[258] The idea that humanity's origins lay in "the cabbages of the field" was from this perspective patently ridiculous.[259]

The transformist worldview coursing through Darwin's natural history, politics, and radical social agenda was also targeted by the Tory cartoonist James Gillray in 1798 in a spectacular caricature—printed in the *Anti-Jacobin Review*—titled the 'New Morality' (**FIGURE 3**). Gillray depicted Darwin carrying a basket of red flowers made to look like the red Jacobin caps that festooned a tumultuous crowd of other figures deemed radical, including Joseph Priestley, Thomas Paine, William Godwin, and a passel of politicians. Five Romantic poets, including Samuel Taylor Coleridge, were depicted near or holding up a "Cornucopia of Ignorance." (Lest anyone miss his drift, Gillray labeled Darwin's flower basket, "Zoonomia, or, Jacobin Plants.") For many, the Jacobin-capped flowers probably also pointed toward the extravagant sexual morality of *The Loves of the Plants*. Central to the image was a sea monster denoted "Leviathan," crawling out of the water and ridden by reform figures including John Thelwall and the Whig Charles James Fox. The monster lends itself to interesting layers of interpretation. "With its reticulated ears and webbed claws," observes art historian Andrei Pop, "this creature is a tour-de-force even for Gillray: at once sea monster, biblical Beast, and travesty of Darwin's theory of 'Organic Life [that]

FIGURE 3. James Gillray, 'New morality; – or – the promis'd installment of the high-priest of the Theophilanthropes, with the homage of Leviathan and his suite' (August 1798), courtesy of the National Portrait Gallery (UK), D13094.

258 Canning et al., "The Loves of the Triangles," 171.

259 Canning et al., "The Loves of the Triangles," 164.

began beneath the waves.'"[260] In the eighteenth century, the Leviathan sea monster was evoked as a symbol of state power. Gillray portrayed his Leviathan with its hind end (still in the water) in the shape of a sea creature's tail, while its front end (emerging onto land) was depicted with the distended fins apparently in the process of transforming into arms with hands. The creature's face and nascent limbs were perhaps a gesture toward the land-dwelling biblical Behemoth, Thomas Hobbes' symbol of civil war (the creature's head bore the face of Francis Russell, 5th Duke of Bedford, a Whig politician with French sympathies).[261] In the cartoon, the transforming Leviathan was depicted by Gillray being drawn from the water by an altar of corrupt, bloody, atheistic French principles.[262] The image, then, depicted the connection that Darwin and many of his critics saw between transmutations of the physical world and those of the political.

CONCLUSION

This essay shows that our understanding of Darwin's transformism is impoverished if we approach him searching only for features that seem to point toward the evolutionary theory of his grandson, Charles Darwin, thereby focusing our attention only on those parts of his philosophy of nature that directly consider the transformation of organic species. Taking a step back to consider the universal scope of Darwin's economy of life is essential, because his was not simply a theory of the transformation of organic species, but of holistic, universal transformation.

His transformism was universal both in the sense that Darwin embraced the progressive transformation of objects in the astronomical heavens, including our solar system, based on the natural historical model of William Herschel, but more broadly Darwin's theory was universal because he identified a principle of transformation suffusing everything in the universe, from the microscopic to the macroscopic, encompassing animate and inanimate nature alike.

Recognizing the universal scope of his views, in turn, illuminates the way in which his social, political, and theological commitments—particularly as manifest in his arguments regarding the transformations of human society through revolution and reform—both motivated and were in

---

260 Andrei Pop, *Antiquity, Theatre, and the Painting of Henry Fuseli* (Oxford: Oxford University Press, 2015), 175.

261 See Stephen Holmes, "Introduction," in Thomas Hobbes, *Behemoth or the Long Parliament*, edited by Ferdinand Tönnies (Chicago: University of Chicago Press, 1990 (1682)), ix.

262 Like many of his works, Gillray's "New Morality" contained layers of meaning. The Leviathan was also a reference to a contemporary rivalry: in his caption, Gillray noted that the Leviathan was landed with a hook in its nose (i.e., in the face of the pro-French 5th Duke of Bedford) by Edmund Burke, who opposed the French Revolution and with whom the duke quarreled. "The Duke of Bedford is the Leviathan among all the creatures of the Crown," wrote Burke. "He tumbles about his unwieldy bulk; he plays and frolicks in the ocean of the Royal bounty." Edmund Burke, *A Letter from the Right Honourable Edmund Burke to a Noble Lord*, 3rd ed. (London: J. Owen and F. & C. Rivington, 1796), 37. Burke famously depicted the French Revolutionaries in terms of monstrous creatures and hell beasts, which generated a rich counter-Revolutionary iconography that Gillray embraced. Radicals, reformers, and revolutionary sympathizers, in turn, appropriated this kind of imagery to depict counter-revolutionaries as the true monsters. See David Duff, "Burke and Paine: contrasts," in Pamela Clemit, ed., *The Cambridge Companion to British Literature of the French Revolution* (Cambridge: Cambridge University Press, 2011), 63–65. "The French revolutionists complained of every thing; they refused to reform any thing; they left nothing, no, nothing at all *unchanged*," wrote Burke. "The consequences are *before* us,—not in remote history; not in future prognostication: they are about us; they are upon us. […] The revolution harpies of France, sprung from night and hell, or from that chaotick anarchy, which generates equivocally 'all monstrous, all prodigious things,' cuckoo-like, adulterously lay their eggs, and brood over, and hatch them in the nest of every neighbouring State." Burke, *A Letter from the Right Honourable Edmund Burke to a Noble Lord*, 20–21. For revolutionary debate primary sources with scholarly commentary, see Marilyn Butler, ed., *Burke, Paine, Godwin, and the Revolution Controversy* (Cambridge: Cambridge University Press, 1984).

turn shaped by his larger transformist enterprise. Darwin used the idea that transformation was central to the order of nature to imbue revolution and reform with a sense of inevitability and of natural (and potentially divine) sanction.

His choice of an organic, generative model of nature was intimately connected to the idea of ubiquitous transformation throughout the universe (as it was for others who developed similar views). Darwin saw the whole of nature as the family of "one parent," infused by a vital spirit, everywhere characterized by generative powers sharing a kinship with those of life. In this model, the agency motivating change came from within nature itself (as opposed to models of nature, particularly passive, mechanical ones, in which agency was external to nature in the mind of a divine designer; Darwin instead suggested that nature was conditioned by some manner of divine law-maker). As a consequence of his generative understanding of nature, Darwin expected to find all manner of transformative change exhibiting analogous features—even as the immediate laws governing change differed—throughout the whole of universal nature.

Darwin's philosophy of nature substantially, in the aggregate, reflected a mode of Romantic natural philosophy that was universalist, holistic, and anti-reductive in both form (a fusion of poetry and prose) and substance (his organic, vitalistic, universal theory of transformation in nature). Humanistic and natural philosophical approaches to understanding were united in Darwin's mode of natural philosophy.

Like many other Romantics, his was an organic universe suffused by a vital principle within, characterized by the dialectical processes of opposites, and manifesting an essential unity and harmony. Transformations throughout the universe had both cyclical and linear elements, tracing a Romantic spiral through time: the fusion of circular return and linear progress. As for other Romantics, imagination, poetry, and feeling were central to Darwin's approach to revealing these truths. He pushed the boundaries of knowledge through a kind of disciplined scientific imagination, which found a natural medium in poetry produced for a popular audience. Because no one could actually witness the emergence and transformations of the universe, the transmutations of chemical entities, the emergence and transformations of living forms, or the fullness of human history and humanity's future, any theory of such transformations required the imagination—a window into the past through the mind's eye. Thus, knowledge of the universe's unobservable processes in time and space was facilitated by Darwin's poetic form, which enabled the inquirer to contemplate the unobservable based on what *was* observable, with analogy guiding the imagination.

Even as I argue that Darwin's natural philosophy was characterized by Romantic form and content, I have rejected the idea that this excludes the value of analyzing him as an Enlightenment figure, suggesting that many of the features of his Romantic universal transformism bore the imprint of Enlightenment preoccupations and ideas that were, throughout society in the last decades of his life, subtly shading and transforming into new forms and into new relationships with one another—forms and relationships that have come to be recognized by historians (on the whole, with much heated debate) as Romantic. Erasmus Darwin's life is for this reason a productive case study through which to reflect on the relationship between the historical categories of Enlightenment and Romanticism, and the ways in which they both illuminate and limit our understanding of historical change in the late eighteenth and early nineteenth centuries.

Though Darwin's earlier works fell from the height of their initial popularity, it would be premature to conclude that his work was an interesting but relatively inconsequential foray into

evolutionary waters.[263] Erasmus Darwin's arguments inspired conversations about—and in important cases served as a model for—thinking about nature's transformations, including those of human society and even those of the human soul, well into the nineteenth century. Because of transformism's dangerous radical associations in Britain, these conversations had a more subterranean existence in the first decades of the nineteenth century. By the 1830s and 40s, however, authors of popular evolutionary texts such as Robert Chambers and the Romantic astronomer and political economist John Pringle Nichol were presenting their evolutionary ideas in strikingly similar terms, as a universal rather than strictly biological phenomenon that was particularly well illustrated by Herschelian cosmology, driven by its own internal vital energy, progressing through time, sublimely interconnected, its essence captured in the myth of Eros and Psyche.[264] The universal scope of transformism or evolution became a core principle for many of Charles Darwin's supporters, including John Tyndall, Asa Gray, Edward Clodd, Grant Allen, and, most famously, Herbert Spencer. When Spencer declared that a law of progress moved the universe "[f]rom the earliest traceable cosmical changes down to the latest results of civilization"[265]—and John Tyndall identified evolutionists as those who supported the nebular origins of the solar system "and accept as probable the unbroken sequence of development from the nebula to the present time"[266]—they were participating in a long evolutionary tradition, to be sure: one exemplified and shaped by Erasmus Darwin. A

ACKNOWLEDGMENTS. This research was made possible by support from the National Science Foundation (US), the Stanford University History Department, the Stanford Humanities Center, and the Institute on the Formation of Knowledge at the University of Chicago. I would also like to thank Jessica Riskin, Paula Findlen, Trent Leinenbach, Greg Priest, the Stanford European History workshop, and my colleagues at the University of Chicago for useful conversations and insightful feedback on earlier versions of the article; additional thanks to the Herschel family (UK), the Erasmus Darwin House Collection (UK), the Wolfson Centre for Archival Research at the Library of Birmingham (UK), the Linda Hall Library (US), the British Museum of Natural History (UK), and Burcak Kozat for so kindly facilitating my research both inside and outside the archives. Images were kindly provided by the Science History Institute (US) and the National Portrait Gallery (UK).

---

263 Charles Darwin and some of his adherents deliberately wrote earlier evolutionary thinkers, like his grandfather, "out of history," Patricia Fara observes. "This deliberate erasure made evolution by natural selection look much more attractive, because it was presented as the only viable alternative to repeated miraculous creation." Fara, *Erasmus Darwin: Sex, Science, and Serendipity*, 235. Charles took pains to distance himself from his grandfather. See Priestman, *Poetry of Erasmus Darwin*, 120–21; and Porter, "Erasmus Darwin: Doctor of Evolution?", 58–59. Devin Griffiths has recently given the relationship between the Darwins focused analysis in *The Age of Analogy: Science and Literature Between the Darwins* (Baltimore: Johns Hopkins University Press, 2016).

264 J.P. Daly, "Audacious Psyche: Visualizing Evolution in John Pringle Nichol's Romantic Universe," *Endeavour* 42:2–3 (Jun.–Sept. 2018): 133–44. The influential naturalist and anatomist Robert Grant credited Erasmus Darwin with inspiring his own lifelong enthusiasm for transformism. See Jenkins, *Evolution Before Darwin: Theories of the Transmutation of Species in Edinburgh,* 102.

265 Herbert Spencer, "Progress: its Law and Cause," in *Essays: Scientific, Political, and Speculative*, Vol. 1 (London: Longman, Green, Longmans, and Roberts, 1858), 3.

266 Robert W. Smith, "The 'Great Plan of the Visible Universe': William Huggins, Evolutionary Naturalism and the Nature of the Nebulae," in Bernard Lightman and Michael S. Reidy, eds., *The Age of Scientific Naturalism: Tyndall and His Contemporaries* (New York: Routledge, 2016), 113–36, at 131. "We neither affirm nor deny that Professor Tyndall existed in a nebulous state an infinite number of centuries ago," declared the *Times*. Quoted in John Tyndall, "On the Scientific Use of the Imagination," in *Essays on the Use and Limit of the Imagination in Science* (London: Longman, Green, and Co., 1870), 2.