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George Palade, Obituary

We mark the passing of George Palade, who died at his home in San Diego on October 7, 2008. Palade, together with his co-winners of the Nobel Prize in 1974, was described by the Nobel Committee as the father of Cell Biology. Characteristic of truly pioneering science, Dr Palade's research outstripped the vocabulary and conceptual boundaries of his time. Cell Biology, the concept and the noun, did not exist when he embarked on his phenomenal scientific career.

Palade's scientific passion was in revealing the subcellular components of the cell. These elements were appreciated as fundamental to all cellular function, but they were invisible by light microscopy. Palade's pursuit straddled biochemistry and anatomy, physics and medicine. His science was an intellectual crossbreed among the pedigreed disciplines of the time, but his findings illuminated the elemental organelles and structures of the cell that are now textbook chapters: ribosomes, endoplasmic reticulum, microsomes, the function of mitochondria, adhesive junctions between cells, the ultrastructure of the Golgi apparatus, the path of secretion from cells (see Wells, 2005), and the synaptic vesicle (Palade, 1954). His tools were the newly developed electron microscope and sugar solution in a concentration gradient spun at high speed in a centrifuge to stratify the cellular components according to density. Scrutinizing the blurry jumble of structure revealed by the primitive electron microscope and using new methods of tissue fixation that he developed, Palade and his colleagues discerned fact from artifact, and function from structure, with consistent accuracy.

Some of the earliest electron micrographs that reveal the ultrastructure of neural tissue were provided by Palade and his colleague Sanford Palay. Their work weighed in definitively on the debate of historic proportions over the validity of Cajal's neuron doctrine, that neurons are separate cells that communicate across microscopic gaps of separation at synapses. This ground-breaking research on neuronal structure in the 'submicroscopic realm' was not published in one of the high-profile scientific journals; it was published in a new journal, the *Journal of Biophysics and Biochemical Cytology*, more than a decade before the term 'neuroscience' was coined (Palay and Palade, 1955). Later the journal changed names to become the *Journal of Cell Biology* as recognition of the new field of science dawned. The same issue contained a paper by De Robertis and Bennett that introduced the words 'synaptic vesicle' to science (De Robertis and Bennett, 1955). Over his lifetime Palade would publish 109 papers in the same journal.

George Emil Palade was born November 19, 1912 in Romania. His scholarly interests were nourished by his father, a philosophy professor, and by his mother, a teacher. Trained in medicine he served in the medical corps of the Romanian army in World War II. After the Soviet occupation of his homeland he moved to the United States and became a US citizen in 1952.

After leaving Rockefeller University in New York, he served as Chairman of the newly created Department of Cell Biology at Yale University in 1973. He then became Dean for Scientific Affairs at the University of California at San Diego, serving from 1990 until he retired in 2001. After the death of his first wife, Irna Malaxa, in 1969, he married Marilyn Farquhar, who chairs the Department of Cellular and Molecular Medicine at the University of California, San Diego. In addition to his Nobel Prize for Physiology or Medicine, he was honored with the National Medal of Science, the Albert Lasker Award for Basic Medical Research and Columbia University's Louisa Gross Horwitz Prize.

Although his father had wished that his son would become a philosopher like himself, Palade preferred to deal with tangibles and specifics, as he explained in his autobiography for the Nobel Prize Foundation [http://nobelprize.org/nobel_prizes/medicine/laureates/1974/palade-autobio.html]. Yet the same autobiography highlights how he retained a scholarly interest in ancient history, "Especially in Roman history, a topic on which I have read rather extensively. The Latin that goes with this kind of interest proved useful when I had to generate a few terms and names for cell biology."

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