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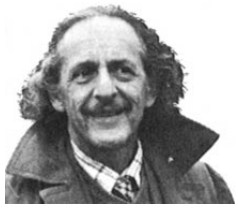

The Poetry-Science Connection

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When Donald F. Patterson, University of Pennsylvania, summarized a 1981 National Institutes of Health symposium, "Animal Models of Inherited Metabolic Diseases," he delivered his paper entirely in verse.[1] Patterson, who teaches medical genetics in the School of Veterinary Medicine, writes verse as a hobby. Here's a brief quote from his summary on gene structure, organization, and expression:

> Well, we thought that we finally had
> figured it out!
> We knew what the structure of genes
> was about....
> But there's two kinds of Karyotes—
> there's Eu- and there's Pro-
> And what's true for *E. coli* just
> isn't so,
> When it comes to the genes of a
> mouse or a man.
> Mother Nature, it seems, has used
> more than one plan.

In a lighthearted way, Patterson was carrying on the ancient scientific tradition of expressing science in poetry. If one is fortunate enough to have studied the classics, which I wasn't, one is introduced to the epic poems of antiquity. While most are concerned with the mythology of ancient heroes, many deal with scientific issues. Indeed, about 60 BC, the Roman poet Lucretius wrote *De Rerum Natura*. Its title has been variously translated to read *On the Nature of the Universe*[2] or *The Way Things Are*. Besides being one of the great epic poems, this *magnum opus* of Lucretius is the most extensive description of nature of its time. The poem deals with human nature and religion, but in large part it is a commentary on atomic theory, meteorology, astronomy, the origin of life, and the mechanics of perception. In this excerpt from James H. Mantinband's translation, Lucretius discusses the size of the universe:

> The universe must be infinite in all
> its paths,
> for otherwise it would have a limit
> or boundary,
> and clearly nothing has a boundary,
> unless
> something lies beyond it, to bound
> and limit it,
> something visible, beyond which we
> cannot perceive.
> But we must confess that there is
> nothing beyond
> the sum of things, no extremity,
> no end or limit.
> And it makes no difference in which
> part you are standing:
> for in whatever place one stands,
> the universe
> will stretch out to infinity in all
> directions.[2] (p. 28)

Lucretius was not the only ancient to incorporate the science of his day into poetry. The Greek Hesiod, who lived around 800 BC, worked weather lore and advice about agriculture into his verse. So did Virgil (70-19 BC), author of the *Aeneid*, in his *Georgics*.[3] From the C. Day Lewis translation, the following quote contains some of Virgil's astronomy-related farming tips:

As soon as the first months of the
year begin, your strong bulls
Should turn the fertile loam and
leave the clods lying
For the full suns of summer to bake
into a fine dust:
But if the land's not heavy, you'll
find it enough at the North Star's
Rising to ridge it out in shallow
furrows:—the one
Lest weeds should check the corn's
exuberance, the other
Lest lack of moisture turn your soil
to a sandy desert.[4] (p. 91)

Besides preaching the superiority of the bucolic life, these poems included practical information on animal husbandry, farming, and the changing of seasons. Other sciences have also been covered by ancient bards. In the first century AD, Manilius, in his *Astronomica*, put astronomical calculations into verse.[5]

Unfortunately, in our academic and everyday lives there has been a tendency to assume that the humanities, including poetry, are somehow incompatible with science. In his classic book, *The Two Cultures and the Scientific Revolution*,[6] C.P. Snow described the divergence, observed in his own lifetime, between the older culture of letters and the younger culture of science. But the conflict between humanists and scientists preceded Snow, and continues today. Nevertheless, during most periods of history there have always been scientists and poets who felt that poetry and science complement each other. The influence of extremists of either kind has varied according to the circumstances.

Perhaps the most beautiful contemporary resolution of the two-culture issue is to be found in the writings of Norman Cousins, editor emeritus of *Saturday Review*. In a recent commencement address about writers and physicians,[7] published in *Archives of Internal Medicine*, he says:

> ...Snow's two cultures may not be so unbridgeable after all. For in the end, the writer and the physician deal with the uniqueness of human beings and with the need to protect the human condition. Moreover, the physician and the writer need one another—the writer because he can profit from the discipline of testing his facts and slowing down the rush to judgment, and the physician because language is connected to the therapeutic power of attitudes and belief.

Using the forum of *Current Comments®* and my "captive" audience of *Current Contents®* readers, it has been my particular "shtick" to use every opportunity to remind you of these important connections. Most recently, this came up in an analysis of the connections between science and humanities journals.[8,9] And we have dealt with the aesthetic side of science many times in the past.[10,11] I had this in mind when I introduced Frederick G. Kilgour as the recipient of the first Lazerow lectureship. I said that there is no greater compliment that one can pay a fellow scholar or scientist than to say, "Not only did you do a beautiful job, but you identified a beautiful, significant problem."

I have often wanted to discuss the poetry-science connection, but it was not until I had the good fortune to meet Alan L. Mackay in London that I decided the time was right. Mackay is reader in crystallography at the University of London, Birkbeck College. He was also a colleague of J.D. Bernal.[12] Quite coincidentally, I had recently been discussing his book of poems, *The Floating World of Science*,[13] with a group of crystallographers and physicists I met at a conference at the Weizmann Institute of Science, Israel.

Most of the works in Mackay's 1980 poetry book are on scientific subjects. Some of the poems deal with serious topics like quantum mechanics and napalm. Others, like this selection from a series called "Thoughts on the Titles of Scientific Journals," are in a lighter vein:

> Current Contents are too few,
> and discontents are now in view.
> 'SCIENCE' fails to find a cure,
> but sends us back to 'NATURE.'

Mackay also pokes gentle fun at other journals in poems entitled "Discrete Mathematics," "Nuclear Energy," "Personal Computer World," and "Kidney International."

Mackay has also compiled a very entertaining book called *The Harvest of a Quiet Eye*.[14] In addition to philosophical, historical, and political quotes on science, the book contains lines of science-related poetry by Auden, Burns, Byron, Chaucer, Dickinson, Donne, Frost, Kipling, Poe, Pope, Shelley, Tennyson, Wordsworth, and others.

"Anecdotal Evidence," a column by Mackay on the human side of science, appears regularly in *The Sciences*. In one piece, entitled "Rhyme and reason," he divides scientific poetry into two main types.[15] The first type borrows from the terminology of science images used to "illuminate the eternal issues of the human condition." Examples of those who have written this kind of poetry are the Czech biologist Miroslav Holub and the American novelist John Updike. The second kind deals with the nature of science itself. Such poetry has been written by Sir Ronald Ross (1857-1932), discoverer of the malaria parasite's life cycle, and by molecular biologist Thomas H. Jukes, University of California, Berkeley. Jukes used one of his own poems for the frontispiece of his textbook, *Molecules and Evolution*.[16] Recently, I quoted from the poetry of another molecular biologist—the late Sol Spiegelman.[17]

Many volumes have been written on the links between science and poetry.[18-21] The subject is one of infinite proportions. The connections are so numerous that one can only scratch the surface and hope that readers will be inspired to learn more on their own. So I've attempted to summarize here some of the more interesting points of view expressed in the past.

Lucretius and the other ancients were not the only poets who worked science into their epics. As the late literary critic Claude Williamson noted, the Ptolemaic theory of the universe is woven into the structure of the *Divine Comedy* by Dante (1265-1321). John Milton (1608-1674) also made use of the Ptolemaic system.[22]

In *Faust*, Goethe (1749-1832) depicted a scientist who wanted absolute knowledge. Besides being an artist, Goethe also worked in science. He identified the intermaxillary bone, and also a common constituent of natural rust, named goethite in his honor. He also wrote *Theory of Chromatics*, an unsuccessful attempt to refute Isaac Newton's *Optics*.[23]

It was during the early phases of the Industrial Revolution that discordant notes were increasingly sounded between scientists and poets. People with a scientific point of view began to harshly criticize poetry on the grounds that it was unscientific and false. Newton, when asked for his opinion of poetry, called it "a kind of ingenious nonsense." English philosopher John Locke (1632-1704) echoed the opinions of the Puritans when he compared poetry to gambling and said that both "seldom bring any advantage but to those who have nothing else to live on."[24] (p. 300)

Poets began to respond in kind. Some poets felt that science was intruding on their territory and in the process robbing nature of its beauty. "Science grows and Beauty dwindles," wrote Tennyson (1809-1892).[14] (p. 146) D.H. Lawrence (1885-1930) said nearly the same when he wrote, " 'Knowledge' has killed the sun, making it a ball of gas, with spots...."[24] (p. 312) Keats (1795-1821) lamented that science would "unweave a rainbow."[14] (p. 85) William Blake (1757-1827) depicted Newton, Locke, and Francis Bacon as an unholy trinity.[25]

There has also been among poets a feeling that science is dangerous. In "Sagesse" ("Wisdom") Paul Verlaine (1844-1896), the French poet, likened the practice of science to the picking of forbidden fruit: "Brothers touch not gluttonous science / That off the forbidden vines seeks to steal / The bloody fruit we must not know."[14] (p. 153-4)

Though some poets have said they hated science, many, including those

who have spoken critically of it, have held an ambivalent attitude. Wordsworth (1770-1850) described a scientist as "one that would peep and botanize upon his mother's grave."[26] He expressed a similar attitude in his much quoted statement: "We murder to dissect."[27]

But he also believed science should be part of poetry's subject matter.[26] His *Lyrical Ballads* (1798) contain material from biologist Erasmus Darwin's (1731-1802) immense scientific work *Zoonomia; or, the Laws of Organic Life*.[28] In many of his *Lyrical Ballads*, Wordsworth presented cases of persons at psychological extremes. "Goody Blake and Harry Gill," the story of a man with schizophrenia, came directly from an anecdote in *Zoonomia*.[26]

Other poets have also understood the significance of science. Samuel Taylor Coleridge (1772-1834) regarded science and poetry as complementary forms of activity.[29] He studied science extensively. He wrote in 1796 that he would spend 20 years writing an epic poem—ten years to study science and ten years to write and revise the poem. According to Mackay, Coleridge believed that an epic poem should take all knowledge into account, and that it would take at least a decade to accumulate and assimilate a scientific view of life.[15]

In his famous poem, "When I Heard the Learn'd Astronomer," Walt Whitman (1819-1892) described how a lecturer treated the stars in dry, technical terms. Whitman's reaction: "How soon unaccountable I became tired and sick/ Till rising and gliding out I wander'd off by myself,/In the mystical moist-night air, and from time to time,/Look'd up in perfect silence at the stars."[30] (p. 409-10)

Many people conclude from this poem that Whitman didn't think scientific knowledge was valuable. But in a 1951 book entitled *Walt Whitman—Poet of Science*, linguist Joseph Beaver, now retired from Northeastern Illinois University, Chicago, showed that Whitman was far from ignorant about astronomy. In both his prose and his verse, Whitman made extensive references to the positions of the stars and planets in the sky, and to the astronomical discoveries of his day, such as the discovery of the moons of Mars and observations of nebulas.[31]

William Shakespeare's plays have also been scrutinized for their scientific content. Several volumes have been written about his use of science, nature, and medicine.[32-35] In a phone conversation, Jukes pointed out one example of a Shakespearean scientific statement.[36] In *The Merchant of Venice*, this line appears: "The weakest kind of fruit/ Drops earliest to the ground...."[37] Jukes suggests that this line foresees the discovery of natural selection. The *New England Journal of Medicine* (*NEJM*) recently published a paper on Shakespeare's science. Authors Avrim R. Eden, Mt. Sinai School of Medicine, New York, and Jeff Opland, Rhodes University, Grahamstown, South Africa, suggested that Shakespeare's knowledge of medicine aided him in plotting *Hamlet*.[38]

While many poets have turned to science for ideas and imagery, there have also been scientists who wrote poetry. Erasmus Darwin, following in the footsteps of Lucretius, wrote long poems which resemble ancient epics. In works such as *The Temple of Nature*,[39] he tried to describe almost all of what was known about nature in his day.

William Carlos Williams (1883-1963), the eminent American novelist and poet, was also a physician. Williams is perhaps best known for his long poem *Paterson*,[40] about a New Jersey town. He is not known for writing about medical themes, but critics have suggested he brought a surgeon's sharp eye for detail to his work.[41]

Other medical people have also written poetry. For example, Park J. White, formerly of St. Louis Children's Hospital, writes verse on medical and social issues.[42]

There have also been scientists who have written *about* poetry. Jacob Bronowski, for example, in his 1939

book, *The Poet's Defense*, distinguished between the imperfect "near-truths" of science and the "absolute truth" of poetry.[43]

Lewis Thomas, who isn't known for poetry but is famous for his often poetic essays about science, e.g., *The Lives of a Cell*,[44] says the poet's nonscientific outlook affords valuable insights into science. He wrote, "We will need all sorts of brains outside the fields of science... And that means pretty nearly everyone else—most of all the poets... A few of these people, at least, will be able to imagine new levels of meaning which may be lost on the rest of us."[45]

Modern examples of science in poetry include Diane Ackerman's *The Planets*. This work contains one poem for each planet in the solar system, as well as poems on the asteroids and comets.[46] It's not uncommon today to see poetry in periodicals like *Journal of the American Medical Association*, *NEJM*, or popular magazines such as *Science 83*.

While it cannot be dealt with here at length, there is good reason to believe that we may see papers one day on the "biochemistry of poetic expression." Several studies show associations between manic-depressive illness and creativity. Kay R. Jamison, University of California, Los Angeles, and colleagues reported that increased creativity is one of several *benefits* sometimes reported by manic-depressives.[47] Another study, by Mogens Schou, Aarhus University, Risskov, Denmark, showed that some manic-depressive artists reported lower artistic productivity during lithium treatment. However, most of the artists studied reported increased or unaltered productivity.[48] Lithium's possible favorable effects on creativity in manic-depressives were also reported by Richard H. Phillips, State University of New York, Syracuse.[49]

Many eminent artists have suffered mental illness. And it may well be that the depths of depression or the mania may "provoke" the most creative "outbursts" of our more illustrious poets. Insanity is not a prescription for creativity, but the very aberration of a thinker who is ahead of his time may foster a kind of depression that produces those biochemical changes which trigger what later generations may recognize as genius.

The poetry-science connection, like many fads in science and medicine, rises and falls depending upon the stresses of the time. Science is a collective effort and it too has a collective consciousness. Cousins[7] reminds us of the Jungian[50] perception that this collective consciousness "does not exist without collective desires, collective fears, collective anguish, and collective breakdown." Creative people mirror these feelings, whether they are poets or scientists.

* * * * *

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