Creative tension

What links Aristotle, William Blake, Darwin and GM crops?

Keith G. Davies

In 1809, at 28 Broad Street, Soho, in London, there was an exhibition of paintings by the then-neglected artist William Blake, including "A Subject from Shakspear … The Horse of Intellect is leaping from the cliffs of Memory and Reasoning; it is a barren Rock: it is also called the Barren Waste of Locke and Newton". Blake loathed reductive science and the mechanized materialism of the Industrial Revolution. His Aristotelian way of thinking has a history dating back to Plato.

Aristotle believed that although each individual died and perished, its ideal 'Form' was eternal and fixed as a species. Or, as Blake put it: "Whatever can be Created can be Annihilated: Forms cannot: The Oak is cut down by the Ax, the Lamb falls by the Knife, But their Forms Eternal Exist For-ever." Charles Darwin was less than a year old at the time of Blake's exhibition, and it would be 50 years before his reductions would take on Aristotle's holistic thinking. Yet the current furore over genetically modified organisms is one modern consequence of the ancient conflict between these two ways of thinking.

In the *Origin of Species*, Darwin presented his idea of natural selection in terms of analogies to the tradition of artificial selection on plants and animals. Darwin replaced Aristotle's concept of species as eternal, ideal Forms with one based on groups of individuals in a population. Darwin's population thinking stresses the uniqueness of everything in a related living world, where the species is a statistical abstraction and only unique individuals have a reality. Aristotle thought the reverse: the ideal Form is real and individual variation is an illusion. Darwin's view is reductionist and individualistic, Aristotle's holistic. As Ernst Mayr has said, "No two ways of looking at nature could be more different."

After Darwin, holistic thinking had to change its form to survive: although Darwin had shown that species were mutable, a debate raged into the next century about whether life could be reduced to physics and chemistry. As Niels Bohr argued, "Vitalism scarcely finds its proper expression in the old supposition that a peculiar vital force, quite unknown to physics, governs all organic life … if we were able to push the analysis of the mechanism of living organisms as far as that of atomic phenomena, we should scarcely expect to find any features differing from those of inorganic matter."

During the Second World War many physicists who were driven to address vitalism entered Britain and the United States from mainland Europe. A research effort began to try to understand how like begets like, but not quite. We call the result molecular biology. But what about vitalism and holistic thinking? Can biology be reduced to just physics and chemistry? The answer is subtle.

In physics and chemistry, things tend to equilibrate: but for living cells equilibrium means death. Molecular biology was born with the recognition that the large molecular structures essential to living cells gave rise to autonomous feedback systems. They are based on chemical circuitry and yet, as François Jacob put it, they "transcend chemistry". The living and the non-living do not differ in composition, but rather in their level of organization. All life can be seen as an interacting hierarchy of feedback systems, from cells to individuals, and from populations to communities and ecosystems.

Aristotle and Plato believed that humans could use "intellectual intuition" to visualize eternal species and discriminate between them. Given that this view of immutable species lasted for more than 2,000 years, it is not surprising that many people today find the mere thought of taking a gene from one species and placing it in another abhorrent.

Aristotle faced strong opposition even in his time: a contemporary, Antisthenes, is reported to have said: "I can see a horse, but I cannot see horseness." But the Aristotelian/Platonic view was doctrinal in the West until Darwin.

There is still tension between the holistic ideal and the material reductionist way of thinking; this tension maintains openness and is progressive. For science to have a healthy future, the balance between these approaches must never become dogmatic. Our imagination gives our guesses a holistic basis, our reductive experiments a way to falsify them: the confrontation is essential. Or as Blake put it, "The true nature of knowledge is experiment," but "what is now proved was once only imagin'd." ■

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***The Genius of Shakespeare* by William Blake: Blake's holistic thinking, which originated in Aristotle's time, would be challenged from Darwin onwards.**