Wordsworth, Priestley, and the Revolution in Knowledge

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Foreword

Gillian Beer

I REMEMBER THE SURPRISE I FELT, as many modern readers must have done, on first reading Wordsworth's distinction between the poet and the scientist, where the scientist is figured as solitary and the poet as communal: for Wordsworth, the scientist's truths are isolated, the poet's are universal. Now we take for granted that science is team-based while poetry is still, in the main, the product of a single mind. Kurtis Hessel here addresses the question of Wordsworth's characterisation of scientist and poet and uncovers subtle and learned answers that bear on the late eighteenth century turn to technical instrumentation and quantitative methods, away from the holistic and 'mutual illumination' between humanity and nature. The arguments of Priestley, Lavoisier, and Davy are all exactly placed here. These thoughts chime with John Beer's work, and Kurtis Hessel develops his arguments in ways that John would have relished and admired. This is just the kind of enquiry that carries Romanticism into new fields while respecting, as Hessel puts it, 'the myriad commitments comprising Romantic thought'. I am delighted that Kurtis Hessel is the first bursary holder in John's name.

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IN THE 1802 PREFACE TO *LYRICAL BALLADS*, WORDSWORTH OFFERS a characterization of the "man of science" that opens a rift between poetry and science. Where the knowledge of the poet "cleaves to us as a necessary part of our existence, our natural and unalienable inheritance," the sciences are "a personal and individual acquisition, slow to come to us, and by no habitual and direct sympathy connecting us with our fellow-beings."[1] Poets offer universal truth while scientists, estranged from their fellows by their work, seek narrower discoveries, driven by ambition and self-regard. What motivated this generalization? Surely Wordsworth could recall Joseph Priestley, who less than thirty years before had inextricably linked science with revolutionary politics by arguing that "the English hierarchy (if there be anything unsound in its constitution) has equal reason to tremble even at an air pump or an electrical machine."[2] Priestley saw science as pivotal to reform; it democratized natural knowledge, empowering people to change the world for society's betterment. He explicitly rejected narrowly technical experimentalism, framing science as

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[1] William Wordsworth, "Appendix A: Additions to the 1802 Edition of *Lyrical Ballads*," in *Lyrical Ballads, 1798 and 1800*, eds. Michael Gamer and Dahlia Porter (Buffalo, NY: Broadview Editions, 2008), p. 423.

[2] Joseph Priestley, *Experiments and Observations on Different Kinds of Air* (London: J. Johnson, 1774), vol. 1: p. xiv.

bound up with moral philosophy, politics, history, and art.

If Wordsworth's division between poet and scientist surprises us, it is because recent trends in scholarship emphasize Romanticism's tendency to adopt insights from across the arts and sciences. This voracious syncretism undermines hard distinctions between types of knowledge. The list of newly-acknowledged influences on Romantic poets—public lectures at the London Institutions, new specialized journals, crowd-pleasing technological advances like the voltaic battery—grows continually, and we now better recognize the myriad commitments comprising Romantic thought. Today's critics follow a path charted by John Beer, whose work I honor by trying to replicate his incisive eclecticism. Beer emphasizes Romanticism's "largeness of speculation," in which "formerly discredited systems of ideas were now revived and newly examined" alongside a "range of new knowledge" in the sciences and elsewhere.[3] He recognized the need in reconstructing the Romantic mind to consider dominant intellectual systems alongside supposedly defunct philosophies, to let Joseph Priestley jostle against Jakob Boehme and Antoine Lavoisier.

How do we reconcile Wordsworth's division between poetry and science with Romanticism's long-heralded intellectual range? What had happened to drive Priestley from Wordsworth's recollection in estranging the poet from the man of science? Put simply, during the last two decades of the 18th century chemistry changed rapidly. In the 1770s and 80s French chemist Antoine Lavoisier and his coterie provided chemistry with a systematic form, revising its nomenclature, but more importantly re-centering it on a newly-conceived chemical element.[4] Eighteenth-century chemistry had featured more porous epistemological borders in part because its conceptual basis comprised a convoluted mélange of the four classical elements and the Paracelsian principles of early-modern alchemy. But in 1789, French chemist Antoine Lavoisier re-centered chemistry on the idea of the element in his *Traité élémentaire de chimie*, granting the discipline systematic order. This new version of the element was not stable, as the classical four had been; it was provisional: any substance that chemists could not break down would be considered an element, sharply increasing the number of simple substances, while also reframing chemistry as an autonomous discipline.

By contrast, Priestley's earlier writings exemplify a passing 18th-century chemical tradition, a paradigm (to use Thomas Kuhn's formulation[5]) in the process of being replaced by Lavoisier's, one that preceded the division of matter into discrete and fully individuated elements determined explicitly by the chemist's experimental skill. Priestley's second volume of his *Experiments*

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3 John Beer, *Coleridge's Poetic Intelligence* (New York: Barnes & Noble Books, 1977), 32.

4 On 18th-century technical and theoretical developments in chemistry see Bernadette Bensaude-Vincent and Isabelle Stengers, *A History of Chemistry* (Cambridge: Harvard UP, 1996), especially pp. 44-159. For an even more exhaustive account of chemical history see Mi Gyung Kim, *Affinity, that Elusive Dream* (Cambridge, the MIT Press, 2003). For an account of Lavoisier's exertions see pp. 279-334.

5 Thomas Kuhn, *The Structure of Scientific Revolutions*, 3rd ed. (Chicago: The University of Chicago Press, 1996).

and Observations on Different Kinds of Airs explicitly sought to undermine the belief that air was "*a simple elementary substance*, indestructible, and unalterable, at least as much so as water is supposed to be."[6] He cared more about dismantling the last remnant of the classical elemental paradigm than erecting a new one. His vaunted isolation of "dephlogisticated air," which we call oxygen, involved, in his view, extrapolating a new kind of air from among the myriad transmutable forms air could take. "Dephlogisticated air" was common air with the principle of phlogiston removed (rather than the stable constituent substance named "oxygen" it would come to be in Lavoisier's system). Invested with a new store of phlogiston it became common air again. Here, I emphasize a key conceptual shift: Priestley sought to identify species of airs that he nevertheless presumed were still united by common chemical principles, and which could even transform one into another; by contrast, Lavoisier conceived elements as absolutely individuated substances.

The holism of Priestley's ideas appealed to Wordsworth (as well as to Coleridge). Wordsworth's division between the poet and the scientist constitutes a rhetorical tactic, a salvo against Lavoisier's new elemental system meant to capture for poetry the syncretic prerogative of Priestley's natural philosophy. The element was bringing with it a specialist nomenclature, exclusive and expensive apparatuses, and rigid institutionalism, all of which rendered chemistry more exclusive—an enclosure in the intellectual commons. Wordsworth didn't reject chemistry so much as he cautioned poets against replicating its rush to systematicity. At the same time, he forged a new identity for poetry as an all-considering proto-discipline, inheritor of natural philosophy's capacious remit.

Epistemology as a Cracked Retort

Joseph Priestley evaded classification: his practice differed from the ordered chemical system of the early nineteenth century because he embraced, in his multivolume *Experiments and Observations on Different Kinds of Air* (1774-86), a deliberately disordered method.[7] He defends the unsystematic organization of his volumes by emphasizing the urgency of his pneumatic discoveries: "all unnecessary delays in the publication of experiments relating to [this science] are peculiarly unjustifiable."[8] His hurry speaks to the cutting-edge character of the chemistry of air, but also to his disregard for the activities of scientific speculators and system-builders. Priestley opposes himself to such philosophical egotists, who "keep brooding over a new fact, in the discovery of which they might, possibly, have very little real merit, till they think they can astonish the world with a system as complete as it is new, and give mankind a

[6] Joseph Priestley, *Experiments and Observations on Different Kinds of Air* (London: J. Johnson, 1775), vol. 2: p. 30-1.

[7] On disorder and the disciplines during the 18th century see Luisa Calè and Adriana Craciun, "The Disorder of Things," in *Eighteenth-Century Studies* 45, no. 1 (2011), pp. 1-13. Priestley's ambivalence to systems was by no means unique. On the genre of "system" and its discontents see Clifford Siskin, *System: the Shaping of Modern Knowledge* (Cambridge, the MIT Press, 2016), pp. 1-78.

[8] Priestley, *Experiments*, vol. 1: p. vi.

prodigious idea of their judgment and penetration."[9] In rejecting the imperative to produce complete scientific explanations of the natural world, he levies connected accusations of vanity and unchecked fancy upon aspirants after totality. According to Priestley, withholding the results of one's research to accrue fame betrays a "want of a genuine love of science and mankind."[10]

Instead of aspiring to perfect experiments, Priestley chronicles experimental accidents, errors, and inconsistencies to establish the natural philosopher's fallibility. His ideal man of science is a humble experimenter contributing incrementally to a cooperative endeavor. Jan Golinski highlights how Priestley's "carefully framed descriptive narratives were composed with the explicit aim of making experiments reproducible by relatively unskilled practitioners working with minimal equipment."[11] Priestley records the role of accident in these experiment narratives: according to Priestley, preserving in writing the mismatch between hypothesis and discovery "encourages other adventurers in experimental philosophy; shewing them that, by pursuing even false lights, real and important truths may be discovered."[12] Here, he foregrounds the collaborative spirit in his emphasis on encouragement. Furthermore, he argues that mistaken motives give way to truthful discoveries; rather than valorize the scientist-prophet whose experiments confirm his prescience, he lauds unplanned discovery.

In part, for Priestley, accident could produce scientific knowledge because he treated the world as his laboratory, believing that discoveries happened in unscientific spaces. For instance, he explains how living next door to a brewery inspired his research on airs: "It was in the consequence of living for some time in the neighbourhood of a public brewery, that I was induced to make experiments on fixed air, of which there is always a large body, ready formed, upon the surface of the fermenting liquor."[13] He describes conducting experiments in the layer of "fixed air" (CO_2) floating above the vats of beer. The brewery becomes a laboratory for Priestley, in part, because its metabolizing yeast produce voluminous amounts of fixed air. He doesn't merely secure his gas from the brewery but uses its vats as apparatuses: "a large strong frog was much swelled and seemed to be nearly dead, after being held six minutes over the fermenting liquor."[14] If the spectacle of Priestley dangling a particularly robust frog over a vat of beer until it passes out strikes the modern reader as unscientific, it is only because we have inherited a view of science tied to the laboratory's sterile space.

Priestley undermined the stability of most of the categories he took up: as basic a difference as that between apparatuses and their associated types of scientific labor remained provisional. The tools that Priestley used were only sometimes specialized, and they often served multiple purposes. He describes,

[9] Priestley, *Experiments*, vol. 1: p. vi.
[10] Priestley, *Experiments*, vol. 1: pp. vi-vii.
[11] Jan Golinski, *Science as Public Culture* (Cambridge: Cambridge UP, 1992), p. 77.
[12] Priestley, *Experiments,* vol. 1: p. x.
[13] Priestley, *Experiments*, vol. 1: p. 25.
[14] Priestley, *Experiments*, vol. 1: p. 36.

for instance, "*cylindrical jars*" used to contain "several kinds of air."[15] These jars would have been turned upside down and filled with gases, their mouths submerged in a pneumatic trough or in "*tea-dishes*" filled with water or mercury to contain varieties of airs. According to Priestley's description, these same jars are "such as I have generally used for electrical batteries,"[16] the electrostatic batteries of Priestley's *History and Present State of Electricity* (1767). In her poem, "An Inventory of the Furniture in Dr. Priestley's Study," the poet Anna Barbauld, friend of the Priestleys, captures this experimental interchangeability: she describes how his shelves contain "bottles, jar and phial, / By which the rogues he can defy all,—/ all filled with lightning keen and genuine."[17] That poem ends with Priestley discovering a new phenomenon, one "born of the air and doomed to flame"[18] because as Barbauld was writing the poem, Priestley had taken up his post-electrical interest in the chemistry of airs, so his batteries had found new function containing gases.

Even more fundamental categorical distinctions between apparatuses, objects, and experiments become hazy in Priestley's practice. For him, the division between the tools and activities of the natural philosopher and what he studies sometimes breaks down. We see this most clearly in how Priestley writes about mice in his experiments. Mice proved an effective tool for measuring air's breathability. If a mouse enclosed in a vessel died, Priestley knew the air was bad. In this instance, the mouse transforms from a living creature into an apparatus, instrumental to the natural philosopher's work on determining breathability. Indeed, in his *Experiments on Air*, Priestley pays the most sustained attention to mice in section II, subheaded "*An account of the* APPARATUS *with which the following experiments were made.*"[19] In this section, Priestley gathers descriptions of his necessary apparatuses in one place for efficiency's sake, and in it he explains how to care for mice. Though he focuses on how to keep them alive between experiments, he interrupts such guidance with an astonishing erroneous observation:

> I found, to my great surprize, in the course of these experiments, that mice will live intirely without water; for though I have kept them for three or four months, and have offered them water several times, they would never taste it; and yet they continued in perfect health and vigour.[20]

The point I want to emphasize is that Priestley interrupts the apparatus section to comment on the nature of mice irrespective of their purpose. The apparatus itself, in this instance, becomes an object upon which to conduct an

[15] Priestley, *Experiments,* vol. 1: p. 8.
[16] Priestley, *Experiments*, vol. 1: p. 8.
[17] Anna Barbauld, "An Inventory of the Furniture in Dr. Priestley's Study," in *Anna Letitia Barbauld: Selected Poetry & Prose*, eds. William McCarthy and Elizabeth Kraft (Buffalo: Broadview Editions, 2002), pp. 73-5, lines 17-19.
[18] Barbauld, "An Inventory," line 58.
[19] Priestley, *Experiments*, vol. 1: p. 6.
[20] Priestley, *Experiments*, vol. 1: pp. 10-11.

experiment—deprive mice of water, they nevertheless survive.

Virtue in the Air

Without the stabilizing effects of systematic organization, Priestley viewed matter as slipping across categories of knowledge: it was not purely physical but included moral and spiritual dimensions. This conflation was possible because Priestley followed a chemical paradigm that preceded the element's establishment as central to chemistry. In lieu of elements, Priestley's understanding of the differences between types of airs focused on their "constituent principles." The prominence of principles in Priestley's thought reflects the influence of German chemist Georg Ernst Stahl (1660-1734). Stahl argued for the existence of constituent principles of water, air, and earth, with earth being divisible into metallic, vitrifiable, and phlogistic earths. In this schema, each principle commuted qualities to any substance in which it inhered: metallic earth gave malleability, vitrifiable earth the capacity to melt, and phlogistic earth combustibility. Chemists that followed Stahl failed to isolate these principles, so over time they built the apology for that failure into their theory: principles constituted all matter but could not be isolated in material form. They were, as John McEvoy puts it, "apprehendable only by their effects,"[21] and their presence or absence could only be inferred from a substance's attributes. The belief in principles preserved an attractive transformability at the heart of matter for Priestley, who wanted to reconcile his chemical and theological beliefs. As John Beer notes, wryly calling back to the natural philosopher's time spent in the brewery, Priestley's work gave "a new and exciting dimension to matter," at times giving "the sense of an energic God, moving like a yeast in matter."[22]

This conceptual commitment emerges in Priestley's discussion of the "goodness" of airs. He understood gaseous matter to bear moral significance, which followed from his discovery that living vegetation rendered "fixed air" breathable (to put that in our terms, that plants breathed carbon dioxide and exhaled oxygen). As he saw it, "good" air supported life and combustion, and vegetation made corrupt air more "virtuous." As Simon Schaffer notes, he "immediately interpreted respirability as goodness."[23] For Priestley, the existence of sufficient vegetation to rectify the corruption breathed by the planet's animal masses indicated a natural moral balance:

> These proofs of a partial restoration of air by plants in a state of vegetation … cannot but render it highly probable, that the injury which is continually done to the atmosphere by the respiration of such a

[21] John McEvoy, "Causes and Laws, Powers and Principles: The Metaphysical Foundations of Priestley's Concept of Phlogiston," in *Science, Medicine and Dissent: Joseph Priestley (1733-1804)*, eds. R. G. W. Anderson and Christopher Lawrence (London: Wellcome Trust/Science Museum, 1987), p. 64.

[22] Beer, *Poetic Intelligence*, p. 59.

[23] Simon Schaffer, "Measuring Virtue, eudiometry, enlightenment, and pneumatic medicine," in *The medical enlightenment of the eighteenth century*, eds. Andrew Cunningham and Roger French (Cambridge: Cambridge UP, 1990), p. 287.

> number of animals, and the putrefaction of such masses of both vegetable and animal matter, is, in part at least, repaired by the vegetable creation. And, notwithstanding the prodigious mass of air that is corrupted daily by the above-mentioned causes; yet, if we consider the immense profusion of vegetables upon the face of the earth, growing in places suited to their nature, and consequently at full liberty to exert all their powers, both inhaling and exhaling, it can hardly be thought, but that it may be a sufficient counterbalance to it, and that the remedy is adequate to the evil.[24]

Priestley interpreted his experiments to show that humanity's corrupting character and virtue-respiring vegetables had always existed in a divine natural equipoise. Far from isolating scientific from moral thought, or nature-oriented from human-oriented knowledge, Priestley affirms their conjunction.

Priestley's commitment to human progress guided by divine intent appealed to Coleridge, who calls the natural philosopher "patriot, and saint, and sage" in "Religious Musings" (1794).[25] Coleridge's early poem enrolls Priestley among a company that includes both Milton and Newton, celebrating philosophical minds who elevated divinity. Indeed, "Religious Musings" reflects Coleridge's investment during the 1790s in the pious materialist science of the dissenting tradition. The fullest expression of human reason, for Coleridge, is a recognition of one's connection to God, the ability, "to know ourselves/ Parts and proportions of one wond'rous whole!"[26] Coleridge recounts a "primeval age" when "Imagination conjur'd up / An host of new desires: with busy aim, / Each for himself, Earth's eager children toil'd."[27] In its infancy, humanity was motivated by self-interested imagination, which produced "all th' inventive arts, that nurs'd the soul / To forms of beauty, and by sensual wants / Unsensualiz'd the mind."[28] In this construction, Coleridge views "all th' inventive arts" as the product of sensualist individuals, but posits that humanity will eventually attain divine unity. Divisions in knowledge, then, are produced by the senses. Piety brings with time a recognition of intellectual unity. No doubt, this trajectory informs Wordsworth's later conviction in the 1802 preface to *Lyrical Ballads* that "If the labours of men of Science should ever create any material revolution, direct or indirect, in our condition … the Poet will sleep then no more than at present, but he will be ready to follow the steps of the man of Science … he will be at his side, carrying sensation into the midst of the objects of Science itself."[29] In each case, division is an imperfect affliction of the present, but a future state will see the arts and sciences unified.

The moral dimensions of Priestley's airs were not purely a linguistic conceit:

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[24] Priestley, *Experiments*, vol. 1: pp. 93-4.
[25] Samuel Taylor Coleridge, "Religious Musings," *The Collected Works of Samuel Taylor Coleridge*, Ed. J. C. C. Mays, vol. 16, part 1, *Poetical Works* (Princeton: Bollingen Foundation and Princeton UP, 2001), line 372.
[26] Coleridge, *Poetical Works*, lines 127-8.
[27] Coleridge, *Poetical Works*, lines 201-3.
[28] Coleridge, *Poetical Works,* lines 208-10.
[29] Wordsworth, "Appendix A," p. 423.

practical improvements manifested the atmosphere's moral scale. Priestley touted the moral dimensions of his discovery of "nitrous air" (what we call nitric oxide, NO – a different substance than our nitrous oxide, N_2O), a substance he mixed with "common air" to determine its purity (whether it contained oxygen). As Schaffer puts it, in Priestley's view, "a scale of absorption by nitrous air became a scale of *virtue*."[30] This moral linkage gained power and urgency from the fact that, as Priestley maintained, "the goodness of air may be distinguished much more accurately [by this method] than it can be done by putting mice, or any other animals, to breathe in it."[31] Priestley's discovery had immediate moral significance: as a replacement test for breathability, nitrous air abated the murine massacres he had been perpetuating; it both tested for the goodness of other airs and itself created good outcomes by saving the lives of mice. Priestley's view of the air's moral excellence—his certainty that "every person of feeling will rejoice with me in the discovery of *nitrous air*"[32]—likely arose from his exchanges with Anna Barbauld. Her collected poems appeared in 1773, one year before the publication of Priestley's first volume on airs, and included "The Mouse's Petition," a poem in which a caged mouse begs Priestley for his life on the basis that "The well-taught philosophic mind / To all compassion gives; / Casts round the world an equal eye, / And feels for all that lives."[33] Nitrous air allowed Priestley to capitulate to the mouse's plea.

"Born of the Air": at the Onset of Elements

From our vantage, it's worth recognizing that the modern chemical element was, to borrow Barbauld's phrase, "born of the air." Late eighteenth-century pneumatic chemistry rendered the gaseous state available to chemical scrutiny, allowing chemists to consider material continuities persisting across changes in the states of matter. Once chemists like Joseph Black, William Cavendish, and Joseph Priestley had dispelled the singular air of classical metaphysics—one of the last remaining antique elements with philosophical significance—chemistry could reconsider theretofore unquestioned premises. Furthermore, Antoine Lavoisier's work began as an attempt to overthrow the prevailing theory of combustion based on Georg Ernst Stahl's phlogiston principle of combustion. According to Stahl (and Priestley, among other mid-century chemists), combustion occurred when a substance released its phlogiston into the surrounding air, and it ended when that air became so saturated it could not support combustion. Lavoisier, by contrast, argued that oxygen, not phlogiston, sustained combustion, resituating the fuel from the solid substance to the gaseous. This conceptual innovation resolved a longstanding chemical controversy: if combustion results from a substance releasing its phlogiston into the atmosphere, why are combusted metals heavier than those not put to

[30] Schaffer, "Measuring," p. 287.
[31] Priestley, *Experiments*, vol. 1: pp. 114-5.
[32] Priestley, *Experiments*, vol. 1: p.73.
[33] Anna Barbauld, "The Mouse's Petition," in *Anna Letitia Barbauld: Selected Poetry & Prose*, eds. William McCarthy and Elizabeth Kraft (Buffalo: Broadview Editions, 2002), pp. 69-72, lines 25-8.

flame? The answer, of course, is that oxygen combines with the combusted metal to produce an oxide. For this to be conceivable, something in air had to pass into the solid state through combustion. That something was the element oxygen. A substance that could undergo such a striking change in form and yet persist, a substance that could resist every effort at chemical decomposition, must be special.

Chemists submitting complex substances to analysis, breaking them apart using fire, solution, or the force of electricity, brought about physical *and* conceptual changes. Modern elements are metaphorically hardened, impenetrable to moral, historical, or imaginative concerns. The discipline these elements sustained was affected by this change, though it would be an overstatement to argue that chemistry became quarantined from other pursuits. Lavoisier sought to protect his science from the imagination's disorder:

> Imagination, on the contrary, which is ever wandering beyond the bounds of truth, joined to self-love and that self-confidence we are so apt to indulge, prompts us to draw conclusions which are not immediately derived from facts; so that we become in some measure interested in deceiving ourselves.[34]

To Lavoisier, Priestley's roving inquisitiveness must have looked like carelessness. My point is that the modern element pressed chemistry towards epistemological enclosure because its empirical nature foreclosed the kinds of improbable conjunctions between epistemological modes that were possible in Priestley's theory and pervasive during the 18th century. Lavoisier's idea of the element inaugurated a new form of chemistry oriented towards coherence and self-articulation.

Romantic poets registered this change and perceived a gulf growing between the interests and investments of poetry and science. The difference between the pursuits lay in their basic protocols. According to Wordsworth, the knowledge of the man of science "is a personal and individual acquisition, slow to come to us, and by no habitual and direct sympathy connecting us with our fellow-beings. The Man of Science seeks truth as a remote and unknown benefactor; he cherishes and lives it in his solitude."[35] This characterization emphasizes the sciences' alienation from general human pursuits. The man of science, in his philosophical exertions, withdraws from society to focus on the "acquisition" of specialized knowledge. By contrast, the poet, whose task involves an immediate relationship with the natural world and other humans is,

> a man speaking to men: a man, it is true, endued with more lively sensibility, more enthusiasm and tenderness, who has a greater knowledge of human nature, and a more comprehensive soul, than are

[34] Antoine, Lavoisier, *Elements of Chemistry in a New Systematic Order*, translated by Robert Kerr (Edinburgh: William Creech, 1796), p. xvi.
[35] Wordsworth, "Appendix A," p. 423.

> supposed to be common among mankind; a man pleased with his own passions and volitions, and who rejoices more than other men in the spirit of life that is in him; delighting to contemplate similar volitions and passions as manifested in the goings on of the Universe, and habitually impelled to create them where he does not find them.[36]

Wordsworth describes the poet in terms of his intrinsic connection with the universe: the poet recognizes the presence of analogous "passions and volitions" both within himself and in the broader universe. He observes the universe and reflects upon how what is true about nature's inner workings is also true in himself. For Wordsworth, then, as John Beer attests, "newly discovered chemical and electrical powers that were as active in human beings as in the external world" reified the "mutual illumination" between humanity and nature, refreshing and resituating as a peculiar propensity of poetry "the old alchemical sense of correspondences between man and nature."[37] In this regard, the poet investigates the cosmos's basic workings more intimately than does the ascendant chemist modelling himself on Lavoisier. In fact, the new scientist's view is alienated from the world and must be mediated by conceptual and technological apparatuses.

It turns out that the smallest things estranged poets from chemists. Following Lavoisier's revolution, chemists practiced stoichiometry: they sought to calculate the types and proportions of elements comprising complex bodies. Romantic poets responded by embracing consilience and correspondence as central to their pursuits. In the 1790s, figures like Joseph Priestley, Erasmus Darwin and Thomas Beddoes had encapsulated for Wordsworth and Coleridge the promise of a dynamic natural philosophy. The two poets formed a close friendship with the young chemist Humphry Davy, beginning in 1799 while he was working with Thomas Beddoes at the Pneumatic Institution in Bristol. This institution, and Davy's work with it, embraced the holistic methods of Enlightenment natural philosophers like Priestley. But after Davy moved to London to take up a position at the Royal Institution in 1801, he worked increasingly to distance himself from his youthful connection to west-country radicals like Beddoes. In London, he found success, gaining respect and credibility in the chemical community as he embraced Lavoisier's system and repudiated his youthful associations. The system Davy was embracing transformed chemistry into a counting science, which would inspire Coleridge to aim a damning insult at his one-time friend sometime after 1812: "H. Davy is become Sir Humphry Davy & an Atomist."[38] Coleridge's slight probably reflected his disdain for institutional chemistry's tendency over the 19th-century's first decade to embrace quantitative methods more than it did any deliberate criticism of Davy's chemical theories (Davy's views on atomism were notably convoluted: he was not, in any straightforward sense, an

[36] Wordsworth, "Appendix A," p. 420.
[37] Beer, *Poetic Intelligence*, p. 24.
[38] Quoted in Trevor Levere, *Poetry Realized in Nature* (Cambridge: Cambridge UP, 1981), p. 35.

atomist).[39] Chemistry had acquiesced to the tyranny of the scale, and Coleridge did not approve of knowledge conceived as "merely mechanical and like a Carpenter's Ruler, having it's whole value in the immediate outward use to which it is applied."[40] The concept that made chemistry quantifiable, the element, also precluded by its nature chemistry's integration with moral and spiritual concerns, raising Wordsworth's hackles. Priestley's science had been social in a way that Davy's could no longer be. To analyze substances one needed access to a Voltaic battery, an expensive apparatus less easily obtained than Priestley's jars and tea dishes. The emphasis on elements consolidated chemistry, which increasingly became ensconced in institutions that could assemble sufficient capital for chemical research. The focus on isolating and discovering elements in many ways cloistered chemistry and committed it to analysis. The Romantic poets responded by adjusting their sense of their own pursuits, claiming mantles of holism and synthesis.

[39] For more thorough engagement with Davy's complicated relationship to various atomic theories see Trevor Levere, *Affinity and Matter: Elements of Chemical Philosophy, 1800-55* (Oxford: Oxford UP, 1971), pp. 1-67 and David Knight, *Atoms and Elements* (London: Hutchinson and Co., 1967), pp. 16-59.

[40] Samuel Taylor Coleridge, *The Collected Letters of Samuel Taylor Coleridge*, ed. Earl Leslie Griggs, vol. 6 (Oxford: Oxford UP, 1971), p. 630.