

## OBITUARY

# Remembering Marvin Weinstein (1916–2011)

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Marvin Weinstein was totally devoted to the discovery of new antibiotics. During his job interview at the Schering Corporation in 1956, he stated that he knew one thing with 100% certainty, that is, if you don't search for a new medicine, you absolutely will never find one. Upon hearing that, Schering's CEO stated 'You're hired'. Research led by Marvin as the Director of Antibiotic Research at Schering resulted in the 1960s discovery of gentamicin from a soil bacterium provided by Americo Woyciesjes. In contrast to previously discovered antibiotics, such as penicillin obtained from the fungus *Penicillium chrysogenum*, and streptomycin, kanamycin, neomycin and other antibiotics obtained from the bacterial actinomycete genus *Streptomyces*, gentamicin was obtained from a member of the rare actinomycete genus *Micromonospora*, that is, *Micromonospora purpurea*.

Gentamicin, described in 1963, showed strong activity against a variety of microbes, including *Pseudomonas aeruginosa* and kanamycin- and neomycin-resistant bacteria. Indeed, its spectrum of activity was found to be wider than that of any clinically-available antimicrobial agent at the time. Activity was demonstrated against *Pseudomonas*, *Escherichia coli*, *Klebsiella*, enterobacteria, *Proteus*, *Serratia* and other less common Gram-negative bacteria. It also showed activity against *Staphylococcus* and the tubercle bacillus *in vitro*. The gentamicin C complex was of use clinically, especially for infections by *Pseudomonas*. It became the preferred antibiotic for life-threatening Gram-negative infections in general and for *Pseudomonas* infections, in particular. Gentamicin thus became a marketable, effective and world-leading antibiotic. This remarkable effort by Marvin could be traced back to his reading as a teenager of Sinclair Lewis' book *Arrowsmith*. Marvin grew up fascinated by the miracle under the microscope and was inspired by the advances that the age of penicillin had brought to humanity. To him, antibiotic research was a frontier with a promise to eradicate the infectious illnesses of humanity. His development of gentamicin was followed by the discovery of about 20 additional antibiotics at Schering, including sisomicin, verdamicin, rosaramicin and everninomicin.

Marvin was born in 1916 and raised in New York City's borough of Manhattan, where, as a boy, he watched the construction of the George Washington Bridge. He told of writing his name on a paper that he packed into a cement ball and tossed into the bridge foundation. Although his mother died when Marvin was only 4 years old, he was raised by his grandmother, two aunts and his older sister. He attended Dewitt Clinton High School, where he was a member of the Biology Club. His graduation yearbook stated that his career objective was medical research and he was 'Clinton's gift to the medical world'. At the high school, he had raised tadpoles and plated bacteria on Petri dishes. He next attended New York University



(NYU) and then Alfred University, where he obtained his bachelor's degree in 1940. He spent the next 2 years in Washington, DC, working with the Census Bureau and the War Production Board.

In 1942, Marvin joined the US Army Air Force, trained as a Communication Officer at Yale University and graduated as a Lieutenant from Officer's Training School. Marvin spent 2 years in the Pacific area during World War II, predominantly in the Philippines and New Guinea and then in occupied Japan. After his 4 years of war he took a 1-month course in bacteriology at the School of Nursing at Columbia University, and in 1947 he took a position as Chief Laboratory Technician at Long Island University (LIU). At the same time, he took courses at NYU in the evening and summer school toward a Masters Degree in Biology. He did research at NYU in endocrinology and demonstrated the *in vivo* production of estrogen by adrenal glands, in a work that was published in *The Anatomical Record* in 1949. During that year, Marvin married Margaret Seitner, a

biologist teaching at LIU, who had received a scholarship at Mount Holyoke College and a Masters Degree in Biology. After their two children were old enough, Margaret returned to school and received a PhD in immunology at Rutgers University and went on to become a faculty member at the Robert Wood Johnson Medical School. They were married for 59 years.

In 1949, Marvin joined the Squibb Pharmaceutical Company in New Brunswick, New Jersey. His experience at Squibb prepared him well for his important role at Schering. While pursuing his PhD degree at NYU, he worked at Squibb in the pilot plant, on strain development for production of penicillin and streptomycin, transformation of steroids, actinophages and antibiotic screening. He was a co-discoverer of amphotericin B and a co-author on papers describing new antibiotics such as carbomycin and thiostrepton. Other Squibb papers on which he was a co-author dealt with the antifungal antibiotics nystatin, tolnaftate and griseofulvin. He proposed a project to Squibb Management involving microbiological transformation of steroids to more active derivatives. As a result, he was transferred to the Squibb Institute for Medical Research, where he worked with the eminent David Perlman on steroid transformations, actinophages and antibiotic screening. During his work at Squibb, Marvin continued his NYU studies toward the doctorate degree at night, on weekends and in summer school. He did his NYU research at the New York Aquarium and produced a thesis titled 'The Relation of Altered Cell Physiology to Antibiotic Resistance Behavior in Organisms Pathogenic to Fish'. During this period, he spent 7 months at the Squibb facility in Argentina, setting up an antibiotic screening program, which resulted in the isolation of curamycin.

Marvin received his doctoral degree from NYU and moved on to Schering in 1956. In 1958, together with Wayne Umbreit of Rutgers University, Fred Hahn of Walter Reed Hospital and George Brown of Sloan Kettering Institute, he was a member of one of the first United States State Department Scientific Exchange Delegations to the Soviet Union, which involved visiting microbiology laboratories in 13 different Soviet cities.

In addition to his amazing results at Schering Corporation on the discovery of new antibiotics, Marvin worked on and published on the induction of resistance to bacterial infections of mice with Poly I-Poly C and production of insect juvenile hormone activity by microorganisms and plants. His group increased the yield of interferon in a recombinant strain of *E. coli* and he obtained one of the earliest

patents in the field of biotechnology in the early 1970s on a method for extraction of interferon from a recombinant strain of *E. coli*.

At the time of his retirement from Schering in 1981, he was Vice-President for Microbiology, Antibiotic Research and Recombinant DNA Research. After retirement, Marvin continued in the microbiology/biotechnology field as a Director of New Brunswick Scientific Co. and also at Epitope Inc., where a rapid test for AIDS was developed. He was a consultant to a number of multinational corporations, including Yamanouchi Pharmaceutical Co. and Suntory Biomedical Institute and others based on biological technologies. He was also on the Scientific Advisory Board of several biotechnology companies. He held an appointment as Adjunct Faculty member of the Rockefeller University, and in 1985 he became Research Fellow at Drew University's Research Institute for Scientists Emeriti (RISE). In 1990, he was inducted into the New Jersey Inventors Hall of Fame. In 1995, he received the Fellowship award of the Society for Industrial Microbiology (SIM). He was Emeritus Member of the Editorial Board of the Journal of Antibiotics, an elected member and Fellow of the Infectious Disease Society, a Fellow of the American Academy of Microbiology and Chair of the Microbiology Section of the New York Academy of Sciences. In total, Marvin published 70 scientific papers and was inventor on 30 patents and co-author of three books.

In 2002, Marvin moved to Jamesville, NY, outside of Syracuse, after spending nearly 60 years in New Jersey. He became involved as a *pro bono* advisor to a company organized to develop drugs for Third-World countries. He lived a grand life, never losing his love of industrial microbiology and antibiotic discovery. He lived until the age of 94, passing away peacefully on 19 August 2011. Wife Margaret had died three years earlier. He left two sons, Gary of Syracuse, NY and Richard of Knoxville, TN, and three grandchildren. The world of new drug discovery shall miss this great leader as it struggles to solve the problems brought on by the antibiotic crisis of today, that is, the lack of new antibiotics to battle resistant pathogens and newly emerged disease agents.

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