



GM - Unravelling the DNA myth

GM science is based on the dogma that DNA alone holds life's blueprint. Dr Barry Commoner argues that the reality is more complex.

Genetic science is founded on the discovery of the DNA double helix by Francis Crick and James Watson in 1953, and proceeds from the premise that this molecular structure is the exclusive agent of inheritance in all living things: in the kingdom of molecular genetics, the DNA gene is absolute monarch. Known to molecular biologists as the 'central dogma', the premise assumes that an organism's genome – its total complement of DNA genes – should fully account for inherited traits. This premise, unhappily, is false. Tested between 1990 and 2001 in one of the largest and most highly publicised scientific undertakings of our time – the Human Genome project – the theory collapsed under the weight of fact. There are far too few human genes to account for the complexity of our inherited traits or for the vast inherited differences between plants, say, and people.

Dogma disproved

This finding signalled the downfall of the central dogma; it also destroyed the scientific foundation of genetic engineering, and the validity of the biotechnology industry's widely advertised claim that its methods of genetically modifying food crops are "specific, precise, and predictable" and therefore safe.

The Human Genome project was intended to identify all of the genes in the human body by working out the sequence of the three billion nucleotides in human DNA. In 1990 James Watson described the Human Genome project as "the ultimate description of life." It will yield, he claimed, the information "that determines if you have life as a fly, a carrot or a man." President Bill Clinton described the human genome as "the language in which God created life."

How could the minute dissection of human DNA into a sequence of three billion nucleotides support such hyperbolic claims? The power of the theory is based on an extravagant proposition, that the DNA genes have absolute and universal control over the totality of inheritance in all forms of life.

Earlier studies disproved dogma

Yet this theory was disproved, long before the Human Genome project, by experimental studies showing that DNA was not king. The DNA gene clearly exerts an important influence on inheritance, but it is not unique in that respect. It acts only in collaboration with a multitude of protein-based processes that prevent and repair incorrect sequences, transform the nascent protein into its folded, active form, and provide crucial added information well beyond that originating in the gene itself. The net outcome is that no single DNA gene is the sole source of a given protein's genetic information and therefore of the inherited trait. The fact that one gene can give rise to multiple proteins also destroys the theoretical foundation of a multibillion-dollar industry, the genetic engineering of food crops.

Dogma rides roughshod

The scientific community's stubborn resistance to these experimental results led in the 1990s to a massive invasion of genetic engineering into American agriculture, though its scientific justification had already been compromised a decade or more earlier. Nevertheless, ignoring the profound fact that, in nature, the normal exchange of genetic material occurs exclusively within a single species, biotech-industry executives have repeatedly boasted that, in comparison, moving a gene from one species to another is not only normal but also more specific, precise and predictable.

In practice, disruptions are revealed by the numerous experimental failures that occur before a transgenic organism is actually produced and by unexpected genetic changes that occur even when the gene has been successfully transferred.

Most alarming is the recent evidence that in a widely grown genetically modified food crop – soya beans

containing an alien gene for herbicide resistance –the transgenic host plant's genome has itself been unwittingly altered. The Monsanto company admitted in 2000 that its soya beans contained some extra fragments of the transferred gene, but nevertheless concluded that "no new proteins were expected or observed to be produced." A year later, Belgian researchers discovered that a segment of the plant's own DNA had been scrambled. The abnormal DNA was large enough to produce a new protein, a potentially harmful protein.

Untested and uncontrolled

The degree to which such disruptions do occur in genetically modified crops is not known at present, because the biotechnology industry is not required to provide even the most basic information about the actual composition of the transgenic plants to the regulatory agencies. No tests, for example, are required to show that the plant actually produces a protein with the same amino acid sequence as the original bacterial protein. Without detailed, ongoing analyses of the transgenic crops, there is no way of knowing if hazardous consequences might arise. Given the failure of the central dogma, there is no assurance that they will not. The genetically engineered crops now being grown represent a massive uncontrolled experiment whose outcome is inherently unpredictable. The results could be catastrophic.

In the ordinary course of science, such new facts would be woven into the theory, adding to its complexity, redefining its meaning, or, as necessary, challenging its basic premise. Scientific theories are meant to be falsifiable; this is precisely what makes them theories. The central dogma has been immune to this process. Divergent evidence is reported and, often enough, generates intense research. But its clash with the governing theory is almost never noted.

Reductionist

Because of their commitment to an obsolete theory, most molecular biologists operate under the assumption that DNA is the secret of life, whereas careful observation of the hierarchy of living processes strongly suggests that it is the other way around: DNA did not create life; life created DNA.

There can be no doubt that the emergence of DNA was a crucial stage in the development of life, but we must avoid the mistake of reducing life to a master molecule in order to satisfy our emotional need for unambiguous simplicity. The experimental data, shorn of dogmatic theories, points to the irreducibility of the living cell, the inherent complexity of which suggests that any artificially altered genetic system, given the magnitude of our ignorance, must sooner or later give rise to unintended, potentially disastrous consequences. We must be willing to recognise how little we truly understand about the secrets of the cell, the fundamental unit of life.

Concerns derided

The growing opposition to transgenic crops clearly shows that there is persistent public concern not only with the safety of genetically engineered foods but also with the inherent dangers in arbitrarily overriding patterns of inheritance that are embedded in the natural world through long evolutionary experience. Too often those concerns have been derided by industry scientists as the 'irrational' fears of an uneducated public. The irony, of course, is that the biotechnology industry is based on science that is 40 years old and conveniently devoid of more recent results, which show that there are strong reasons to fear the potential consequences of transferring a DNA gene between species. What the public fears is not the experimental science but the irrational decision to let it out of the laboratory into the real world before we truly understand it.

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This edited version is reprinted with kind permission of the author and Harper's Magazine, New York. For the original, published February 2002, see www.commondreams.org/views02/0209-01.htm. Dr Barry Commoner is senior scientist at the Center for the Biology of Natural Systems (CBNS), Queens College, City University of New York. He is also director of the CBNS Critical Genetics Project (see www.criticalgenetics.org)

Further Reading

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