pp 233-234 re: OT Avery

STEPHEN TOULMIN

Human Understanding

VOLUME I

General Introduction *and* Part I

PRINCETON UNIVERSITY PRESS
PRINCETON, NEW JERSEY 1972

Human Understanding will be published in three volumes. This, the first, volume contains the General Introduction and Part I. The second and third volumes, comprising Parts II and III, are still in preparation and will appear at intervals of approximately two years.

(2) Our second example is more recent. It comes from the late 1940s, and concerns the emergence of the 'phage' group and the take-over of theoretical biology by men trained originally in physics. (This take-over formed the essential preparation for the development of molecular biology.)[2] In

[1] Einstein's relations to Mach and Planck are illuminatingly discussed in an essay by Gerald Holton due to appear shortly, together with other essays on Einstein, in a supplement to *The Graduate Journal* (Austin, Texas, 1972).

[2] On this episode, see the interesting paper by Donald Fleming, 'Emigré Physicists and the Biological Revolution', in *Perspectives in American History*, II (1968), 152–89. See also the essays by G. S. Stent, R. Olby and L. Pauling in *Daedalus* (Autumn, 1970), pp. 882–1014.

1944, Avery and his colleagues had published their classic demonstration that deoxyribonucleic acid (or DNA) was the carrier of a particular hereditary trait in a single bacterium; but they were constrained from claiming too much by their commitment to the currently accepted attitudes of classical genetics. Within classical genetics—which had been one of the great success-stories of early twentieth-century biology—biochemical questions about the material nature of the gene were unimportant, if not entirely irrelevant. As a result, the 1944 paper was, in Donald Fleming's words, 'muffled and circumspect': the authors were 'almost neurotically reluctant' to identify genes with DNA.[1] Eight years later, Watson and Crick were subject to no such constraints; but their success should not be allowed to conceal from us the strategic battle that had been going on within biochemistry in the meanwhile. For the new molecular biologists were the self-confident heirs of a new approach that had been hammered out, in the years between 1944 and 1953, by men like Astbury and Delbrück.

Avery and his colleagues exemplified an attitude which the new physicist/biologists rejected completely. Delbrück has said that biology, as he found it, was a 'depressing' subject: the accepted styles of biochemical interpretation 'stalled around in a semidescriptive manner without noticeably progressing towards a radical physical explanation'.[2] And, once again, what is significant here is the nature of the considerations on which the new approach was based. Fleming quotes Szilard as emphasizing that the new, physically-minded biologists brought to biology 'not any skills acquired in physics, but rather an attitude: the conviction which few biologists had at the time, that mysteries can be solved'.[3] This attitude, characteristic of Delbrück and the entire phage group, enabled them to create a fundamentally new strategy for dealing with the problems of virology and genetics, of which Crick and Watson's molecular biology was the most spectacular fruit.

(3) The third example is taken from contemporary physics. Here again, the subject faces theoretical difficulties that call, not for more elegant mathematics or more ingenious experi-

[1] Fleming, op. cit. [2] Ibid. [3] Ibid.