

## Professor H. Gutfreund, FRS (21 October 1921 to 21 March 2021)



Freddie Gutfreund (few used his birth name Herbert) spent much of his career in the Department of Biochemistry at the University of Bristol, from 1965 (1 year after the department was established) through to his retirement in 1986, though remaining here for several more years thereafter.

Freddie had an unorthodox career before arriving in Bristol. He passed only two exams in his life: his high school diploma in Vienna (equivalent to the old 11+ exam) and his PhD in physics from the University of Cambridge. Whilst a teenager in Vienna in 1938, the Nazi invasion of Austria ended his hopes in his home country. But his prospects for emigration from Austria were bleak until he noted that a YMCA scheme, 'British Boys for British Farms', was accepting candidates from Europe due to the lack of British applicants. Freddie thus spent his first 3 years in the UK as a dairyman in Westmorland.

Having experienced a research laboratory whilst still a schoolboy, Freddie made countless applications to local laboratories. He was eventually taken on as a 'lab boy' in Pathology at the University of Liverpool. Freddie's skills in protein analysis were soon noted by his supervisor, who suggested to the neighbouring Biochemistry Department that they too could employ Freddie's skills. His work whilst still a junior technician led to his first publication [Gutfreund, H. (1943) An improved method for the fractionation of protein mixtures by electrophoresis. *Biochem J.* **37**, 186-9]. This paper led many years later to an award from the Biochemical Society for the longest period of contributions to the *Biochemical Journal*. Freddie's final paper for the *BJ* was in 1989, after 46 years. A biochemist in Liverpool then recommended Freddie to Professor Chinball at Imperial College, but who 1 year later moved to Biochemistry at Cambridge. Chinball however stipulated that his new research assistant be allowed to register for a research degree in Cambridge.

Starting in 1943, Freddie spent 13 years in Cambridge. His PhD work was in biophysics, on the reversible dissociation of proteins. One of his main contacts at that time was Fred Sanger, who gave him the protein chemistry needed for his work on protein dynamics. Freddie's interests in physics and physical chemistry led him in the 1950s to contact members of the Department of Physics in Cambridge in the Cavendish laboratory. The Cavendish housed at that time the individuals who would establish the Laboratory of Molecular Biology: Francis Crick, Max Perutz and others. Freddie took to lunching every day with Crick at the Eagle pub near the Cavendish. He was there when Crick burst into the pub to announce that he had solved the secret of life. He also

took the famous – and much reproduced – photograph of Crick and Watson walking alongside King's College chapel.

On completing his PhD in 1947, Freddie started a post-doctoral position with Professor Roughton, head of Colloid Chemistry at Cambridge. This was pivotal for Freddie because Roughton was the first to apply rapid reaction techniques to biological systems. Rapid reaction techniques became the cornerstone of Freddie's research, along with his continued interest in biothermodynamics. Freddie helped to establish the technologies for rapid reaction kinetics, exploiting the stopped-flow and quenched-flow techniques and the relaxation methods such as temperature-jump and pressure-jump. He did much of this work in the 1950s and later in collaboration with many others: Julian Sturtevant (Yale), Quentin Gibson (Cornell), Britton Chance (Philadelphia), Sidney Bernhard (Eugene, Oregon), Leo de Mayer and Manfred Eigen (Göttingen), John Edsall (Harvard) and Ken Holmes (Heidelberg).

Between 1956 and 1965, Freddie worked at the National Institute for Dairying Research in Shinfield. Not that this represented a return to Freddie's initial UK occupation as a dairyman, but rather an opportunity to continue his work on the dynamics of protein reactions. But perhaps the most important event during his time there was meeting and marrying Mary in 1958, his wife to the end of his life.

Freddie spent the rest of his career in Biochemistry in Bristol. The Molecular Enzymology Unit that he founded here quickly became internationally recognized as a world leader in enzymology and protein chemistry. He was elected Fellow of the Royal Society during this time. By applying rapid-reaction techniques to a wide variety of enzyme mechanisms and protein–ligand interactions, his work in Bristol established the crucial roles of protein conformational changes in these reactions. Back in Cambridge, Crick had doubted that proteins ever changed shape and called this 'Freddie's red herring'. But Freddie was right: they do move.

The name 'Molecular Enzymology' was to affect the Biochemical Society. In 1964, Freddie proposed to the Society's Committee the creation of a specialist group to be called the Molecular Enzymology Group. Some Committee members were against the word 'molecular' but still approved of an Enzymology group. Yet when the group was established 1 year later, Molecular had reappeared in its title. This was the first group to be formed within the Society and its many subsequent groups are now central to the Society's organization.

Gutfreund was later made an Honorary Member of the Biochemical Society.

Freddie was never a gifted teacher of basic biochemistry to undergraduates. But he left a major educational legacy. First, many associates benefited enormously from time in his lab and passed that knowledge on to their own students. Second, Freddie wrote a series of key monographs on enzymes and kinetic systems. His most recent book, *Kinetics for the Life Sciences* (Cambridge University Press, 1995), was published several years after his retirement. It remains an invaluable source for solutions to numerous kinetic problems. Freddie retained all of his formidable intellectual and mathematical skills to the end of his days.

The above is an abbreviated version of the obituary for Freddie Gutfreund at the University of Bristol 'News and Features' website: <https://www.bristol.ac.uk/news/2021/april/herbert-gutfreund.html>

A fuller obituary for Professor Gutfreund was previously published by *The Times* on 27 May 2021. This covers Freddie's relationship with Francis Crick but it contains a serious error in describing the dissociation of proteins into atoms whereas it should have said dissociation into subunits.

<https://www.thetimes.co.uk/article/herbert-freddie-gutfreund-obituary-r0cwlw232>

**Stephen Halford** (University of Bristol, UK)