

HISTORY OF MEDICINE

PART ONE

ALEXANDER FLEMING

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Editorial

Microbiology has had great influence on peoples' lives since its very beginning in the 17th century, starting with Anton van Leeuwenhoek who was the first man to ever use the microscope, confirming the theory of existence of microbes. Until then there were some thoughts about microorganisms, but those were only theories hypothesized in ancient India and Rome. In the medieval, during the Islamic golden age, it was also speculated that diseases come from germs or micro parasites. But the first confirmation of their existence is dated to year 1676 and the Dutch scientist Anton van Leeuwenhoek. From that moment microbiology has skyrocketed and became a large and popular field of study in biology, continuing to present days. This topic also came to great importance in medicine and in this edition of //jméno časáku// we are covering a break-through moment of microbiologic medicine, the discovery of penicillin.

Discovered in 1928 by Alexander Fleming, it is considered one of the most important discoveries in the field of medicine, also winning a Nobel Prize for him in 1945 (together with his colleagues Howard Florey and Ernst Boris Chain), penicillin was one of

the first cures against bacteria and the very first one without harmful side effects. He was interested in finding a cure against bacteria, for he encountered many wounded soldiers in World War I, who could have been helped immensely by such a discovery. Until then, antiseptics were used, but they also damaged the immunology of wounded people, making them ineffective. Thus came the research for penicillin.

After his work, what we call modern antibiotics started to be a growing interest of medicine. Besides creating a whole new field of biology, his greatest achievements were claiming the Nobel Prize in medicine, being a member of a Fellow of the Royal Society, being knighted and, more recently, he has been named for one of the 100 most important people of the 20th century by Time magazine in 1999.

In this edition of *HISTORY OF MEDICINE* we will give you a more detailed look on Alexander Fleming, his work and many other things about microbiology.

I hope you will enjoy this week with *HISTORY OF MEDICINE* and that you will enjoy reading with us.

Viktor Bobůrka

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PENICILLIN

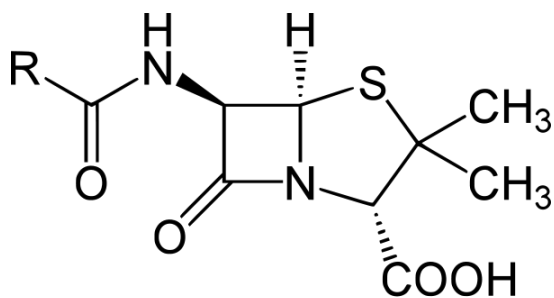
Do you know who discovered penicillin? When was it?

Penicillin is a group of antibiotics which include penicillin G (intravenous use), penicillin V (oral use), procaine penicillin, and benzathine penicillin (intramuscular use). They are derived from fungi of *Penicillium*. Penicillin antibiotics were among the first medications to be effective against many bacterial infections caused by staphylococci and streptococci. All penicillins are β -lactam antibiotics.

Penicillin was discovered in 1928 in England. People began using it to treat infections in 1942.

Chemical properties

Penicillin is chemically bicyclic organic acid of the formula $(\text{CH}_3)_2\text{CH}_2\text{NSO}(\text{COOH})\text{NHCOR}$ (wherein „R“ represents a functional radical). It is slightly soluble in water, more soluble in ethanol, ether, chloroform and organic solvents. Penicillin molecule essentially consisting of two coupled amino acid, cysteine and valine.



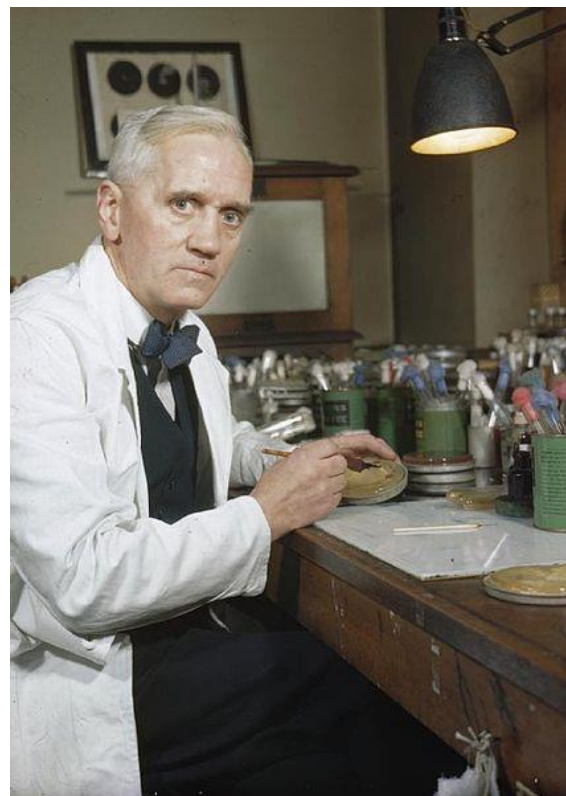
Chemical formula

Effects

Penicillins are bactericidal. They are highly efficient and have low toxicity. They are used mainly against gram-positive bacteria. But show also activity against certain Gram-negative bacteria, such as *Neisseria*, *Borrelia*, treponemes. Beta-lactam antibiotics, including penicillin generally inhibits the synthesis of bacterial cell walls, because they bind to certain major enzymes. Apparently also indirectly they activate autolysin enzymes that cause the cell death of bacteria.

History of research

The discovery of penicillin is attributed to Scottish scientist Alexander Fleming in 1928. He showed that, if *Penicillium* were grown in the appropriate substrate, it would exude a substance with antibiotic properties.



Synthetic Production of Penicillin

The development of penicillin for use as a medicine is attributed to the Australian Howard Walter Florey, together with the German Ernst Chain and the English biochemist Norman Heatley. Fleming recounted that the date of his discovery of penicillin was on the morning of Friday, September 28, 1928. The traditional version of this story describes the discovery as a fortuitous accident. In his

laboratory in the basement of St Mary's Hospital in London, Fleming noticed a Petri dish containing *Staphylococcus* which was contaminated by blue-green mould from an open window, which formed a visible growth. Fleming concluded that the mould released a substance that repressed the growth of the bacteria.

Ondřej Koloušek

FLEMING'S LIFE

Childhood and studies

Alexander Fleming was born in Scotland in August 1881. He was a penultimate son of the second wife of his father. He spent his childhood on a farm in the county of Ayrshire. He was the second youngest child in the family. He began studying in a small school which was attended by only fifteen students. He changed the school when he was ten years old. He started studying in a small nearby city called Darvel. During the study he broke his nose. After that he started studying at the Academy there, where he first encountered natural sciences.

In 1889 the Second Boer War started. Alexander and his brothers served in the army as volunteers. Fortunately, there were a lot of men and they didn't have to go to South Africa.

In his twenties he inherited 250£ from his uncle. He invested this money in his studies. He started studying at the Faculty of Medicine in the hospital Saint Mary. At that time every hospital had a faculty of medicine.

He was the best student in his class. Fleming did the final exams successfully in 1908 as the best student in the grade and he got a gold medal from the London University.

In 1906, Fleming started working in a bacteriological laboratory. He was chosen by the professor Freeman because he was a good

shooter and Freeman wanted to establish a shooting club.



Hospital Saint Mary

Service in France

He could not visit the London Regiment Scottish because he had to work in laboratory and he needed a lot of time. Fleming was summoned to France as a doctor in the First World War. He founded a research laboratory there. During the war, Alexander married a nurse. He met her during the treatment of soldiers.

The greatest discoveries and peaceful life

After the First World War, he returned to England. He continued his research in the hospital Saint Mary. In 1922, he discovered lysozyme. In 1928, he discovered penicillin. In 1943, Fleming was elected a member of the oldest and most esteemed Royal Society and he got a peerage. In 1945 he won the Nobel Prize.

Alexander Fleming died at his home on 11 March 1955 and was buried in St. Paul's Cathedral in London.



The Fleming's memorial

Tomáš Bláha

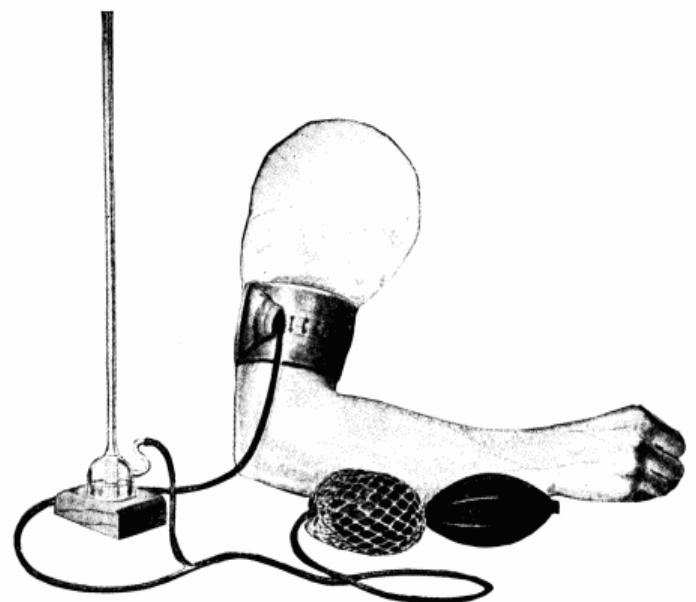
MEDICINE AT FLEMING'S TIME

In 19th century Medicine was already advanced science that overcomes the old superstitions and discovering new methods of treatment. In spite of that, at this time there are living conditions so dreadful that the mortality rates did not decline too much. This is mainly due to bad water, minimum of hygiene, poor quality of food, demanding work and subsequent exhaustion, people were dying at an early age and died of tuberculosis, diphtheria and whooping cough. Drugs were mainly natural.

At the beginning of the 20th century, we have finally begun to put emphasis on hygiene measures and disease prevention. Experts from various sectors have begun to work together to spurred the medicine forward and consequently enable the formation of important medical breakthroughs.

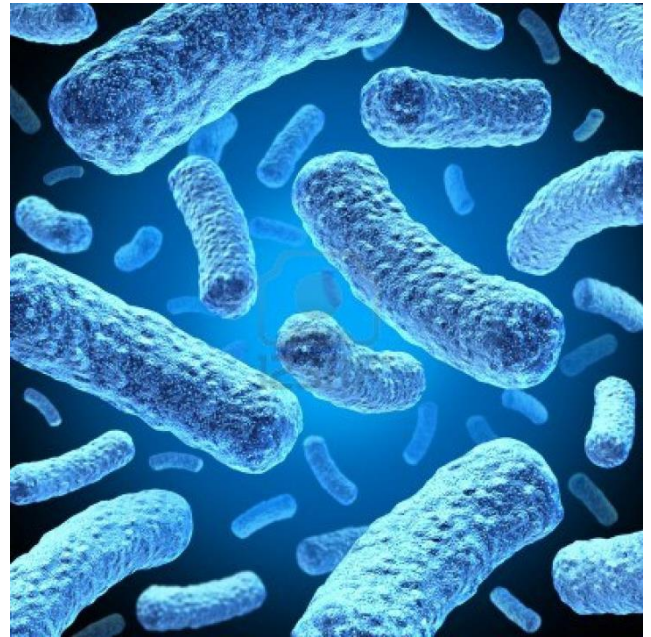
- 1819 French physician René Laennec invented the stethoscope and

described the pathological findings in tuberculosis



Method of taking blood pressure with a patient in sitting position

- 1844 American dentist Horace Wells was first who used nitrous oxide (laughing gas N_2O) for general anesthesia in dentistry
- 1846 British physician William Thomas Morton used ether for the narcosis
- 1847 British obstetrician Sir James Young Simpson used chloroform for the narcosis
- 1858 German pathologist Rudolf Ludwig Karl Virchow showed that diseases are caused by pathological changes of cells
- 1864 British surgeon Joseph Lister started the era of surgical operations carried out under aseptic conditions: He used to spray the surgical field with phenol.
- 1876 German bacteriologist Robert Koch proved that the origin of anthrax is an infectious microorganism (*Bacillus anthracis*)
- 1882 Koch discovered microorganism causing tuberculosis (*Mycobacterium tuberculosis*)
- 1885 French bacteriologist Louis Pasteur evolved and successfully used rabies vaccine
- 1894 Dutch physiologist William Einthoven constructed electrocardiograph
- 1896 Italian surgeon Scipione Riva-Rocci invented a sphygmomanometer to measure blood pressure
- 1900 Viennese doctor Karl Lindstein named three blood groups A, B and O.
- 1901 German physicist Wilhelm Conrad Roentgen discovered X-rays



Bacteria and bacterium cells floating in microscopic space

- 1910 German chemist and bacteriologist Paul Ehrlich discovered arsphenamin as a cure for syphilis - the first of a series chemoterapetik
- 1921 Canadian scientists have managed to isolate insulin from calf pancreas abdominal, which could be administered to diabetics
- 1950 (June 17) American surgeon R.H. Lower successfully transplant a kidney for first time
- 1951 Czech scientist Otto Wichterle developed a gel substance that is well tolerated by the eye. From it were produced in 1961 the first contact lenses

Did you know? From 1898 to 1910 was used heroin for treating children's coughs as a non-addictive substitute for morphine.

Marie Brabencová

OTHER RESEARCHERS FROM THE PERIOD OF ALEXANDER FLEMING

HOWARD FLOREY

Considered the most important Australian figure in medicine, Howard Florey is best known for working on the use of penicillin. His discoveries, along with Alexander Fleming and Ernst Chain, are estimated to have saved over 80 million lives. Strangely, when he was making penicillin work in practice, he never thought he did it to save peoples' lives. He considered it as "an interesting scientific exercise" and thought that it was not the reason why he worked on it.

He was the first to try out penicillin on patients and started out by a tragedy, because his first patient, although penicillin helped him greatly, died anyway, because there was not enough of the drug. From then on, he only tested on children, who didn't need doses as high as adults. Later on, he came up with industrialized mass-production of penicillin which helped to save millions of lives during World War II.

Besides winning a Nobel Prize, he was also elected a member of the Royal Society, and even got his portrait on Australian \$50 bank notes for more than 20 years after his death.

ERNST BORIS CHAIN

The last of the three colleagues to win the Nobel Prize for the discovery of penicillin, Ernst Boris Chain was a German from a Jewish family.

In 1933, he escaped Germany and moved to Britain where he worked as a PhD student in pathology, later as a professor. In 1939, he joined Howard Florey in his research of natural antibiotics. They decided to renew the work of Fleming and study penicillin from the point of view of chemistry, describing a way to produce it and to use it in medicine. He was one of the first biochemists in the world and also one of the most important ones for medicine.

LOUIS PASTEUR

Louis Pasteur, who studied chemistry, but his work consisted more of biology, became famous in 1856, proving that fermentation was a microbiological process, rather than a chemical one. Then again, it was not his most advancing discovery.

Today Pasteur is considered the father of immunology and vaccination, because he invented the method of vaccinating. He first tried the process on chicken, later on cattle, and ultimately, on humans. With this way of prevention, he fought against anthrax, rabies and, most importantly, smallpox, which is estimated to have killed 300-500 million, and thanks to Pasteur was eradicated in 1979.

His legacy continues today both within his method of vaccination and being recognized as a world-changing person for both his discoveries in chemistry and biology. He is even buried in the Cathedral of Notre Dame.

Viktor Bobůrka

SUDOKU

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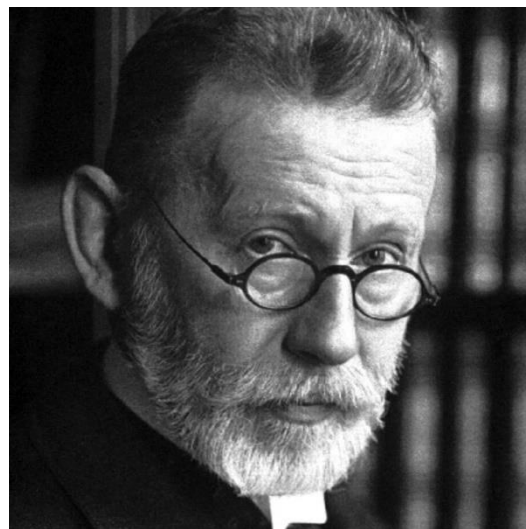
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Right solutions at next page...

In another part two of the magazine History of Medicine you will enjoy the article about Paul Ehrlich, who invented the precursor technique to Gram staining bacteria.



Paul Ehrlich

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RIGHT SOLUTIONS

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