

## **History of the Department of Pathology of the New York University School of Medicine**

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The Department of Pathology of the New York University School of Medicine has its origins in two medical schools that merged to form what is now the NYU School of Medicine. The older of the two was the New York University Medical College, which was founded in 1841, only ten years after the establishment of the University itself. A significant contribution made by this school to medicine in general and pathology in particular was its pioneering approach to dissection of human bodies for both the study of human anatomy and the “dissection of the dead,” which, through the efforts of the faculty, were approved by the New York State legislature in two separate bills enacted in 1853 and 1854 respectively. The younger medical school was founded in 1861 by the physicians of Bellevue Hospital under the name of the Bellevue Hospital Medical College, whose faculty was formed from the attending physicians at the Hospital.

In 1878 the illustrious William Welch joined the faculty. Welch, who ultimately became dean of the Johns Hopkins University School of Medicine, the president of the National Academy of Sciences, and who founded the *Journal of Experimental Medicine*, had graduated from the College of Physicians and Surgeons followed by an internship at Bellevue Hospital. At Bellevue the pediatrician Abraham Jacobi engendered his interest in the German medical sciences, which were recognized as pacesetters in medical research and training. Francis Delafield introduced him to pathologic anatomy and, through his promotion of the autopsy as a major source of medical knowledge, influenced Welch’s career choice to become a researcher of pathological anatomy rather than becoming a practitioner. Welch’s family was relatively affluent and supportive of his ambitions so he could indulge in postdoctoral training in the great laboratories of Europe. Following the advice of Jacobi he sailed for Europe in 1876 and studied at the universities of Strasbourg, Leipzig, Breslau, Vienna, and Berlin. Upon his return to America in 1878, Welch came back to Bellevue as a faculty member and, together with Edward Janeway, established the first pathological laboratory for teaching the use of the microscope. Janeway, who was appointed professor of pathological anatomy and histology, diseases of the nervous system, and clinical medicine in 1873, simultaneously held the position of health commissioner of the city of New York until 1882.

Welch was Janeway’s assistant as a “demonstrator” in pathology. To support himself, Welch gave a private course in the laboratory in fall and spring semesters to a class limited to twelve students, who each paid a fee of 15 dollars per term. Many of these students came from medical schools other than Bellevue. In 1881 Welch became professor of pathologic anatomy and general pathology, a position he held until 1885 and which was the first full-time appointment of its kind in the country. When offered the position of professor of pathology at the Johns Hopkins School of Medicine, Welch left Bellevue in 1885 and pursued the rest of his brilliant career at Johns Hopkins. Notwithstanding his subsequent move to Baltimore, Welch declared that his “most active, vigorous years were here in New York.”

The last year of Welch’s tenure at Bellevue was marked by a gift from Andrew Carnegie to the Medical College for the purpose of studying the “causation and pathology of

many diseases and that the results already obtained [through such study] promise to be of incalculable value to humanity.” The gift was also intended to keep Welch at Bellevue but he had already accepted the offer from Johns Hopkins. Janeway remained as director, together with Frederic S. Dennis, a surgeon who pioneered the study of surgical wound healing, and with Herman Biggs, a younger physician acting as instructor. Biggs was also a bacteriologist and ultimately became Commissioner of Health for New York and a leading international figure in public health, serving on the Medical Advisory Committee of the League of Red Cross Societies in Geneva, Switzerland, of which he became medical director for the year 1920. Thus, the Bellevue laboratory, which these men directed, was, in fact, the first laboratory in the United States established for teaching and investigation in bacteriology and pathology. In 1897 the two medical schools merged to form one institution, affiliated with Bellevue under the aegis of New York University. After several name changes, the merged institution became the New York University School of Medicine in 1960.

During the first half of the 20<sup>th</sup> century the pathology department of the School of Medicine was staffed by distinguished anatomic pathologists who, like most academic pathologists of that era, were formulating new classifications of disease. Chairman Douglas Symmers specialized in hematopathology and is identified with a disease, which was termed Brill-Symmers disease, Brill being on the staff of the department of pathology of the Mount Sinai Hospital. The condition is now included among the non-Hodgkins B cell lymphomas as giant follicular lymphoma. Symmers also contributed to the characterization of Moschowitz’ disease also known as thrombotic thrombocytopenic purpura. Symmers’ successor was William C. Von Glahn, whose special areas of interest were cardiac and hepatic pathology. He chaired the department from 1942 to 1954.

Just as Welch and his colleagues had laid the foundations of modern pathology at New York University-Bellevue in the 19<sup>th</sup> century, Lewis Thomas, who became chairperson of the department of pathology in 1954, laid the foundation for the 20<sup>th</sup> century. His extraordinary intellect and vision broadened the role of the department from academic morphologic pathology to experimental pathology with strong emphasis on immunology and inflammation. Although never formally trained in pathology, his research naturally led him to pathology through his interest in infectious disease, post streptococcal rheumatic fever and glomerulonephritis. Thomas was a gifted teacher and, of equal importance, was able to identify talented scientists early in their careers and recruit them to the department, making it, in a very short time, one of the preeminent pathology departments in the country. Thomas also founded the Honors Program at the School of Medicine, which through NIH funding supported medical students for a full year of research after their first two years. Graduates of the Honors Program who studied in the department of pathology include George Todaro, who developed the 3T3 cell line in the laboratory of Howard Green and later was co-formulator of the oncogene hypothesis, and Fred Miller, who worked with Baruj Benacerraf and then with Henry Metzger at NIH, with whom he described the pentameric structure of IgM.

Thomas also established the first pathobiology training program for pathology residents. The program was supported by the NIH and residents were NIH fellows, trained as anatomic and clinical pathologists while simultaneously carrying on research under the tutelage of the extraordinary faculty Thomas recruited. From Johns Hopkins, Thomas recruited Zoltan Ovary in 1959, who began the practice of medicine as an allergist and then pursued groundbreaking research in anaphylaxis, spending the remainder of his distinguished career at NYU. Jeanette Thorbecke was recruited from the Netherlands in 1957 and, like Ovary, also remained at NYU throughout her career. Thorbecke pursued seminal research in

tumor immunology, autoimmunity and T and B cell development and was elected president of the American Association of Immunologists in 1989. Among the most famous of the faculty recruited by Thomas was Baruj Benacerraf, who won the Nobel Prize in 1980 for his studies of immunogenetics. At NYU Benacerraf trained many notable immunologists, including Victor and Ruth Nussenzweig, who remained at NYU throughout their careers and are today among its most distinguished faculty, pursuing research in the pathogenesis of malaria. Other Benacerraf trainees at NYU include Ira Green, William E. Paul, Gregory Siskind, and Michael Lamm, who conducted significant studies in the field of mucosal immunity and IgA antibodies. Lamm became chairperson of pathology at Case Western Reserve University Medical School and was elected president of the American Society of Investigative Pathology in 1991. William E. Paul is known for the discovery of IL-4 and demonstrating that IL-4 is the central regulator of allergic inflammation as well as the delineation of mechanisms of differentiation of Th2 cells. Paul came from the National Cancer Institute to join Baruj Benacerraf's laboratory as a PHS Special Fellow in 1964 to study the specificity of cellular immune responses. In 1968 he left NYU for the National Institute of Allergy and Infectious Diseases, where he has served as Chief of the Laboratory since 1970. From 1994 to 1997 he was also Associate NIH Director for AIDS Research and Director of the NIH Office of AIDS Research.

Among Thomas' recruits who were trained as pathologists was Robert McCluskey, a graduate of the NYU School of Medicine and the Bellevue residency. McCluskey became director of Laboratories of the newly established New York University Hospital in 1963. Thomas had earlier introduced him to Benacerraf, with whom he became a lifelong friend. A true physician-scientist, McCluskey was a pioneer in the study of the mechanisms of inflammation and use of immunofluorescence as an investigative tool in delineating the nature of glomerular diseases and as an aid in the differential diagnosis of renal disorders in the late 1960s. While at NYU McCluskey became the mentor of Gloria Gallo, who succeeded him as renal pathologist at NYU for many years and, like her mentor, achieved international recognition as a renal pathologist. McCluskey left NYU to become Chairperson of the Department of Pathology at the State University of New York at Buffalo. Shortly thereafter he became Chairman of Pathology at Children's Hospital in Boston. In 1974 he became Chief of Pathology at the Massachusetts General Hospital.

While McCluskey was at University Hospital, the Bellevue laboratories were headed by Marvin Kuschner who also had received his medical degree from NYU and similarly trained in pathology at Bellevue. During World War II, he served as a pathologist in the War Crimes Branch of the 7th Army, taking the lead in performing autopsies of concentration camp prisoners. Kuschner was among the first researchers to study the effects of pollutants, including tobacco, on the lungs. Kuschner held a joint appointment as professor of environmental medicine and was intensely interested in chemical carcinogenesis. He left NYU to become Chairperson of the Pathology Department at SUNY Stony Brook Health Sciences Center and subsequently became Dean of the SUNY Stony Brook School of Medicine.

Thomas' successor as chairperson at NYU was his colleague Chandler Stetson, who served in this capacity from 1958 to 1972. Stetson was interested in endotoxin and the Schwartzman reaction, autoimmunity and transplantation. He continued to promote the research orientation of the department and recruited several additional faculty including his student fellow from the Honors Program, Ross Basch. Basch is currently professor of pathology at NYU and has pursued significant research on hematopoietic differentiation. Howard Green, who had joined the department as an immunologist studying the actions of

antibodies on mammalian cell membranes, changed the direction of his studies to cell biology and became a pioneer in the use of cell lines in culture, with which he attempted to define the in vitro properties of malignant cells. Green left NYU in 1970 to become Professor of Cell Biology at the Massachusetts Institute of Technology and then went to Harvard Medical School in 1980 as Chairman of the Department of Cellular and Molecular Physiology until 1993. Green is currently the George Higginson Professor in the Department of Cell Biology. While at MIT and Harvard Medical School, he developed the first therapeutic use of cultured cells – the use of keratinocytes for the regeneration of epidermis on severely burned patients. Green is a member of the National Academy of Sciences and a Chevalier de la Légion d'Honneur, Republic of France. During his tenure at NYU, Green attracted many talented collaborators and post-doctoral fellows. Burton Goldberg, who was also a trained pathologist, used cell culture systems to study in vitro collagen biosynthesis, remaining at NYU after Green's departure to become professor of pathology until he was invited to become Chairperson of the Department of Pathology at the University of Wisconsin. Among the many outstanding postdoctoral fellows in Green's laboratory was Claudio Basilico, who had come to America from Italy to study with Renato Dulbecco, and subsequently joined Green. Stetson recruited Basilico to the faculty of the NYU pathology department, where he became a viral oncologist of international stature, and he is currently Chairperson of the Department of Microbiology at the NYU School of Medicine. Robert Pollack, a scholar and Guggenheim Fellow who pursues work at the junction of science and religion, was a post-doctoral fellow in Green's laboratory as well and subsequently became an NYU faculty member from 1968 to 1970. Pollack is now Professor of Biological Sciences and Director of the Center for the Study of Science and Religion at Columbia University, where he served as Dean of Columbia College from 1982 to 1989.

Stanley Cohen came to NYU as a fellow from 1964 to 1966 and went on to produce major research on the role of cytokines in the regulation of cell proliferation. He is currently Professor and Chair of the Department of Pathology and Laboratory Medicine, UMDNJ-New Jersey Medical School. Susan Zolla-Pazner came to NYU Medical Center in 1967 with Edward Franklin of the NYU department of medicine's rheumatic disease study group in Bellevue. As assistant professor of pathology, she developed her laboratory at the adjacent Manhattan Veterans Affairs Medical Center Administration Hospital to both carry out her research and participate in the training of residents in immunology. She is now the Director of Research AIDS Center, Veterans Affairs Medical Center, and the recipient of a consortium grant for AIDS Vaccine Discovery from the Bill and Melinda Gates Foundation. M. Julia Phillips-Quagliatta became a faculty member after completion of her postdoctoral fellowship with Jonathan Uhr. She has devoted herself to the study of B-Cell Regulation in the Mucosal Immune System and is professor of pathology. Stetson also invited the "father of immunochemistry" Michael Heidelberger, who had been retired by the College of Physicians and Surgeons in 1954 and then worked at the Institute of Microbiology at Rutgers University, to join the department of pathology in 1964. Heidelberger remained productive throughout his long life, winning the National Medal of Science in 1967 and his second Lasker Award in 1978.

The NIH-supported pathobiology training program started under Thomas' stewardship attracted many residents who wished to pursue careers combining both anatomic and clinical pathology and experimental pathology. The many talented individuals who trained at NYU as pathobiology fellows over several decades under Thomas and his successors include Fred Miller, who became Chairperson of the Department of Pathology at SUNY Stony Brook while pursuing studies in immunochemistry. Thomas' Honors Program

fellow Frederick F. Becker trained in pathology at NYU and became Director of Laboratories at Bellevue while studying liver regeneration and hepatocarcinogenesis. He subsequently became Vice President for Research of the MD Anderson Cancer Center, where he served with great distinction until his recent retirement. Milton Finegold, internationally known pediatric pathologist, succeeded Becker as Director of Laboratories at Bellevue before becoming Director of Pathology at the Children's Hospital of Baylor. Fred Gorstein, distinguished gynecologic pathologist at NYU, became Director of Laboratories at the Tisch University Hospital and subsequently became chairperson of the department of pathology at Vanderbilt and then of the Jefferson University Medical School. Mark Tykocinski, a graduate of the NYU School of Medicine and of the NYU pathobiology residency program, whose research is focused on the design of novel recombinant proteins with immunotherapeutic potential and the development of antigen-presenting cell-centered immunotherapeutics, became Chairperson of the Department of Pathology at the University of Pennsylvania. While a resident, George Teebor, professor of pathology and environmental medicine at NYU, was recruited by Marvin Kushner to become the pathologist for the Department of Environmental Medicine reviewing the results of many animal models of carcinogenesis. This led him, together with Fred Becker, to develop a novel hepatocarcinogenic regimen with which to characterize biochemical properties of preneoplastic hepatic cells. Teebor's interest in carcinogenesis led him to the study of DNA repair. Robert Boorstein who had received his Ph.D in the laboratory of Arthur Pardee at Harvard came to NYU as a resident fellow and worked productively on base excision DNA repair enzymology in Teebor's laboratory. Boorstein is currently Associate Professor of Pathology and Director of Laboratories at Bellevue.

Stetson was recruited by the University of Florida to become Dean of its Medical School and later became the Vice President for Health Affairs. He was succeeded at NYU in 1974 by Vittorio Defendi, a distinguished viral oncologist who had been a Member of the Wistar Institute, American Cancer Society Professor, Professor at the University of Pennsylvania and Editor-in-Chief of the Journal of Cellular Physiology. Defendi presciently pursued research on the carcinogenic properties of human papilloma virus. He also served as Director of the Cancer Center of New York University School of Medicine for almost two decades. Like his predecessors, Defendi recognized and actively recruited talented young faculty in areas of experimental oncology and immunology. Among these recruits was Riccardo Dalla-Favera, who, as a postdoctoral fellow, had demonstrated the c-myc translocation associated with Burkitt's lymphoma. At NYU Dalla-Favera collaborated with Daniel Knowles, a distinguished hematopathologist. The two developed a productive relationship performing seminal molecular biologic analysis of B-cell lymphomas. Knowles became Chairperson of the Department of Pathology of the Cornell University Medical College and Dalla-Favera is Director of the Cancer Center of Columbia University. Blas Frangione, professor of pathology and psychiatry who discovered the first disease-causing mutation of Alzheimer's amyloid precursor protein and who is one of the leaders in Alzheimer and neurodegenerative disease research, joined the department in 1976. David Russell, who has pursued significant research into microbial pathogens was a professor in the department from 1987 to 1990 and is now Professor and Chair of the Department of Microbiology and Immunology at the College of Veterinary Medicine of Cornell University. Other recruits include Angel Pellicer who, as a postdoctoral fellow with Richard Axel at Columbia, performed ground-breaking gene transfer experiments. At NYU Pellicer has productively pursued the properties of the ras genes in oncogenesis. David Levy was recruited from the Rockefeller University and, in 2002, was the recipient of the Milstein

award of the International Society for Interferon and Cytokine Research. Levy is professor of pathology and serves as vice-chairperson for research of the department. Gurdip Sidhu began his work at NYU in 1972. In the first efforts to search for the causes of AIDS, his extraordinary diagnostic acumen and astute powers of observation using an electron microscope to study a tissue sample enabled him to recognize signs of retroviral infection in early 1981. He retired in 2005 to become adjunct professor of pathology. Daniel Meruelo was recruited from Johns Hopkins and is currently professor of pathology, devoting himself to several lines of investigation directed towards therapeutic intervention in HIV and cancer. Michele Pagano joined the faculty in 1996 and over the past decade has done ground-breaking work in cell cycle regulation and ubiquitylation. He established a liaison with Avram Hershko, who visits and works in the Pagano laboratory regularly and who is co-winner of the Lasker Award in 2000 and the Nobel Prize in Chemistry in 2004. Hershko became adjunct professor of pathology at the NYU School of medicine in 2002.

The current chairperson is David Roth who was recruited to the Molecular Pathogenesis group of the Skirball Institute at NYU and, upon Defendi's retirement, became the choice of the search committee for chairperson of the department in 2004. Roth, who is a trained pathologist, is an eminent scientist investigating the development of the immune system with emphasis on the VDJ recombination mechanisms. In keeping with the tradition established by his distinguished predecessors, Roth is actively recruiting imaginative, talented young faculty who will continue the legacy of the NYU department of pathology to contribute to human well-being through its efforts to elucidate disease mechanisms and thereby identify novel strategies of both prevention and therapy.