The double helix 50 years on: models, metaphors, and reductionism

R E Ashcroft

Bioethics should update its conception of the gene

The 25th of April marks the 50th anniversary of the publication in Nature of the letter by James Watson and Francis Crick announcing their solution to the structure of deoxyribonucleic acid (DNA). By that time, much was known about the role of chromosomes in inheritance, the contribution of DNA to chromosome structure, and the chemistry of DNA. The gene concept itself was also well established by then; the principal scientific problem became to specify what genes were in molecular terms and how they functioned in the cell during ordinary function and cell division.

The importance of the solution of the structure of DNA was twofold. First, it gave insight into finding a mechanism for DNA replication, as the authors recognised in this famous sentence:

"It has not escaped our notice that the specific pairing we have postulated immediately suggests a copying mechanism for the genetic material."

Second, it showed how Erwin Schrödinger’s suggestion that genetic information could be represented as a one dimensional aperiodic crystal could actually work in material terms.

It has been argued that the cultural power of the Watson/Crick model of DNA turns on two things. Firstly, there is the beautiful and memorable image of the double helix itself, which has become as instantly recognisable a symbol as the Coca Cola bottle or the sign of the power of the Watson/Crick model of DNA recognised in this famous sentence:

"for DNA replication, as the authors structure of DNA was twofold. First, it they functioned in the cell during ordinary process by the string of instruction—

programme. Even attempts to loosen this information theory or a sort of computer analogous to message transmission in evolutionary biology, molecular biology, embryology, and clinical medicine. When challenged about reductionism or talk of “genes for” we become more subtle, but sublty is hard to keep up! In this, the influence of the Human Genome Project on bioethics has been most unfortunate, in that it has concentrated our attention on one, rather narrow, if hugely time and resource consuming, approach to understanding the nature of the gene. The thought that by printing out the genetic code we will understand the whole programme, while not taken seriously even by the architects of the Human Genome Project, continues to dazzle many of us. More generally, the idea of chromosomal structure as a programme has a structure as a metaphor which disposes us to think in mechanical and deterministic terms about how cells, bodies, and lives develop.

It is high time to review the history of “genetics” since 1953, to revisit our own ideas of what 1953’s papers mean for us today, and to challenge the unhelpful and simplistic notions of genetic causation which we have inherited. Only then can we effectively understand, challenge, or defend contemporary developments in sequencing, gene therapy, association studies in medicine, psychology, and criminology, and pharmacogenetics. Molecular biology has moved on, and so should we. Our use of scientific models in ethics should both keep up with the models in play in current science, and grasp their limits.

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15 Nature special web resource to mark the 50th anniversary of DNA. See www.nature.com/nature/dna50/index.html (accessed 7 February 2003) and follow the links to the index.


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