Christian de Duve

(1917–2013)

Biologist who won a Nobel prize for insights into cell structure.

The path to excellence in experimental biology is long and arduous. Christian de Duve was one of the few to reach a summit that opened new vistas onto uncharted territories. In 1974, he shared the Nobel Prize in Physiology or Medicine with Albert Claude and George Palade, for their discoveries “concerning the structural and functional organization of the cell”.

De Duve was born in 1917 near London, where his parents, of Belgian–German ancestry, had moved to escape the First World War. Soon after the war ended, the family returned to Antwerp in Belgium, where Christian attended school — at which he excelled. He then enrolled as a medical student at the Catholic University of Louvain in 1934 and joined its physiology laboratory, directed by J. P. Bouckaert. In 1943, he married Janine Herman, who subsequently became a noted painter. She steadfastly supported him throughout the rest of her life. His many moves required huge sacrifices from her and their four children, and gave de Duve the freedom to focus his efforts on scientific research.

During these years, de Duve made several respectable discoveries about storage and retrieval of the body’s principal fuel, glucose, as affected by the pancreatic hormones insulin and glucagon. After the Second World War, top-notch international laboratories opened their doors to him. He first went to Hugo Theorell’s lab at the Nobel Medical Institute in Stockholm and then to Gerty and Carl Cori’s lab at Washington University in St. Louis.

In 1947, family ties enticed de Duve to return to Louvain as a professor in its medical school. On his way back from St Louis, he stopped at the Rockefeller Institute for Medical Research (now Rockefeller University) in New York for a life-changing meeting with his countryman Albert Claude.

Claude had gone to Rockefeller in 1929 to isolate what we now know as the Rous sarcoma virus. On route to this goal, he revolutionized cell research by experimenting with two recently developed instruments: the electron microscope and the high-speed centrifuge. The electron microscope enabled Claude, with Keith Porter, to look inside cultured cells at a magnification much greater than that possible with a light microscope. Their epochal discovery, reported in 1945, was the lace-like network surrounding the cell’s nucleus, the ‘endoplasmic reticulum’.

Using the high-speed centrifuge, Claude and his collaborators managed to separate and enrich various cell components on the basis of their size and density.

Heading his own laboratory in Louvain, de Duve continued research on insulin and glucagon, this time inspired by Claude. Among his first observations at Louvain was that the enzyme activity of glucose-6-phosphatase was mostly associated with a cell fraction that sedimented at high centrifugal forces. More detailed analyses by de Duve, and by Philip Siekevitz and Palade, established glucose-6-phosphatase as the first ‘marker’ enzyme for the endoplasmic reticulum. These findings supported the idea that the cell contains distinct compartments with characteristic enzyme activities.

De Duve promptly set his insulin research aside to search for these uncharacterized cellular compartments. Because it could be readily measured, he chose the enzyme acid phosphatase. His observations — which to most contemporaries would have seemed trivial curiosities related to this enzyme’s activity and its cellular partitioning, and thus not worth close attention — became important clues for de Duve. Could acid phosphatase be a marker enzyme for yet another cellular compartment? Perhaps the enzyme was part of a cell’s digestive quarter, stored with other hydrolytic enzymes to break down the multitude of

macromolecules taken up by the cell?

To answer these questions, he used an early version of an ‘-omic’ approach. He combed the literature for other known hydrolytic enzymes and, after several reassuring findings, went public with the concept of the lysosome (C. de Duve *et al.* *Biochem. J.* **60**, 604–617; 1955), now known as the hub of the cell’s digestive system. Using similar approaches, his laboratory also discovered the peroxisome, a cellular compartment containing enzymes involved in oxidation.

Thereafter, others discovered lysosomal and peroxisomal diseases. Some of these disorders, in which one lysosomal enzyme is either missing or faulty, can now be treated by providing the requisite lysosomal enzyme.

Next, de Duve expanded and consolidated these findings and established himself as a skilled administrator. He directed a lab at Rockefeller University (1962–87) and founded and ran (1975–85) the International Institute of Cellular and Molecular Pathology in Brussels (a prescient realization of the idea of translational medicine), subsequently named the de Duve Institute. He also had a principal role in creating the prestigious and unique L’Oreal–UNESCO Awards for Women in Science, presented to one woman annually in each of five continents. In the last ‘contemplative’ period of his life, he wrote influential books directed at the educated lay public, primarily on biology and evolution.

As de Duve wrote in his memoirs, *Sept vies en une* (Odile Jacob Sciences, 2013), he was a precocious child, perpetually the best student (*‘primus perpetuus’*) in his school except for one year, when he was declared out of competition (*‘hors concours’*) so that another student could come top. These early accolades, and the many that followed, reinforced an inherent sense of self-confidence that sometimes had unintended consequences. He emphatically denied having been an authoritarian boss (*‘patron autoritaire’*), but in a typically de Duvean way admitted, in brackets, that some people may feel differently. Personally, he struck me as a warm, humorous and compassionate human being, whom I will miss thoroughly. ■

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