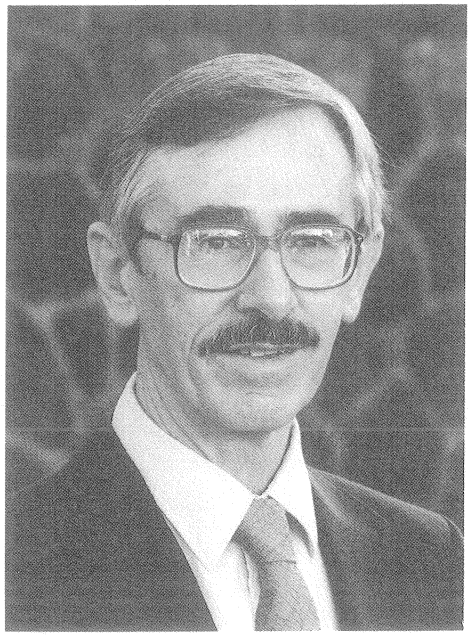
Professor Ian Read Gibbons



Date of Birth: October 30, 1931

Nationality: U. K. (U. S. Permanent Resident)

Position: Professor, University of Hawaii

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Education and Career:

1954	B.A. Cambridge University
1957	Ph.D. Cambridge University (Biophysics)
1957-58	Postdoctoral Fellow, University of Pennsylvania
1958-67	Lecturer, Assistant Professor, Harvard University
1967-69	Associate Professor, University of Hawaii
1969	Professor, University of Hawaii

Awards and Distinctions:

1983	Royal Society Fellow
1984	Excellence in Research Prize, University of Hawaii
1988	Lezioni Lincei, Academia dei Lincei, Rome
1994	E.B. Wilson Medal. American Society for Cell Biology

Representative Works:

Gibbons, I.R. and Grimstone, A.V. (1960). On flagella structure in certain flagellates. *J. Biophys. Biochem. Cytol.* 7:697-716

Gibbons, I.R. (1963). Studies on the protein components of cilia from *Tetrahymena pyriformis*. *Proc. Nat. Acad. Sci.* 50:1002-1010

Gibbons, I.R. and Rowe, A.J. (1965). Dynein: A protein with adenosine triphosphatase activity from cilia. Science 149:424-426

Summers, K.E. and Gibbons, I.R. (1971). Adenosine triphosphate-induced sliding of tubules in trypsin-treated flagella of sea-urchin sperm. *Proc. Nat. Acad. Sci. USA* 68:3092-3096

Gibbons, B.H. and Gibbons, I.R. (1974). Properties of flagellar "rigor waves" formed by abrupt removal of adenosine triphosphate from actively swimming sea urchin sperm. *J. Cell Biol.* 63:970-985

Gibbons, B.H. and Gibbons, I.R. (1976). Functional recombination of dynein 1 with demembranated sea urchin sperm partially extracted with KCl. *Biochem. Biophys. Res. Comm.* 73:1-6

Gibbons, I.R. et al. (1978). Potent inhibition of dynein adenosinetriphosphatase and of the motility of cilia and sperm flagella by vanadate. *Proc. Nat. Acad. Sci. USA* 75:2220-2224

Lee-Eiford, A., Owe, R.A. and Gibbons, I.R. (1986). Specific cleavage of dynein heavy chains by ultraviolet irradiation in the presence of ATP and vanadate. *J. Biol. Chem.* 261:2337-2342

Gibbons, I.R., Shingyoji, C., Murakami, A. and Takahashi, K. (1987). Spontaneous recovery after experimental manipulation of plane of beat in sperm flagella. *Nature* 325:352-353

Gibbons, I.R., Gibbons, B.H., Mocz, G. and Asai, D.J. (1991). Multiple nucleotide binding sites in the sequence of dynein β heavy chain. *Nature* 352:640-643

Gibbons, B.H., Asai, D.J., Tang, W.-J.Y., Hays, T.S. and Gibbons, I.R. (1994). Phylogeny and expression of axonemal and cytoplasmic dynein genes in sea urchins. *Mol. Biol. Cell* 5:57-70

Academic Achievements:

Professor Gibbons has been a leading figure in cell biology for over the past four decades. He has not only contributed greatly to the field of cell motility but also to the development of other fields of cell biology. The results of his excellent and careful works have been published in many original papers and reviews.

In the latter half of 1950's, Professor Gibbons tried to use the then new technique of thin-section electron microscopy and revealed with greater clarity the ultrastructure of the axoneme in flagella and cilia. Until the 1960's, people had believed that all kinds of cell motility in eukaryotes, including ciliary and flagellar movement, are conducted through the interaction between a motor protein, myosin, and a cytoskeletal protein, actin, as in muscle contraction. In 1963, he extracted the major ATPase protein from demembranated *Tetrahymena* cilia and localized it on the "arms" projecting from the outer doublet microtubules in the ciliary axoneme. The new motor protein was given the name dynein by him. Professor Gibbons and his colleagues also characterized the protein, now called

tubulin, constituting the outer doublet microtubules left after extraction of dynein. This was the first discovery of a new motor protein other than myosin in living organisms.

In the early 1970's, Professor Gibbons started using the abundant sea urchins as sources of sperm flagella. A short while later he drew on his training in physics to tackle another important phase of his work, which involved developing the use of dark-field illumination in the light microscope. He published a classic paper in which he provided the first light microscopic evidence of ATP-driven sliding of microtubules. Remarkably, he showed that a single microtubule can be seen under the light microscope. This work should be regarded as the foundation for all of the recent work with in vitro gliding/motility assays that has proven so important in the study of all molecular motors. Indeed, the discovery of kinesin, the second microtubule motor, depended directly on such an in vitro assay and the discovery that sea urchin sperm demembranated with Triton X-100 can show ATP-reactivation of flagellar motility that is fully equivalent to in vivo motility. The demonstration of the "rigor" state in flagella, providing the evidence for the now widely accepted view that dynein utilizes a cycle of crossbridge attachment. In collaboration with Japanese colleagues, he performed a mechanical manipulation of the plane of flagellar beating, which revealed an internal mechanism for determining the beat plane.

Professor Gibbons demonstrated that vanadate is a potent inhibitor of dynein ATPase, and he discovered the vanadate-induced UV photolysis of the dynein heavy chain. These unique properties became important diagnostic tools in probing for dynein presence and function, and invaluable to other investigators in identifying cytoplasmic dynein that participates in a wide variety of fundamental processes in the cell, such as cell division, axonal flow in the nerve cells, and intracytoplasmic transport.

Recently Professor Gibbons led his laboratory into a new phase of the study of dynein and cell motility using molecular biological techniques. They were able to determine the entire sequence of a heavy chain of sea urchin flagellar dynein. This work has led to an explosion in the identification of dynein heavy chain sequences in a wide variety of organisms. He is also actively pursuing questions of dynein evolution and the three-dimensional structure of dynein.

Professor Gibbons possesses a penetrating insight into biological phenomena. His work, starting with an ultrastructural study, and his relentless challenge of new techniques in the fields of biochemistry, physiology and even molecular biology have yielded unprecedented and exceedingly outstanding scientific achievements. As a biochemist herself, his wife, Barbara, has been an invaluable collaborator in his work over many years.

Professor Gibbons' work has not only contributed to the field of cell motility and cytoskeleton, but also to various other fields of cell biology. It has also had an immense impact on the field of biology in general.