REVIEW

The Most Influential Scientists in the Development of Medical informatics (12): Joshua Lederberg

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JOSHUA LEDERBERG (1925–2008)

Joshua Lederberg (May 23, 1925 - February 2, 2008) was an American molecular biologist known for his work in microbial genetics, artificial intelligence, and the United States space program. He was just 33 years old when he won the 1958 Nobel Prize in Physiology or Medicine for discovering about bacterial genetic information transfer. His father, Zvi Lederberg, was an orthodox rabbi; and his mother Esther a homemaker. Joshua felt drawn to science at an early age, stating in a homework assignment at age seven that his career aspiration was to become “like Einstein,” to “discover a few theories in science.”

He graduated from Stuyvesant at the age of fifteen. At the Columbia University, his mentor Francis J. Ryan introduced him to the red bread mold, *Neurospora*, as an important new experimental system in the emerging field of biochemical genetics.

In the United States Navy's V-12 training program, he performed his military training duties and examined stool and blood specimen from malaria patients.

After receiving his bachelor's degree in zoology in 1944, he enrolled in Columbia University's College of Physicians and Surgeons and continued to do his research.

Lederberg carried out experiments with the intestinal bacterium *Escherichia coli* which demonstrated that certain strains of bacteria can undergo a sexual stage, that they mate and exchange genes. The most important of his discovery was the discovery of viral

transduction, the ability of viruses that infect bacteria to transfer snippets of DNA from one infected bacterium to another and insert them into the latter's genome. The use of viruses in manipulating bacterial genomes became the basis of genetic engineering in the 1970s. In the year 1958 he received a Nobel Prize in Physiology or Medicine, along with Tatum and George W. Beadle, “for his discoveries concerning genetic recombination and the organization of the genetic material of bacteria.”

The launch of Sputnik in 1957 led Lederberg toward an interest in astronomy that lasted 20 years. His concern about the risk of spacecraft returning to Earth with contaminants from space resulted in a quarantine for space travel that remains in effect today. He went on to design experiments intended to detect the presence of life on Mars, resulting in the Mars Viking lander.

Lederberg became increasingly aware of the value of computers. He

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formed collaborations with researchers at Stanford to create a program for analyzing mass-spectrometric data of molecular structures, called DENDRAL, which led to further programs for disease diagnosis and management. It was the first expert system for specialized use in science.

Over the course of his life, Lederberg was elected to the National Academy of Sciences, the Institute of Medicine, received the National Medal of Science, was named an honorary life member of the New York Academy of Sciences, was awarded Foreign Membership of the Royal Society of London and holds the title of Commandeur, L'ordre des arts et des lettres in France.

Lederberg published over 300 scientific and policy-related articles and was the editor of several books, including *Papers in Microbial Genetics: Bacteria and Bacterial Viruses* (1951), *Emerging Infections: Microbial Threats to Health in the United States* (1992), and *Biological Weapons: Limiting the Threat* (1999). His first marriage ended in divorce and he remarried Marguerite Stein Kirsch, a clinical psychologist, with whom he had two children. Following a battle with pneumonia, Lederberg passed away in New York in 2008 at

the age of 82.

Interesting facts:

- As a child, his idol was Einstein.
- He was a member of Royal Society of London for Improving Natural Knowledge.
- He studied how astronauts from Sputnik can contaminate Earth with space organisms - modern space quarantine.
- He invented first expert system for specialized use in science.
- He won a Nobel Prize at the age of 33.

• Conflict of interest: None declared.

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