Dr. Morris Karnovsky is the 1990 recipient of the E. B. Wilson Award, the highest honor bestowed by the American Society of Cell Biology. Dr. Karnovsky is so honored for his numerous fundamental and seminal discoveries on cell structure and function relationships that have far-reaching interdisciplinary impact on cell biology, in physiology, and in pathology.

Morris was born in South Africa. He received his medical education at the University of Witwatersrand, and after internships in medicine and surgery, he went to London for postgraduate work in pathology, where he received a postgraduate degree in clinical pathology. He then moved to Boston where he worked as a Research Fellow in Pathology at Harvard Medical School. He advanced through the ranks, and he is presently the Shattuck Professor of Pathological Anatomy at Harvard Medical School. From 1975 to 1989 he was Chairperson of the Program in Cell and Developmental Biology at Harvard Medical School.

Perhaps his most widely appreciated contribution to cell biology was the extension of the horseradish peroxidase (HRP) tracer method of Werner Straus to both the light and electron microscopic level, by introducing diaminobenzidine (DAB) as an electron donor. HRP oxidizes DAB in the presence of \( \text{H}_2\text{O}_2 \) and converts it into an insoluble polymer; this polymer causes reduction of added osmium tetroxide, and the reduced osmium forms an insoluble electron-opaque precipitate at the site of the HRP. When HRP is injected into the bloodstream, its pathways can be followed, by fixing tissues at various times after injection, and by carrying out the DAB reaction.

In the first paper introducing this technique, Morris and Richard Graham traced the endocytotic uptake of HRP from the glomerular infiltrate into cells of proximal tubules. This paper is one of the most quoted in the biomedical literature.

With Thomas Reese, he used the HRP method to establish that endothelial cells in the brain vasculature form the cellular correlate of the so-called blood–brain barrier. This endothelial barrier prevents macromolecules in the blood from reaching neurons.

Likewise, with Elio Raviola, he established the blood–thymus barrier and with Eveline Schneeberger the blood–air barrier in the lungs.

The HRP-DAB technique has been widely used in numerous studies to trace macromolecular transport. Another important application was to link HRP to antibodies and to detect the location of the corresponding antigens by electron microscopy.

Another huge leap forward was the introduction of colloidal lanthanum as an electron-opaque tracer. Using this tracer, Morris and Jean-Paul Revel succeeded in revealing the fine structure of gap junctions. These gap junctions were the structural correlate of the electrophysiologically defined electrical synapses that were known to occur in cells of excitable tissues. Jean-Paul and Morris showed that these structures consisting of subunits in hexagonal arrays were ubiquitous and were formed also by cells of nonexcitable tissues.

A number of other cytochemistry techniques were developed by Morris. For example, with A. Seligman and co-workers, he used DAB for a high resolution detection of mitochondrial cytochrome c oxidase. With L. Roots, he devised a cytochemical reaction for the localization of cholinesterases. These cytochemical techniques, together with the HRP-DAB reaction, were instrumental in mapping pathways of both the peripheral and central nervous systems.

In association with Richard Briggs, John Robinson, and Manfred Karnovsky, Morris has published a series of papers describing unique methods for localizing to the cell and phagosomal Karnovsky, Morris has published a series of papers describing unique methods for localizing to the cell and phagosomal membrane some of the oxygen-derived products of the oxygen burst in activated leukocytes.

The fine structural organization of the kidney has been a research interest of Morris for many years. With Richard Rodewald, he described the slit diaphragm in the glomerulus, and with Graeme Ryan, he demonstrated that the glomerular basement membrane serves as the barrier to endogenous albumin. He pioneered studies on the isolation of glomerular cells and demonstrated that mesangial cells are contractile.

In the early 1980s, Morris and his collaborators, R. Klausner, A. Kleinfeld, L. Dawidowicz, and R. Hoover, proposed that the lipids in many cell membranes are organized into domains that differ in their fluidity, and that perturbation of these domains can have profound functional effects.

More recently, Morris together with A. Clowes, discovered that heparin, a well-known anticoagulant, also inhibits proliferation of smooth muscle cells. Vascular damage triggers proliferation of smooth muscle cells and thereby causes blockage of the blood vessels—a serious clinical problem. Morris and his co-workers have carried out a number of studies in vitro and in vivo systems to determine how heparin, and endogenous heparan sulfate, exert this anti-proliferative activity. The antiproliferative activity of heparin and related molecules is presently a major research focus of Morris's laboratory.

In addition to his seminal and fundamental research contributions, Morris is an inspiring teacher and an outstanding citizen of the cell biology community. He has served on the council of the ASCB (1977–1980), as President of the ASCB (1984), and on the Editorial Board of The Journal of Cell Biology. He has received numerous honors and awards, among them the Roux-Whipple Award of the American Association of Pathologists, and Fellowship in the American Academy of Arts and Sciences. Recently, he was elected to the Institute of Medicine of the National Academy of Sciences.

It is with great pleasure that on behalf of the American Society of Cell Biology I present the 1990 Ninth E. B. Wilson Medal to Dr. Morris Karnovsky.

Dr. Karnovsky is with the Department of Pathology, Harvard Medical School.

These remarks were made by Dr. Günter K. Blobel upon presentation of the medal.

E. B. WILSON MEDALIST, 1990