THE SIDE-BY-SIDE MODEL OF DNA:

Logic in a Scientific Invention

a dissertation
submitted by

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Dedicated to the memory of Darren Turner

Except where otherwise acknowledged, the work in this dissertation is original.

T.D. Stokes 23/11/83

Abstract

Watson and Crick's double-helical model of DNA is considered to be one of the great discoveries in biology. However, in 1976, two groups of scientists, one in New Zealand, the other in India, independently published essentially the same radical alternative to the double helix. The alternative, Side-By-Side (SBS) or 'warped zipper' conformation for DNA is not helical. Rather than intertwine, as do Watson and Crick's helices, its two exoskeletal strands are topologically independent. Thus, unlike the double helix, they may separated during replication without unwinding.

This dissertation presents, but does not arbitrate among scientific arguments. Its concerns are meta-scientific; in particular, why and how the individuals who invented the 'warped zipper' came to do so. Against Popper and most recent philosophers of science, it is taken to be "the business of epistemology to produce what has been called a 'rational reconstruction' of the steps that have led the scientist to a discovery [Popper (1972), p. 31, emphasis in the original]."

On the received view, the invention of the 'warped zipper' must be irrational or, at best, non-rational - thereby excluded from philosophical investigation. I establish that this philosophical dogma is not true a priori, as is usually supposed, and, in the case of the SBS structure of DNA, false a posteriori. The

motivation for, and development of the SBS structure for DNA reveals a process best characterized as significantly, though not entirely, rational. The 'warped zipper' is a plausible alternative to the Watson-Crick model because of this. Thus theory change in science may be regarded as basically rational.

The account of research on the structure of DNA from 1953 to the present which is provided, is selective and directed to the specific concerns of the disseration. What is revealed, however, is a sustained critique of the double helix which has been hidden within the triumph of molecular genetics.

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The dissertation could not have been written without the generous co-operation of the scientists who invented the 'warped zipper': G.A. Rodley, R.H.T. Bates and Clive Rowe in New Zealand; V. Sasisekharan, N. Pattabiraman and Gautam Gupta in India. However, it should not be supposed that they necessarily agree with what I have said about their work.

I could not have visited the University of Canterbury or the Indian Institute of Science without the grants provided by the Faculty of Arts and the Department of History and Philosophy of Science, University of Melbourne. The H.P.S. Department was as nearly ideal a place to work as I can imagine. Nevertheless, I doubt whether I would have finished this disseration without the encouragement of my colleagues in the social studies of science at Deakin University, where I now work. The secretarial staff of the School of Humanities have been particularly tolerant in permitting me to invade their domain and use the word processor.

Dr R.M. McLaughlin, of the School of History, Philosophy and Politics, Macquarie University, and I never discussed the possibility of a logic in 'discovery' whilst I was his student. But, after my departure for Melbourne (at his suggestion), we both independently became immersed in the idea. For a time, we regularly reported very similar thoughts. I hope that Chapter XII, below, provides an explanation of this. All the same, I drew much from these discussions, and I rely at crucial points on Robert McLaughlin's account of the inventionist position.

My friends have, as friends do, put up with me and my thesis.

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