

The Scientist and the Poet

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The worthiest professor of physics would be one who could show the inadequacy of his text and diagrams in comparison to nature and the higher demands of the mind.

—Johann Wolfgang von Goethe

This is the kind of comment we expect from a poet on a scientist. Poets generally seem to be unsympathetic to science; they question its capacity to tell us the full truth about our world. Typically, poets claim that science offers us only abstractions, and destroys the living phenomena it purports to study in the very process of analyzing them into their separate (and hence lifeless) parts. As William Wordsworth famously put it: “We murder to dissect.”

Accordingly, the scientist and the poet seem to us to be perpetually at odds. To the poet, the scientist seems unimaginative and literal-minded—with his head buried in the ground of facts, incapable of comprehending the larger significance of what he does. To the scientist, the poet seems to have his head up in the clouds, indulging in fantastic visions of what might be and losing sight of the way things really are. It is difficult for us to imagine a successful conversation between a scientist and a poet—they seem almost to speak different languages.

But before positing an unbridgeable gulf between science and poetry, it is well to remember that the great poet Goethe was also a scientist. He is of course best remembered for his imaginative works, such as *Wilhelm Meister* and *Faust*, but his contributions to science were not insignificant. Among other things, he was an accomplished botanist, he helped found the field of comparative anatomy, he coined the term *morphology*, and he anticipated the theory of evolution. If these achievements do not sound enough like “hard science,” it is well to remember that in 1784 Goethe discovered the intermaxillary bone in the human jaw, thus supplying a link to primate anatomy that proved crucial to later evolutionary theories. Goethe is an exception in many respects, and thus his ability to combine the talents of a poet and a scientist does not tell us much about the general run of poets, but it does at least offer evidence that science and poetry are not utterly incompatible. One might think of other examples, such as the twentieth-century American poet William Carlos Williams, who earned his living as a practicing physician. To open up a dialogue between science and poetry, we do not have to show that the two fields are completely in tune—only that they have

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at least been in touch. And given the possibility that poets might have something to teach scientists, it is worth looking back at the history of their interaction to see if they have enough in common to be able to speak to each other.

Wisdom and Ignorance

This is potentially a vast historical undertaking, and in order to make it more manageable, I will confine myself to the area I know best, roughly the beginning of the nineteenth century, the Romantic Period. The Romantics were the first poets to confront science in its fully modern sense. Living at a time when the Industrial Revolution was well underway, the Romantic generation experienced the chief distinguishing characteristic of modern science: its link to modern technology and its effort to transform the world from the ground up in material terms. The Romantics are famous for reacting to these developments with hostility. We think of them as nature poets, and chiefly remember them for being appalled at the way the beautiful landscape of England was transformed into something ugly by the scars of industrialization. Think of William Blake's well-known lines (from his preface to his poem *Milton*):

And was Jerusalem builded here
Among these dark Satanic Mills?

Blake's sense that the material transformations brought about by the new factory system in England were at odds with ancient spiritual impulses colors his understanding of modern science. In "Mock on, Mock on Voltaire, Rousseau," a poem attacking the spirit of the French Enlightenment, Blake contrasts the reductionist tendencies of modern science with the expansive vision of a mythic/poetic view of the world:

The Atoms of Democritus
And Newton's Particles of light
Are sands upon the Red sea shore,
Where Israel's tents do shine so bright.

Here Blake takes atomic theory as emblematic of science's more general tendency to reduce things to their component parts and in the process to lose sight of their wholeness, their larger human meaning and above all their spiritual significance.

Blake thus seems to fit our stereotype of the Romantic and the poet more generally as someone hostile to science. It is understandable that a scientist, with a turf to defend, might mistake this hostility for ignorance. Indeed, a scientist might justify ignoring a poet's criticism of science on the grounds that the poet did not know what he was talking about. Often the Romantics do appear to be reactionaries in their critique of science, clinging to old-fashioned and outmoded ways of life in the face of developments that, in retrospect, we recognize as the wave of the future in their day.

A scientist might further attempt to discredit a poet as a critic of science by imputing to him a kind of professional jealousy. Beginning in the nineteenth century, science and poetry began to compete for prestige and authority in Western culture, and there is little question that in this competition science gradually won out, displacing poetry from a position it had occupied for centuries as the cultural center of the West. Going into the nineteenth century, poets were still thought of as the great embodiment of the wisdom of their societies. If people in the nineteenth century had been asked: "Who is the wisest man in Europe?" many would have answered: "Goethe." But in the twentieth century, if the same question had been posed, I very much doubt that many people would have offered a poet, or any imaginative writer, as their answer. I would venture to say that the most common answer in the twentieth century to the question: "Who is the wisest man?" would have been: "Albert Einstein." That is a rough indication of how in the course of the nineteenth century science replaced poetry as the central image of wisdom in our culture. "No wonder the poets are so hostile to us," scientists could say: "We stole their thunder."

Reason and Myth

The idea that science would replace poetry as the center of our culture was actually suggested during the Romantic period, by a minor poet named Thomas Love Peacock, who in 1820 published a provocative essay entitled "The Four Ages of Poetry." Peacock argues that poetry flourished in the early stages of humanity, when people were passionate and superstitious, and grand poetic myths appealed to them. But as humanity advances, and develops the various sciences, people lose their taste for myth and embrace a more prosaic view of the world. As Peacock writes:

Feeling and passion are best painted in, and roused by, ornamental and figurative language; but the reason and the understanding are best addressed in the simplest and most unvarnished phrase. Pure reason and dispassionate truth would be perfectly ridiculous in verse, as we may judge by versifying one of Euclid's demonstrations.... As the sciences of morals and of mind advance towards perfection,... as reason gains the ascendancy in them over imagination and feeling, poetry can no longer accompany them in their progress, but drops into the background, and leaves them to advance alone. Thus the empire of thought is withdrawn from poetry.

Although Peacock did not know Blake's poetry, he might as well have been writing in answer to Blake's criticism that science misses the mythic dimension of human life. For Peacock, by contrast, poetry has gone wrong in the nineteenth century precisely because it insists on producing myths in a demythologized world:

In the origin and perfection of poetry, all the associations of life were composed of poetical materials. With us it is decidedly the reverse. We know too that there

are no Dryads in Hyde-park nor Naiads in the Regent's canal. But barbaric manners and supernatural interventions are essential to poetry... While the historian and the philosopher [the scientist] are advancing in, and accelerating, the progress of knowledge, the poet is wallowing in the rubbish of departed ignorance, and raking up the ashes of dead savages to find gewgaws and rattles for the grown babies of the age... A poet in our times is a semi-barbarian in a civilized community. He lives in the days that are past. His ideas, thoughts, feelings, associations, are all with barbarous manners, obsolete customs, and exploded superstitions. The march of his intellect is like that of a crab, backward.

I have quoted Peacock at length to show that the quarrel between science and poetry did not begin in the twentieth century and that in fact a contemporary of the Romantics—indeed a friend of Percy Shelley—could be as nasty in his comments about poetry as any poet has ever been about science. But was Peacock right about the Romantic poets (and he does attack Byron, Wordsworth, and Coleridge by name)? Were they ignorant of science, jealous of its new-found prestige, and simply hostile to its progress? Let us look at the evidence. Blake was probably the least educated of the Romantics. He basically lacked formal schooling, and taught himself whatever he knew in a very eccentric manner. But even Blake was interested in the new science of comparative mythology, and there are signs that he was aware of developments in what came to be known as the Higher Criticism, the scientific study of the Bible as a text that was just beginning in the late eighteenth century. Those who believe that Blake was implacably opposed to science would be surprised to read the final lines of his magnum opus, *The Four Zoas*. It builds up to a magnificent apocalyptic vision, in which the divisions of the world are overcome and human life is redeemed, culminating in the words:

The war of swords departed now,
The dark Religions are departed & sweet Science reigns.

This is a strange way for a foe of science to describe the redemption of the world—indeed, with its dismissal of “dark Religions” and triumphant turn to science, this passage seems to be very much in the spirit of the Enlightenment.

One might question whether Blake is using the word science here in its modern sense; perhaps he intends it as a synonym for a more general concept of “wisdom.” But if one turns to a comparable moment in Blake's poetry—the conclusion of his other great work, *Jerusalem*—one finds something similar and this time Blake is more specific in his references to science. Once again, at the moment of apocalypse, science has a role to play in the redemption of the world, but now we recognize the participants:

The innumerable Chariots of the Almighty appear'd in Heaven,
And Bacon & Newton & Locke, & Milton & Shakespeare & Chaucer.

Blake's poetry is notoriously obscure, and never more so than in *The Four*

Zoas and *Jerusalem*. One cannot say for certain what Blake is getting at in this enigmatic and to some extent bizarre passage. But we saw how Newton was his representative of science in “Mock on, Mock on Voltaire, Rousseau,” and we know from his other writings that he closely associated Bacon and Locke with the scientific/empiricist view of the world. Thus in the culminating moment of *Jerusalem* (and in a sense the culminating moment of all his poetry), Blake seems to call for a reconciliation of science and poetry, as the chief representatives of both camps are brought together to make the apocalypse possible. Whatever one ultimately makes of these passages, they strongly suggest that the negative view of science expressed frequently in Blake does not tell the whole story. He would hardly invite scientists to his apocalyptic party at the end of the universe if he had nothing but contempt for them. He was capable of thinking of science as an integral part of human life, and indeed in his vision of the apocalypse, he insists on integrating science—and some very famous scientists—into his account of the restoration of human wholeness.

Sublime Steamboats

We find a similar complexity in Wordsworth’s attitude toward science when we examine his writings carefully. To be sure, he often laments the impact of modern science and technology on the realm of nature, and, like Blake, he also regards the domination of the scientific worldview as a threat to the imagination. It is less well-known, however, that at times Wordsworth speculated that science might open up imaginative possibilities for poetry. He does so in a generally neglected passage in his most famous piece of prose, his preface to the 1802 edition of the volume of poetry he published with Samuel Taylor Coleridge, *Lyrical Ballads*:

If the labours of men of Science should ever create any material revolution ... 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.... The remotest discoveries of the Chemist, the Botanist, or Mineralogist, will be as proper objects of the Poet’s art as any upon which it can be employed.... If the time should ever come when what is now called Science, thus familiarized to men, shall be ready to put on, as it were, a form of flesh and blood, the Poet will lend his divine spirit to aid the transfiguration.

“The Poet ... will be ready to follow the steps of the man of Science”—that does not sound like the Wordsworth of “We murder to dissect.” Here Wordsworth even seems to be anticipating, and already trying to counter, Peacock’s later objections to poetry. He suggests that, if scientists advance our understanding of the human condition, poets will be prepared to follow their lead and will be able to produce a new kind of poetry out of the new science.

Wordsworth never wrote an “Ode to Mineralogy,” but he did produce a son-

net with the equally unromantic title “Steamboats, Viaducts, and Railways”:

Motion and Means, on land and sea at war
With old poetic feeling, not for this,
Shall ye, by Poets even, be judged amiss!
Nor shall your presence, howsoe'er it mar
The loveliness of nature, prove a bar
To the Mind's gaining that prophetic sense
Of future change, that point of vision, whence
May be discovered what in soul ye are.
In spite of all that beauty may disown
In your harsh features, Nature doth embrace
Her lawful offspring in Man's art; and Time,
Pleased with your triumphs o'er his brother Space,
Accepts from your bold hands the proffered crown
Of hope, and smiles on you with cheer sublime.

It certainly runs counter to our common conception of the Romantics to find their chief representative using a poem to celebrate “steamboats, viaducts, and railways”—prime examples of the cutting edge of technology in his day, and cutting right into the English countryside. To be sure, Wordsworth observes how these forms of modern technology “mar the loveliness of nature” and for that reason he views them as “at war / With old poetic feeling.” But rather than seeing technology as simply at odds with nature, Wordsworth in this sonnet chooses to view it as an extension of nature's power: “Nature doth embrace / His lawful offspring in Man's art.” Wordsworth has a point—insofar as man is part of nature, even his technological powers may be said to grow out of nature and are in that sense natural themselves.

We begin to see here the chief point of contact between Romantic poetry and modern science—both are creative forces and put a premium on bringing new things into the world. Insofar as Romantics like Wordsworth sensed a creative power in science, they felt that they could embrace it. They too, like modern scientists, hoped to alter the world for the better. Hence Wordsworth's sonnet culminates in his seeing something “sublime” in modern technology. *Sublime* was one of the keywords of the Romantics and they often used it to designate the peak of their aspirations. But we normally expect a Romantic to call an aspect of the natural world “sublime”—a towering mountain or a thundering waterfall. That Wordsworth chose to call steamboats, viaducts, and railways “sublime” should shake up our preconceptions about the Romantics. Once again, it shows that they did not simplistically reject science, but tried to incorporate what was new and powerful in it into their understanding of the world, and perhaps even to appropriate some of that power for their poetry.

Of all the Romantics, Lord Byron and Percy Shelley were the ones most interested in science and most aware of new scientific developments in their age.

Shelley was intrigued by chemistry as early as his student days at Oxford, and showed so much promise in the field that the great philosopher of science, Alfred North Whitehead, was led to write: “if Shelley had been born a hundred years later, the twentieth century would have seen a Newton among chemists.” Both Shelley and Byron were fascinated by what was happening in astronomy and cosmology in their day—a fascination that is reflected in the cosmic speculations that appear in poems such as Shelley’s *Prometheus Unbound* or Byron’s *Cain*. Shelley and Byron took a special interest in the emerging fields of geology and paleontology, and in particular kept up with the latest theories about the prehistoric creatures that came to be known as dinosaurs. This kind of scientific development fed the religious skepticism of Shelley and Byron, and above all their tendency to question the Biblical account of creation. Well before Darwin’s time, Shelley and Byron were taking cues from modern science to suggest in their poetry that man might not have been created perfectly by a benevolent God. The evidence thus suggests that the Romantic poets, although they certainly had their doubts about certain aspects of modern science, did not condemn it out of simple ignorance or jealousy, but had instead entered into a genuine dialogue with the science of their day. If Shelley and Byron are any indication, the Romantics were not simply willing, but quite eager to listen to what contemporary scientists had to say.

One can even detect signs of the beginnings of science fiction in the poetry of Shelley and Byron. Byron’s remarkable poem “Darkness” portrays the end of the world in the starkest possible terms, and describes the kind of negative apocalypse that has become a characteristic mode in science fiction, beginning with H.G. Wells’s *The Time Machine*. Byron seems to anticipate the concept of entropy and the heat-death of the universe, and rivals Wells in his unnerving vision of the extinction of the sun. In the cosmic vistas of *Prometheus Unbound*, Shelley anticipates space travel. He in fact directly influenced Wells, who based his science fiction novel *In the Days of the Comet* loosely upon the apocalyptic vision of *Prometheus Unbound*. The fact that science fiction grows out of Romantic literature is perhaps our best evidence that the Romantics were not ignorant of science; rather they were among the first to recognize its imaginative potential. Even our brief survey of the Romantic view of science suggests that, although scientists of course remain free to reject the advice of Romantic poets, they cannot do so on the grounds that the Romantics knew nothing about science.

Gods and Monsters

If there is one imaginative work of the Romantic era that scientists should pay attention to, it is undoubtedly Mary Shelley’s *Frankenstein*. Mary was of course the wife of Percy Shelley, and in her account of the genesis of *Frankenstein*, she

explains how the novel had its origins in learned conversations she listened to between her husband and Lord Byron:

During one of these, various philosophical doctrines were discussed, and among others the nature of the principle of life, and whether there was any probability of its ever being discovered and communicated. They talked of the experiment of Dr. Darwin, . . . who preserved a piece of vermicelli in a glass case, till by some extraordinary means it began to move with voluntary motion. . . . Perhaps a corpse would be reanimated; galvanism had given token of such things: perhaps the component parts of a creature might be manufactured, brought together, and endued with vital warmth.

Mary Shelley here displays her familiarity with some of the latest and most exciting scientific developments of her day, and especially Galvani's experiments with electricity as a life-force (incidentally, the Dr. Darwin referred to in this passage is not Charles, but his grandfather Erasmus). Very much rooted in the science of its day, *Frankenstein* embodies a profound awareness of the larger human context of scientific endeavor. This may be difficult for us to believe today, accustomed as we have become to the cheap thrills offered by all the horror movies based on the Frankenstein motif. But even these movies have something to say about the dangers of unbridled scientific research, and it is no accident that the image of Frankenstein has entered the popular imagination as our chief symbol of science gone awry. But if we go back to the original story in Mary Shelley's novel—which is much more literate and intellectually sophisticated than the movie versions would lead us to expect—we will get our fullest sense of what literature might have to say to science.

Above all, Mary Shelley concentrates on presenting the story of Frankenstein's attempt to create a living being as a human drama. She dwells on Frankenstein's motives as a creator and the consequences of his mode of creation on the creature he brings to life. In terms of Frankenstein's goals in creation, Shelley actually presents him as a kind of artist: "I doubted at first whether I should attempt the creation of a being like myself, or one of simpler organization; but my imagination was too exalted by my first success to permit me to doubt of my ability to give life to an animal as complex and wonderful as man." With his "exalted" "imagination," Frankenstein sounds like a Romantic poet, trying to translate an ideal vision into material terms. We begin to see the problem with Frankenstein's creative activity when Shelley reveals how much Frankenstein is concerned with his own glory: "Life and death appeared to me ideal bounds, which I should first break through, and pour a torrent of light into our dark world. A new species would bless me as its creator and source; many happy and excellent natures would owe their being to me." In his imagery of pouring light into a dark world, Frankenstein reveals himself to be a child of the Enlightenment, and Shelley brings out the connection between modern science and modern technol-

ogy—the Baconian desire to conquer nature “for the relief of man’s estate.” Frankenstein thinks of himself as a kind of god, and his motivation for bringing a new species into being is to enjoy their worship of him as their creator.

Why does he go on to claim: “No father could claim the gratitude of his child so completely as I should deserve theirs”? Hitherto, every father has had to share the glory of human creation with a mother, whose role in bringing the child into existence was at least as great, if not greater. One can see Shelley thinking as a woman in this passage, and calling into question the masculine pride of the scientific creator. Frankenstein acts out a kind of male fantasy—to skip over any natural means of reproduction, to be solely responsible for the creation of his offspring, and thus to be able to claim its total gratitude. In her deepest insight into scientific creativity, Shelley sees its link to a will to power, and a desire to go beyond all conventional and natural limits on human aspiration.

Frankenstein’s obsession with his own glory has disastrous consequences for the being he creates. He is in a hurry to achieve his goal, and worries only about how quickly he can reach it, not about whether he can do the job right: “As the minuteness of the parts formed a great hindrance to my speed, I resolved, contrary to my first intention, to make the being of a gigantic stature, that is to say, about eight feet in height, and proportionably large.” Notice how quick Frankenstein is to revise his original plan, and solely in order to speed up his ability to get results. He does not pause to consider the consequences for his creature of the “gigantic stature” with which he endows it. In fact, all the misery the creature is forced to endure can be traced to its inability to fit in to society, and being eight feet tall is its primary problem in being accepted as normal by the human beings it encounters. Ultimately Frankenstein’s failure as a creator is a failure of imagination—he does not think through in advance what it will feel like to be a giant among ordinary men. Shelley identifies the purely technical nature of scientific thinking as its chief defect. For Frankenstein creation is simply a matter of technique. He has the parts and his only concern is how to assemble them quickly into a whole. He does not think about the nature of the whole he is creating—how the way it is being brought into being will affect the character of that whole. The result of Frankenstein’s lack of foresight and imagination is to bring tragedy on his creature and ultimately on himself.

Mary Shelley was of course an amateur when it comes to science, but in many ways her understanding of the larger context of science was well in advance of the thinking of the greatest scientists of her day. Notice that she is not skeptical about the power of science; she is not the sort of know-nothing who doubts the claims of scientists to be able to change the world. On the contrary, at the very beginning of what was to become the science of biochemistry, Shelley foresaw how potent a tool it would be in the hands of scientists. When scientists were priding themselves on merely getting the legs of a dead frog to jump,

Shelley could already imagine the creation of a live human being through science. Indeed, we can now say in retrospect that *Frankenstein* is one of the most prophetic books ever written, and it is difficult to think about the disturbing questions raised by contemporary possibilities in biotechnology without invoking the warnings of Mary Shelley. The basic lesson *Frankenstein* can teach us is this: science can tell us *how* to do something, but it cannot tell us whether we *should* do it. To explore that question, we must step outside the narrow range of science's purely technical questions, and look at the full human context and consequences of what we are doing. To fill in our sense of that context and those consequences, literature can come to the aid of science. No matter how imaginative science itself can be—and recall that Shelley does see Frankenstein as fired up by his imagination—literature is better at imagining the human things. As we have seen, Shelley can do what Frankenstein fails to do—to imagine what it would feel like to be a being created by science. And Shelley also usefully reminds us that science itself is a human activity, and that scientists may sometimes be impelled by human, all-too-human motives. Frankenstein presents his great experiment in creating life as a form of pure research, but Shelley makes us understand the dubious personal motives that are driving him, motives that in the end lock Frankenstein and his creature into a mutually self-destructive struggle.

The Wisdom of Poetry

The role that literature can play for science was eloquently formulated by Mary Shelley's husband in his essay "Defence of Poetry." Percy Shelley was not about to let his friend Peacock get away with his scurrilous attack on poetry, and thus he set out to answer it in an essay that lays out the contribution the imaginative arts in general have made to civilization over the centuries. Shelley argues that we may have all the scientific knowledge we need, but that only poetry in the broadest sense can teach us how to use it properly:

We have more moral, political and historical wisdom, than we know how to reduce into practise; we have more scientific and œconomical knowledge than can be accommodated to the just distribution of the produce which it multiplies. The poetry in these systems of thought, is concealed by the accumulation of facts and calculating processes... We want the creative faculty to imagine that which we know; we want the generous impulse to act that which we imagine; we want the poetry of life: our calculations have outrun conception; we have eaten more than we can digest. The cultivation of those sciences which have enlarged the limits of the empire of man over the external world, has, for want of the poetical faculty, proportionally circumscribed those of the internal world; and man, having enslaved the elements, remains himself a slave.

When Shelley writes "our calculations have outrun our conception; we have eaten more than we can digest," it is hard to believe that he was writing early in

the nineteenth century and not early in the twenty-first. For when he claims “man, having enslaved the elements, remains himself a slave,” he seems to have captured perfectly the great threat of modern technology in our day. Shelley leaves us with a sobering sense of the dangers of a scientific wisdom completely severed from poetic wisdom. As his wife’s portrait of Victor Frankenstein suggests, such a liberated science may lead to a new kind of slavery, as human beings lose control of the products of their technological imagination, and perhaps end up serving the very forces that were meant to serve them.