THE FACULTY OF MEDICINE
Harvard University

Bernard Nathan Fields

Bernard ("Bernie") Nathan Fields was born on March 24, 1938 in Brooklyn, New York and died on January 31, 1995 after fighting pancreatic cancer for more than two and one half years. With Bernie's death we lost a great friend and true statesman of biomedical science, but he lives on in the minds of his family, friends, colleagues, and students.

Bernie attended Brandeis College where he majored in biology, and he then received a medical degree from New York University. He was an intern and resident at Beth Israel Hospital and an infectious disease fellow at Massachusetts General Hospital. As alternative service during the Vietnam War, Bernie served as a medical virologist and assistant chief of the Arbovirus Infections unit at the Centers for Disease Control, and he then became a postdoctoral research fellow with Bill Joklik at Albert Einstein Medical School where he initiated his life-long studies of reovirus. In 1969 Bernie became an assistant professor in the departments of medicine and cell biology at Albert Einstein and then in 1971, associate professor of medicine and cell biology and chief of infectious diseases. In 1975 Bernie came to Harvard as Professor of Microbiology and Molecular Genetics and chief of the Infectious Diseases Division of Peter Bent Brigham Hospital. In 1982 Bernie became chairman of the Department of Microbiology and Molecular Genetics, and he ably led the Department until his death.

Bernie pioneered the field of molecular genetics of viral pathogenesis through his studies on reovirus. His work, arguably more than any other, showed that it is feasible to use viral genetics to define the roles of individual gene products in each step of the infection pathways of a host organism, much as if they were metabolic pathways. The concept of the integration of the principles of basic genetics and pathogenesis ran through all of Bernie's work, and he convinced many of the need to appreciate both molecular and biological aspects of viruses to understand viral pathogenesis.

In tribute to their dedicated efforts to science and medicine, deceased members of the Harvard Faculty of Medicine (those at the rank of full or emeritus professor) receive a review of their life and contributions with a complete reflection, ***a Memorial Minute****.*

Bernie studied the segmented, double-stranded RNA genome virus, reovirus, throughout much of his scientific career. Bernie first isolated a set of temperature-sensitive mutant reovirus strains and used these to show that gene reassortment occurs by exchange of the RNA segments of co-infecting viruses. This work was important in defining the genetic properties of segmented viral genomes. He recognized the power of viral genetics in the reassortment of reovirus gene segments and that reassortant analysis would allow the mapping of protein coding assignments and various phenotypic markers to individual viral genes. Through the most basic genetic experiment, the "cross" of two viruses differing in their serotype (and therefore the electrophoretic mobility of their gene segments) and a phenotypic property, he and his group mapped numerous phenotypic traits to individual genes. Their use of intertypic reassortants presaged the use of intertypic reassortants and recombinants for the genetic analysis of several other RNA and DNA viruses.

Perhaps the most significant application of the reassortant approach was its use to identify the role of the reovirus S1 gene product, the cell attachment protein, in defining the tropism and virulence of a viral strain. This work showed that tropism was an important determinant of virulence. Perhaps just as importantly, this work showed that it was possible to apply the principles of molecular genetics to the study of viral pathogenesis, thereby opening up the field of molecular viral pathogenesis. Using this system, Bernie's lab systematically analyzed the roles of reovirus gene products in other stages of virus infection and pathogenesis, including neural and hematogenous spread, development of biliary, cardiac, and nervous system disease, viral persistence, and stability of the virus in the environment. This led to a conceptual framework of viral pathogenesis and infection of the host that has been applied to many other viruses.

In his last few years Bernie turned to the study of structure and function of reovirus particles. He and his colleagues began structural studies of the reovirus particle with his view that "form follows function" and that reoviral structure would provide information about the biology and pathogenesis of the virus. Their biochemical and molecular studies defined the general structure of the virion and constitutent proteins and showed that the virion is an inert particle until activated by proteases in the gut or in endosomal vesicles. Bernie speculated that virions could be "spore-like" particles that are inactive until they enter a host organism. The value of this approach has been borne out in the precise structural studies of reovirus proteins by Nibert and Harrison.

Bernie influenced microbiology in many ways other than his own research. He envisioned combining basic virology and medical virology in a virology textbook, which became known as Fields Virology. Bernie chaired an NIAID task force on the "Future of Microbiology" and co-organized the first FASEB meeting on microbial pathogenesis. One of the major ideas emerging from those meetings was the unity of many of the basic steps in pathogenesis of viruses, bacteria, and parasites, a theme that Bernie championed. He lobbied hard to save the smallpox stocks from destruction because he felt they could provide important biological information in the future. In these and other ways, Bernie's leadership exerted considerable influence over the emergence of a modern identity of the field of microbiology.

It is impossible to forget Bernie as a person. He transmitted enthusiasm and warmth, zest for life, and love of people to everyone who had the privilege of knowing him. Bernie relished the personal interactions with individuals from his department, whether they were faculty colleagues, postdoctoral fellows or students. No one laughed louder than Bernie at the holiday skit performed by the students, particularly when they were portraying him. Bernie's enthusiasm was contagious. His faculty, students and fellows all experienced the "Bernie pep talks" that he loved to deliver. Bernie's colleagues and students knew that they had a new assignment coming, when, in his avuncular style, he put his hand on your shoulder and started to tell you about the importance of a certain project. Bernie had an uncanny instinct about human nature. He could sense your problems and was ready to offer solutions. Bernie made everyone around him feel important. He was persuasive, and he knew it.

Images of Bernie's enthusiastic descriptions of his many passions are easy to conjure up: an exciting new experimental result that could explain a lot, a new scientific model, one of his sons' special soccer games or swim meets, a poker hand that allowed him to clean up, a memorable bottle of wine and an especially fine dinner, an especially interesting art exhibit, a special chamber music performance, or a book that one just had to read. A particular enthusiasm was for the art of his wife, Ruth. For Bernie, everyone and everything was "special".

Bernie's family was very important to him, and he was very proud of Ruth and their sons. He set a strong example for everyone of the priority of family in one's life. Bernie considered all of his students and postdocs to be part of an extended family, and the summer lab parties at his house fostered this sense of family. His annual dinners at the American Society for Virology meeting for current and past lab members and colleagues have continued as a tradition after his death.

As accomplished as Bernie was prior to his diagnosis with pancreatic cancer in 1992, he lived what he called the "best two years" of his life from that time on. The strength and the gusto with which he lived were truly inspiring. In his own words, "every day was a gift." One of his scientific priorities was to publish the third edition of Virology, the book that will always be known as Fields Virology. It was a source of great satisfaction to Bernie when the last chapters of the book were submitted to the publisher only about a month before his death. Although he chose not to take the position as the head of the Office of AIDS Research, he influenced the future of AIDS research perhaps even more by his article in Nature calling for a return to basic science in the HIV and AIDS field. He worked on his studies of reovirus structure and function and recruiting of new faculty members for the department right up until the time when he was too sick to come into the lab.

Finally, to his colleagues and students, Bernie was most of all a scholar, mentor, and teacher. Bernie loved to think deeply about all kinds of topics, and one of the greatest compliments he paid someone was to say that she/he was a "scholar." His classic lectures on viral pathogenesis and infectious diseases to the medical students were well attended, even by students, fellows, and faculty that were not associated with the class. In fact, Bernie always seemed to have a group gathered around him, whether

it was in the lab or at the lunch table. He taught and inspired us to ask the best questions that we could and to keep the big picture in our minds in our work. His lessons were taught well because frequently, his words come back to us, and we think, "What would Bernie have said or done in this situation?"

Dean Daniel Tosteson's eloquent words serve as a fine summation: "Bernie was a distinguished and creative scientist, a dedicated and brilliant teacher, and a responsible and effective citizen and leader of the Faculty of Medicine. He was my friend and a friend to many of you as well as to countless students and colleagues throughout the world. He made our community and the community of science a better place for all."

Respectfully submitted,

David Knipe, *Chairperson*
Harold Amos
John Collier
Dan Fraenkel
Stephen Goldfinger
Stephen Harrison
Morris Karnovsky