Edward Jenner

- **Edward Jenner**, (born May 17, 1749, Berkeley, Gloucestershire, England—died January 26, 1823, Berkeley),
- English surgeon and discoverer of vaccination for smallpox.
- Father of Immunology

Edward Jenner

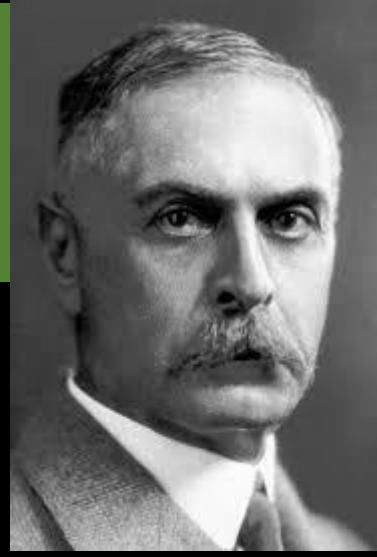
- The story of the great breakthrough is well known. In May 1796 Jenner found a young dairymaid, Sarah Nelmes, who had fresh cowpox lesions on her hand.

- On May 14, using matter from Sarah's lesions, he inoculated an eight-year-old boy, James Phipps, who had never had smallpox.

- Phipps became slightly ill over the course of the next 9 days but was well on the 10th. On July 1 Jenner inoculated the boy again, this time with smallpox matter.

- No disease developed; protection was complete. In 1798 Jenner, having added further cases, published privately a slender book entitled *An Inquiry into the Causes and Effects of the Variolae Vaccinae*.

Karl Landsteiner



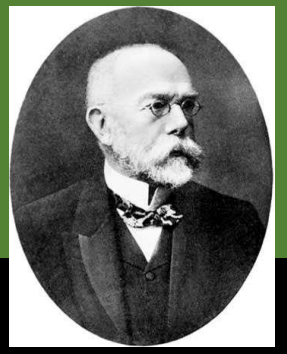
- Austrian immunologist and pathologist
- **Karl Landsteiner**, (born June 14, 1868, Vienna, Austrian Empire [Austria]—died June 26, 1943, New York, N.Y., U.S.)
- Received the 1930 Nobel Prize for Physiology or Medicine for his discovery of the major blood groups and the development of the ABO system of blood typing that has made blood transfusion a routine medical practice.
- He and the Romanian bacteriologist Constantin Levaditi discovered that a microorganism is responsible for poliomyelitis and laid the groundwork for the development of the polio vaccine.

Karl Landsteiner

- Landsteiner also helped identify the microorganisms responsible for syphilis.

- However, he considered his greatest work to be his investigations into antigen-antibody interactions, which he carried out primarily at Rockefeller Institute (now called Rockefeller University) in New York City (1922–43).
- In this research Landsteiner used small organic molecules called haptens—which stimulate antibody production only when combined with a larger molecule, such as protein—to demonstrate how small variations in a molecule's structure can cause great changes in antibody production.
- Landsteiner summarized his work in *The Specificity of Serological Reactions* (1936), a classic text that helped establish the field of immunochemistry.

Robert Koch



- **Robert Koch**, in full **Robert Heinrich Hermann Koch**, (born Dec. 11, 1843, Clausthal, Hannover [now Clausthal-Zellerfeld, Ger.]—died May 27, 1910, Baden-Baden, Ger.),
- German physician and one of the founders of bacteriology. He discovered the anthrax disease cycle (1876) and the bacteria responsible for tuberculosis (1882) and cholera (1883).
- For his discoveries in regard to tuberculosis, he received the Nobel Prize for Physiology or Medicine in 1905.

Robert Koch

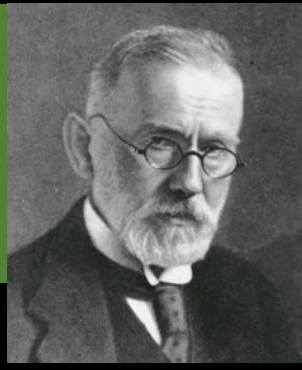
- **Contributions To General Bacteriology And Pathology**
- In 1877 Koch published an important paper on the investigation, preservation, and photographing of bacteria.
- His work was illustrated by superb photomicrographs.
- In his paper he described his method of preparing thin layers of bacteria on glass slides and fixing them by gentle heat.
- Koch also invented the apparatus and the procedure for the very useful hanging-drop technique, whereby microorganisms could be cultured in a drop of nutrient solution on the underside of a glass slide.

Robert Koch

Koch determined guidelines to prove that a disease is caused by a specific organism. These four basic criteria, called Koch's postulates, are:

1. A specific microorganism is always associated with a given disease.
2. The microorganism can be isolated from the diseased animal and grown in pure culture in the laboratory.
3. The cultured microbe will cause disease when transferred to a healthy animal.
4. The same type of microorganism can be isolated from the newly infected animal.

Paul Ehrlich



- **Paul Ehrlich**, (born March 14, 1854, Strehlen, Silesia, Prussia [now Strzelin, Pol.]—died Aug. 20, 1915, Bad Homburg vor der Höhe, Ger.), German medical scientist known for his pioneering work in hematology, immunology, and chemotherapy and for his discovery of the first effective treatment for syphilis.

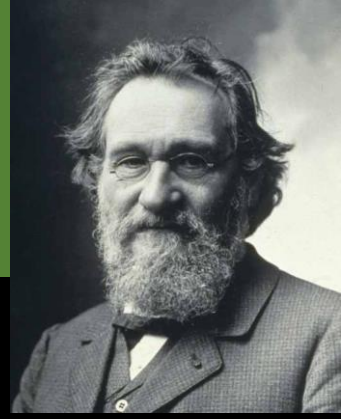
- He received jointly with Élie Metchnikoff the Nobel Prize for Physiology or Medicine in 1908.
- Ehrlich also differentiated the numerous types of blood cells of the body and thereby laid the foundation for the field of hematology.
- Based on his research, he is considered as the founder of chemotherapy, since he was the first scientist to develop targeted pharmaceutical treatment against syphilis using the organic arsenic-based compound, Salvarsan.

Paul Ehrlich

- The hypothesis Ehrlich developed to explain immunological phenomena was the side-chain theory, which described how antibodies—the protective proteins produced by the immune system—are formed and how they react with other substances.

- On the basis of his achievements, Ehrlich was made director of a government-supported institute near Berlin, which was transferred to Frankfurt am Main in 1899 as the Royal Institute for Experimental Therapy.

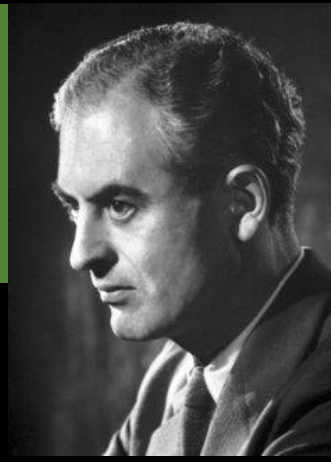
Elie Metchnikoff



- **Élie Metchnikoff**, Russian in full **Ilya Ilich Mechnikov**, (born May 16, 1845, near Kharkov, Ukraine, Russian Empire [now Kharkiv, Ukraine]—died July 16, 1916, Paris, France),
- Russian-born zoologist and microbiologist
- The 1908 Nobel Prize for Physiology or Medicine (with Paul Ehrlich) for his discovery in animals of amoeba-like cells that engulf foreign bodies such as bacteria—a phenomenon known as phagocytosis and a fundamental part of the immune response.

- Contributions to immunology. Mechnikov discovered phagocytes, immune cells that protect organisms by ingesting foreign particles or microorganisms, by conducting experiments on starfish larvae. He then developed a theory of the cellular process involving phagocytes, known as phagocytosis, to explain how inflammation is a part of the self defense system found in both vertebrates and invertebrates.

Peter Medawar



- Peter Brian Medawar
  The Nobel Prize in Physiology or Medicine 1960
- Born: 28 February 1915, Rio de Janeiro, Brazil
- Died: 2 October 1987, London, United Kingdom
- Affiliation at the time of the award: University College, London, United Kingdom
- Prize motivation: "for discovery of acquired immunological tolerance."

Peter Medawar

- **Work**
- Our immune system protects us against attacks by microorganisms and rejects foreign tissue.
- Part of our immunity has a hereditary basis, but part of it is acquired and is not present in the fetus.
- After Macfarlane Burnet theorized that the ability to distinguish between one's own and foreign tissue is acquired during the fetus stage, Peter Medawar successfully transplanted tissue between mouse fetuses without rejection in 1951.
- He could perform new transplants on the mice when they became adults, something that did not work when the transplants were not performed during the fetus stage.
- The results had significance for organ transplants.

MacFarlane Burnet

- **Sir Macfarlane Burnet**, in full **Sir Frank Macfarlane Burnet**, (born Sept. 3, 1899, Traralgon, Australia—died Aug. 31, 1985, Melbourne)
- Australian physician, immunologist, and virologist
- With Sir Peter Medawar, was awarded the 1960 Nobel Prize for Physiology or Medicine for the discovery of acquired immunological tolerance, the concept on which tissue transplantation is founded.

MacFarlane Burnet

- Although Burnet's work in virology was important, his most significant achievements in science were made in immunology.
- He helped unravel the question of how the vertebrate immune system learns to distinguish between its own cells and foreign materials (antigens), such as those of infectious agents, and how during development a vertebrate becomes able to tolerate those components belonging to itself—the concept called immunological tolerance.
- He also developed a model, called the clonal selection theory of antibody formation, that explains how the body is able to recognize and respond to a virtually limitless number of foreign antigens. The theory states that an antigen entering the body does not induce the formation of an antibody specific to itself—as some immunologists believed—but instead it binds to one unique antibody selected from a vast repertoire of antibodies produced early in the organism's life.
- Although controversial at first, this theory became the foundation of modern immunology.

Niels K Jerne

- Niels K. Jerne
  The Nobel Prize in Physiology or Medicine 1984
- Born: 23 December 1911, London, United Kingdom
- Died: 7 October 1994, Castillon-du-Gard, France
- Affiliation at the time of the award: Basel Institute for Immunology, Basel, Switzerland
- Prize motivation: "for theories concerning the specificity in development and control of the immune system and the discovery of the principle for production of monoclonal antibodies."

Niels K Jerne

- He shared the Nobel jointly with César Milstein (AAI '79) and Georges J.F. Köhler (AAI '85),
- Honored for developing the hybridoma technique for producing monoclonal antibodies, for his theories concerning "the specificity in development and control of the immune system.“
- Jerne's three main theories challenged widely held views concerning the development of antibodies and laid new foundations for contemporary immunology. Jerne published his first theory, the "natural-selection theory" of antibody formation, in 1955. At the time, immunologists believed that specific antibodies were nonexistent until their corresponding antigens entered the system and served as templates upon which the antibodies were created. Another leading theory at the time held that antigens introduced into cells were modified by enzymes and that repeated antigen exposure caused replication of antibodies that were partial replicas of these enzyme-modified antigens. Jerne challenged both of these notions, hypothesizing that all antibodies are formed during fetal development and are present in the body from birth. He suggested that when an antigen enters the body, it binds to a pre-existing complementary antibody and stimulates the rapid production of identical antibodies.

Niels K Jerne

- With his second theory, first set forth in 1971, Jerne sought to explain how the immune system learns to distinguish self from non-self. Immunologists at the time thought that the body's self-tolerance could not be inherited as a standard pattern but must be learned. Jerne theorized that this "learning" takes place in the thymus gland in the upper chest, where different populations of lymphocytes are exposed to histocompatibility antigens. Lymphocytes that recognize self-antigens are suppressed, whereas non-self lymphocytes, which have accumulated spontaneous mutations, develop and multiply into lymphocytes that can detect foreign antigens.
- In 1974, Jerne published his third and most significant theory, his "network theory," which revolutionized the way immunologists thought about adaptive immunity and immune regulation. Jerne posited that an antibody can bind to the antigen-specific variable region of another antibody and elicit production of anti-antibodies, a process, which, in turn, triggers a successive cascade of anti-anti-antibody production. This cascade broadens the diversity of the antibody population, and the network attains a state of balance under normal conditions, which can be perturbed and restored during additional antigen exposures.

Rodney Porter

- Rodney Robert Porter born 8 October 1917 at Newton-le-Willows, Lancashire, England.
- *Rodney R. Porter died on September 6, 1985.*
- 1972 Nobel Prize in Physiology or Medicine with Gerald M. Edelman (AAI '70) “for their discoveries concerning the chemical structure of antibodies.”

Rodney Porter

- Rodney R. Porter was awarded the 1972 Nobel Prize in Physiology or Medicine jointly with Gerald M. Edelman (AAI '70) for their related but independent work that established the chemical structure of antibodies. Together, Porter and Edelman are recognized as having provided much of the foundation for the developing field of molecular immunology. Their groundbreaking work of the late 1950s and early 1960s ushered in a new era of research on antibodies, which previously had been only vaguely understood.
- Porter's most fundamental contribution was his hypothesis that antibodies had a Y-shaped structure. In the 1950s, using the enzyme papain, he succeeded in splitting rabbit immunoglobulin G (IgG) into three parts: a large component that had no antigen-binding capability (the base of the Y) and two smaller fragments with active sites that bound to the antigen (the Y's arms). He demonstrated that the large fragment, or fragment crystallizable, was the same across all IgG molecules, but the two smaller fragments, which he called fragment antigen-binding (Fab), varied among antibodies. Based on his own research and that of Edelman, Porter correctly surmised that each Fab fragment consisted of two polypeptide chains and that each antibody was composed of four polypeptide chains: two long, heavy chains and two short, light chains. The heavy chains lie parallel for a distance, forming the Y's base. On the other end, they spread apart, forming two arms, each with a light chain attached parallel to it, with the highly variable, antigen-binding site, comprised of the N-terminal regions of both the heavy and light chains, at the ends of the arms.

Susumu Tonegawa

- Born September 5, 1939, Nagoya, Japan
- The Nobel Prize in Physiology or Medicine 1987 was awarded to Susumu Tonegawa "for his discovery of the genetic principle for generation of antibody diversity.“
- **Susumu Tonegawa** was the one who finally answered the question how the gene material in B cells could suffice to create the structures of a seemingly endless number of different antibodies. In 1976 he could in a convincing and elegant manner show how different immunoglobulin genes which were far apart in the embryonic cell in the B lymphocyte had been moved in closer contact. Under development from the germ cells (the sperm and egg cell) to an antibody producing B lymphocyte the genes forming the immunoglobulins had accordingly been redistributed.