NEW

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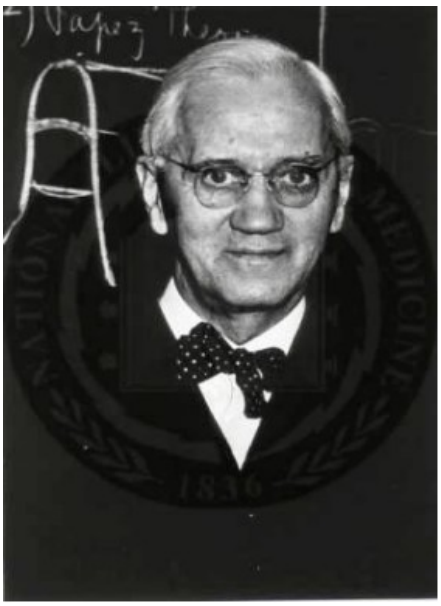
From the Annals of the World History

Alexander Fleming

6 August 1881 - 11 March 1955



Sir Alexander Fleming (6 August 1881 - 11 March 1955) was a Scottish biologist and pharmacologist. Fleming published many articles on bacteriology, immunology and chemotherapy. His best-known achievements are the discovery of the enzyme lysozyme in 1923 and the antibiotic substance penicillin from the fungus Penicillium notatum in 1928, for which he shared the Nobel Prize in Physiology or Medicine in 1945 with Howard Walter Florey and Ernst Boris Chain.

In 1999, Time Magazine named Fleming one of the 100 Most Important People of the 20th Century for his discovery of penicillin, and stated; "It was a discovery that would change the course of history. The active ingredient in that mould, which Fleming named penicillin, turned out to be an infection-fighting agent of enormous potency. When it was finally recognized for what it was-the most efficacious life-saving drug in the world-penicillin would alter forever the treatment of bacterial infections. By the middle of the century, Fleming's discovery had spawned a huge pharmaceutical industry, churning out synthetic penicillins that would conquer some of mankind's most ancient scourges, including syphilis, gangrene and tuberculosis".

Life

Sir Alexander Fleming was born at Lochfield near Darvel in Ayrshire, Scotland on August 6th, 1881. He attended Louden Moor School, Darvel School, and Kilmarnock Academy before moving to London where he attended the Polytechnic. He spent four years in a shipping office before entering St. Mary's Medical School, London University. He qualified with distinction in 1906 and began research at St. Mary's under Sir Almroth Wright, a pioneer in vaccine therapy. He gained M.B., B.S., (London), with Gold Medal in 1908, and became a lecturer at St. Mary's until 1914. He served throughout World War I as a captain in the Army Medical Corps, being mentioned in dispatches, and in 1918 he returned to St.Mary's. He was elected Professor of the School in 1928 and Emeritus Professor of Bacteriology, University of London in 1948. He was elected Fellow of the Royal Society in 1943 and knighted in 1944.

Early in his medical life, Fleming became interested in the natural bacterial action of the blood and in antiseptics. He was able to continue his studies throughout his military career and on demobilization he settled to work on antibacterial substances which would not be toxic to animal tissues. In 1921, he discovered in "tissues and secretions" an important bacteriolytic substance which he named Lysozyme. About this time, he devised sensitivity titration methods and assays in human blood and other body fluids, which he subsequently used for the titration of penicillin. In 1928, while working on influenza virus, he observed that mould had developed accidently on a staphylococcus culture plate and that the mould had created a bacteria-free circle around itself. He was inspired to further experiment and he found that a mould culture prevented growth of staphylococci, even when diluted 800 times. He named the active substance penicillin.

Fleming, a Fellow of the Royal College of Surgeons (England), 1909, and a Fellow of the Royal College of Physicians (London), 1944, has gained many awards. They include Hunterian Professor (1919), Arris and Gale Lecturer (1929) and Honorary Gold Medal (1946) of the Royal College of Surgeons; Williams Julius Mickle Fellowship, University of London (1942); Charles Mickle Fellowship, University of Toronto (1944); John Scott Medal, City Guild of Philadelphia (1944); Cameron Prize, University of Edinburgh (1945); Moxon Medal, Royal College of Physicians (1945); Cutter Lecturer, Harvard University (1945); Albert Gold Medal, Royal Society of Arts (1946); Gold Medal, Royal Society of Medicine (1947); Medal for Merit, U.S.A. (1947); and the Grand Cross of Alphonse X the Wise, Spain (1948).

He served as President of the Society for General Micro-biology, he was a Member of the Pontifical Academy of Science and Honorary Member of almost all the medical and scientific societies of the world. He was Rector of Edinburgh University during 1951-1954, Freeman of many boroughs and cities and Honorary Chief Doy-gei-tau of the Kiowa tribe. He was also awarded doctorate, honoris causa, degrees of almost thirty European and American Universities.

In 1915, Fleming married Sarah Marion McElroy of Killala, Ireland, who died in 1949. Their son is a general medical practitioner. Fleming married again in 1953, his bride was Dr. Amalia Koutsouri-Voureka, a Greek colleague at St. Mary's. In his younger days he was a keen member of the Territorial Army and he served from 1900 to 1914 as a private in the London Scottish Regiment. Dr Fleming died on March 11th in 1955 and is buried in St. Paul's Cathedral.

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Work before penicillin

After the war Fleming actively searched for anti-bacterial agents, having witnessed the death of many soldiers from septicemia resulting from infected wounds. Antiseptics killed the patients' immunological defences more effectively than they killed the invading bacteria. In an article he submitted for the medical journal The Lancet during World War I, Fleming described an ingenious experiment, which he was able to conduct as a result of his own glass blowing skills, in which he explained why antiseptics were killing more soldiers than infection itself during World War I. Antiseptics worked well on the surface, but deep wounds tended to shelter anaerobic bacteria from the antiseptic agent, and antiseptics seemed to remove beneficial agents produced that protected the patients in these cases at least as well as they removed bacteria, and did nothing to remove the bacteria that were out of reach. Sir Almroth Wright strongly supported Fleming's findings, but despite this, most army physicians over the course of WWI continued to use antiseptics even in cases where this worsened the condition of the patients.

Accidental discovery

"When I woke up just after dawn on September 28, 1928, I certainly didn't plan to revolutionize all medicine by discovering the world's first antibiotic, or bacteria killer," Fleming would later say, "But I suppose that was exactly what I did".

By 1928, Fleming was investigating the properties of staphylococci. He was already well-known from his earlier work, and had developed a reputation as a brilliant researcher, but his laboratory was often untidy. On 3 September 1928, Fleming returned to his laboratory having spent August on holiday with his family. Before leaving he had stacked all his cultures of staphylococci on a bench in a corner of his laboratory. On returning, Fleming noticed that one culture was contaminated with a fungus, and that the colonies of staphylococci that had immediately surrounded it had been destroyed, whereas other colonies further away were normal. Fleming showed the contaminated culture to his former assistant Merlin Price who said "that's how you discovered lysozyme." Fleming identified the mould that had contaminated his culture plates as being from the Penicillium genus, and-after some months' of calling it "mould juice"- named the substance it released penicillin on 7 March 1929.

He investigated its positive anti-bacterial effect on many organisms, and noticed that it affected bacteria such as staphylococci, and many other Gram-positive pathogens that cause scarlet fever, pneumonia, meningitis and diphtheria, but not typhoid fever or paratyphoid fever-which are caused by Gram-negative bacteria-for which he was seeking a cure at the time. It also affected Neisseria gonorrhoeae, which causes gonorrhoea although this bacterium is Gram-negative.

Fleming published his discovery in 1929, in the British Journal of Experimental Pathology, but little attention was paid to his article. Fleming continued his investigations, but found that cultivating penicillium was quite difficult, and that after having grown the mould, it was even more difficult to isolate the antibiotic agent. Fleming's impression was that because of the problem of producing it in quantity, and because its action appeared to be rather slow, penicillin would not be important in treating infection. Fleming also became convinced that penicillin would not last long enough in the human body (in vivo) to kill bacteria effectively. Many clinical tests were inconclusive, probably because it had been used as a surface antiseptic. In the 1930s, Fleming's trials occasionally showed more promise, and he continued, until 1940, to try to interest a chemist skilled enough to further refine usable penicillin.

Fleming finally abandoned penicillin, and not long after Florey and Chain took up researching and mass producing it with funds from the U.S and British governments. They started mass production after the bombing of Pearl Harbor. When D-day arrived they had made enough penicillin to treat all the wounded allied forces.

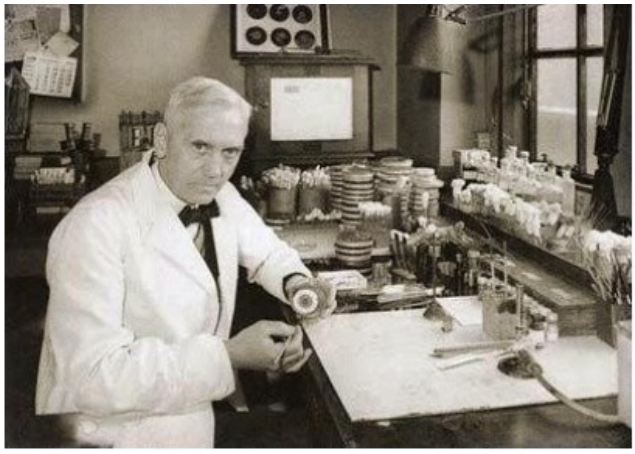
Purification and stabilization

Ernst Chain worked out how to isolate and concentrate penicillin. He also correctly theorized the structure of penicillin. Shortly after the team published its first results in 1940, Fleming telephoned Howard Florey, Chain's head of department to say that he would be visiting within the next few days. When Chain heard that he was coming he remarked "Good God! I thought he was dead". Norman Heatley suggested transferring the active ingredient of penicillin back into water by changing its acidity. This produced enough of the drug to begin testing on animals. There were many more people involved in the Oxford team, and at one point the entire Dunn School was involved in its production.

After the team had developed a method of purifying penicillin to an effective first stable form in 1940, several clinical trials ensued, and their amazing success inspired the team to develop methods for mass production and mass distribution in 1945. Fleming was modest about his part in the development of penicillin, describing his fame as the "Fleming Myth" and he praised Florey and Chain for transforming the laboratory curiosity into a practical drug. Fleming was the first to discover the properties of the active substance, giving him the privilege of naming it: penicillin. He also kept, grew and distributed the original

mould for twelve years, and continued until 1940 to try to get help from any chemist who had enough skill to make penicillin. Sir Henry Harris said in 1998: "Without Fleming, no Chain; without Chain, no Florey; without Florey, no Heatley; without Heatley, no penicillin."

Antibiotics



Modern antibiotics are tested using a method similar to Fleming's discovery. Fleming's accidental discovery and isolation of penicillin in September 1928 marks the start of modern antibiotics. Fleming also discovered very early that bacteria developed antibiotic resistance whenever too little penicillin was used or when it was used for too short a period. Almroth Wright had predicted antibiotic resistance even before it was noticed during experiments. Fleming cautioned about the use of penicillin in his many speeches around the world. He cautioned not to use penicillin unless there was a properly diagnosed reason for it to be used, and that if it were used, never to use too little, or for too short a period, since these are the circumstances under which bacterial resistance to antibiotics develops.

Honours, awards and achievements

His discovery of penicillin had changed the world of modern medicine by introducing the age of useful antibiotics; penicillin has saved, and is still saving, millions of people around the world. The laboratory at St Mary's Hospital, London where Fleming discovered penicillin is home to the Fleming Museum. There is also a school in the Lomita area named Alexander Fleming Middle School. The University of Westminster has named one of its student buildings located near Old Street in honour of Fleming and Imperial College also has a building named after him, the Sir Alexander Fleming Building. It is based in the South Kensington campus and is the site of much of the preclinical undergraduate medical teaching.

- Fleming, Florey and Chain jointly received the Nobel Prize in Medicine in 1945. According to the rules of the Nobel committee a maximum of three people may share the prize. Fleming's Nobel Prize medal was acquired by the National Museums of Scotland in 1989, and will be on display when the Royal Museum re-opens in 2011.
- Fleming was awarded the Hunterian Professorship by the Royal College of Surgeons of England
- Fleming and Florey were knighted in 1944.
- Florey went on to be elected President of the Royal Society in 1943 and received the greater honour of a peerage in 1965 for his monumental work in making penicillin available to the public and saving millions of lives in World War II, becoming a Baron.
- The discovery of penicillin was ranked as the most important discovery of the millennium when the year 2000 was approaching by at least three large Swedish magazines. It is impossible to know how many lives have been saved by this discovery, but some of these magazines placed their estimate near 200 million lives.
- A statue of Alexander Fleming stands outside the main bullring in Madrid, Plaza de Toros de Las Ventas. It was erected by subscription from grateful matadors, as penicillin greatly reduced the number of deaths in the bullring.
- In mid-2009, Fleming was commemorated on a new series of banknotes issued by the Clydesdale Bank; his image appears on the new issue of £5 notes.

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