

# Book Review

## *Designs for Life: Molecular Biology After World War II*

The birth of molecular biology

How biophysicists and biochemists in the 1950s shaped a new science.

by Soraya de Chadarevian, Cambridge University Press: 2002, 444 pp.

Reviewed by Vernon M. Ingram\*

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The history of the genesis and development of the molecular-biology group at Cambridge University, UK, under Max Perutz is endlessly fascinating. Why did it begin? Why in Cambridge? Why at that time? And why these particular scientists?

Soraya de Chadarevian presents a historian's account of the conception and birth of the group that founded what is arguably the reigning movement in modern biology. She describes the circumstances and tactics needed to enable the field of molecular biology to mature from a child to become an adolescent, with predictable awkwardness, and then to achieve adulthood. Throughout gestation and childhood it was nurtured by Perutz, who had a clear vision of the next essential step in the development of biological science.

Perutz, who died earlier this year, set out to solve the chemical structure of haemoglobin, the protein molecule that carries oxygen in vertebrates. He took from John Desmond Bernal and Lawrence Bragg the notion that the young science of X-ray crystallography could be used not only to find the chemical structures of small molecules such as salts and sugars, but also the structure of enormously complex molecules such as haemoglobin. Many people told him he was crazy, that the task was impossible; however, he succeeded after some 25 years. De Chadarevian gives a clear account of this story. In the late 1940s and early 1950s,

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Perutz attracted a nucleus of remarkably able young collaborators. His single-minded devotion to the task and his personality were key to this collaboration coming together. There was John Kendrew, who solved the structure of the muscle protein myoglobin; Francis Crick and James Watson, who solved the structure of DNA; Tony Broad, the engineer who made the most powerful X-ray machine in the world; Hugh Huxley, who (with Jean Hanson) solved the molecular mechanism of muscle contraction; and, a little later, Sydney Brenner, who with Crick founded much of modern molecular genetics. I was fortunate to be an early member of the group (1952-58), working as a protein chemist, helping the X-ray crystallographers, and studying the defect caused by the sickle-cell anaemia mutation. Perutz was mentor to the whole group.

The excitement about our work was palpable; it permeated every conversation and dominated our leisure time. However, the book fails to capture this excitement. This is unfortunate, because we were spurred on and held together by an obsessive desire to understand the molecules of life — proteins and nucleic acids. In *Designs for Life*, the historian eclipses the storyteller.

Also lost is the spirit of intense competitiveness that we felt towards Linus Pauling and his group at the California Institute of Technology, and the X-ray crystallographers at King's College London. Although de Chadarevian gives historical credit to other groups who worked on X-ray crystallography, and protein chemistry in particular, she only touches on the crucial importance of knowing the amino-acid sequences of myoglobin and haemoglobin when progressing from a crude to a detailed structure of these proteins. This information was developed in the United States, and was not available earlier to Perutz and Kendrew.

The early X-ray crystallographers' use of existing and new technologies to solve major biological problems is well described in this book — they were “the right men at the right time”. Also fascinating is the crucially important and parallel development of digital computing in the Cambridge University Mathematics Department next door. There was a difference in personality between Perutz and his pupil Kendrew. The latter embraced and spearheaded the development of computers, but he had to be defensively careful about their use because of Perutz's early scepticism about the accuracy of the new method.

*Designs for Life* deals well with certain important areas of history. The author links the timing of the appearance of the early Medical Research Council (MRC) unit in Cambridge to the availability of new technologies developed during the war in Britain and the United States, and to the availability of young and eager scientists who had had maturing experiences during the Second World War. The early group, led by Perutz, used their success in solving these incredibly difficult structures to publicize the new science of molecular biology by television, radio and newsprint. They encouraged the

development of similar research groups elsewhere, and taught molecular biology to a new generation of students from many countries.

Especially detailed is de Chadarevian's account of the politics involved in expanding the group to the size of an institute, large enough to be varied and self-sustaining. The difficulties encountered were both academic and governmental. Although there is much repetition of this theme, there is also a great deal that is interesting.

The group's expansion was helped enormously by the arrival of Fred Sanger, a protein biochemist who went on to win two Nobel prizes — he was the first to establish the complete chemical structure of a protein, insulin, and he later invented the current method for sequencing the genome.

In the late 1950s and early 1960s, the vigorous drive to establish new molecular-biology departments was in full swing in the United States but had barely begun in Britain. As a result of the reluctant atmosphere at Cambridge University, the hoped-for expansion did not occur within a university department. There were delays, prevarication and disappointments before the group arrived at their large new MRC site on the outskirts of Cambridge. Unfortunately, this was far away from the university, so the researchers were not integrated into its teaching and collegiality. This enforced separation was in part responsible for the desire of so many of the group to leave the MRC laboratory for teaching positions elsewhere. It is interesting to speculate whether a true integration into Cambridge University would have prevented the exodus.

Much space in this book is devoted to the discovery and world-wide expansion of structural protein biochemistry, and rightly so. It is therefore surprising that less attention is paid to the discovery of the Watson-Crick model of DNA. The impact of their double-helix structure was tremendous and lasted for years. Even more than the great influence of protein-structure determination, the DNA model and its consequences were crucial to fashioning modern molecular biology.

In describing the development of molecular biology, de Chadarevian pays some, but not enough, attention to the vital role of scientists such as Erwin Chargaff, William Cochran, Rosalind Franklin and Linus Pauling, not to mention the other American and French groups. After all, truly great advances in biology are built on the work of others — to give them credit would not diminish the achievements of Watson, Crick and Brenner.

Perhaps de Chadarevian should have paid more attention to the influence of Crick and Brenner on the development of the new and exciting fields of molecular genetics and protein synthesis. Their work and the publicizing of their ideas made molecular biology the lingua franca of modern biology. Even the new generation of engineers feel the urgent need to learn this new treatment of biology.

The author deliberately focuses on the (unique) instance of the MRC Unit for the Molecular Structure of Biological Systems, housed in the Cavendish Laboratory, Cambridge, and its direct descendant, the MRC Laboratory of Molecular Biology. The account of these units' relationship to government, to private funding agencies and to the university makes an interesting and valuable book. One must realize, however, that the narrow focus does not imply that the group was entirely self-contained — we depended, at the time, on the outside world for scientific nourishment and for funding. In short, de Chadarevian's historical account is recommended to all who are interested in the development of molecular biology.