



PENICILLIN



The Discovery of Penicillin

About Penicillin

Penicillin was the first antibiotic that was successfully used in treating bacterial infections. Before its development, many people suffered and died from bacterial infections that are no longer considered dangerous today. For instance, just hurting yourself on a nail could eventually lead to death.



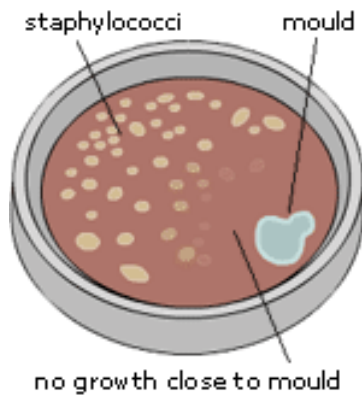
What is an Antibiotic?

"Anti" is a Greek word that means "against," and "bio" means "life." Put together that should mean "against life"! You might wonder: shouldn't it be "for life" or "pro life" instead? Good question.

When scientists came up with the word, what they meant was that an "antibiotic" is something that fights harmful life forms residing in animals or humans, namely bacteria. In fact, a commonly used definition of an antibacterial substance is "a substance produced by a microorganism which harms or kills another microorganism."

How Does an Antibiotic Work?

A bacterial infection is caused by millions of tiny bacteria that are trying to survive and multiply in the body system. An antibiotic attacks and kills these bacteria, or at least prevents them from multiplying.



Alexander Fleming and the Discovery of Penicillin

In 1928, Alexander Fleming was working at St. Mary's Hospital in London. He was researching agents that could be used to combat bacterial infections. One serious infection at that time was caused by staphylococci bacteria.

Once, when Fleming went on vacation, he left his culture plates unwashed. When he came back a few weeks later, he noticed that something had "grown" on one of the culture plates. It was mould, and the staphylococci were not growing around it! Apparently, the mould was secreting a substance which prevented these harmful bacteria from growing. Fleming named the substance "Penicillin" after the mould, "*Penicillium notatum*," that was found on the culture plate. He later did some experiments with penicillin, but was not able to purify it, and did not really realize its potential for treatment against infections.

Florey, Chain and the "Miracle Drug"

In one of the reports Fleming wrote on penicillin, he described the substance as very unstable. This was probably one of the factors that sparked the interest of a brilliant chemist, Ernest Chain, some ten years later. Chain, who was working with Howard Florey in Oxford, had started an investigation on antibacterial substances, with Florey's permission. Chain suggested, and Florey agreed, that they should take a closer look at penicillin. As the head of the Sir William Dunn School of Pathology, Florey had relatively large resources at his disposal. But at this point, penicillin was not a top priority project.

The amount of penicillin that Chain was able to produce on his own was much too little to have any effect on infected mice. But Chain decided to inject an extract of the mould culture he had grown into two mice, just to test the substance's toxicity. The mice were perfectly healthy before and after the experiment! Chain became very excited by this, and probably succeeded in arousing some enthusiasm in Florey, because it was at this point that Florey decided to give his full attention to penicillin.

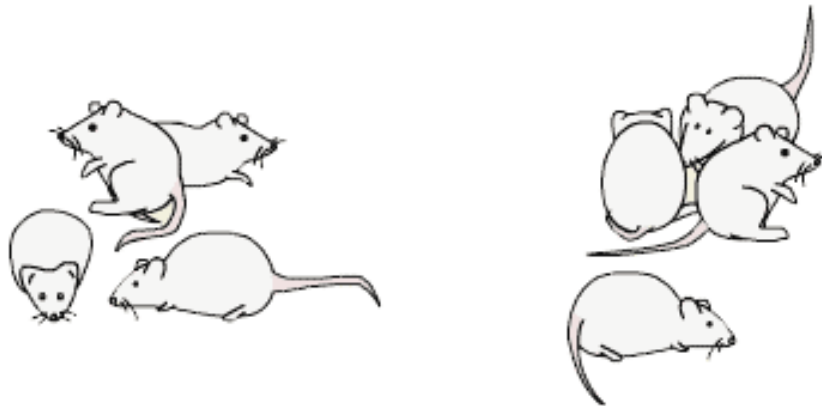
A research team was formed and started working to develop a sufficient amount of penicillin to be used in clinical tests. Florey was a very practical person and soon realized that a large cooperative effort would be required to achieve their goal. Florey also possessed an unusual amount of drive and energy, and became and remained the undisputed leader of the team.

Norman Heatley

To acquire enough penicillin for the treatment of even a few mice, technical inventions were needed. Up to this point, trays, tins and bottles were used in growing the mould for the production of penicillin. But Norman Heatley, a member of the team, made several technical inventions that made it possible to produce penicillin on a larger scale. Heatley made important contributions to the understanding of the purification process, and experimented with different methods of growing mould in various containers. After many tests, Heatley discovered that ordinary bedpans, which were borrowed from the Radcliff Infirmary, were the most efficient containers for growing penicillin!

"It's a Miracle!"

In May 1940, the team had been able to produce enough penicillin to test on infected animals for the first time. Here, streptococci, another kind of bacteria which can be harmful to humans, were used. Eight mice were infected with a deadly dose of 110 million bacteria each. One hour later, four of them were injected with penicillin and four mice were left without treatment.



Heatley watched and waited. In the late afternoon the four mice that hadn't been injected with penicillin started to show signs of illness and soon after midnight they started to die. At 3:30 in the morning all the untreated mice were dead.



The four mice treated with penicillin remained fine! When Howard Florey heard of the result the next day he exclaimed, "It looks like a miracle!" Since Howard Florey was a man known never to exaggerate, his words really showed what he felt about it.

Treating Patients

The mice experiment had undoubtedly been a great success, but to treat a human being, the amount of penicillin needed was about 3,000 times greater. England was at war, and even though Florey was the head of an important institution at Oxford, the team's financial resources were quite limited. Therefore, the team had to be very creative in producing all the needed penicillin. Heatley designed a container resembling a bedpan out of ceramic, which was more suited to their needs. 400 stackable containers were made where penicillin was grown.

Although the first patient treated with penicillin died due to a shortage of supply, further tests showed that the use of penicillin was successful for treating humans as well.

World War II

Florey tried to get British pharmaceutical companies interested in making penicillin. But he failed because of several factors, including the circumstances of the war.

In July 1941, Florey and Heatley flew to the USA on a mission to convince the medical industry there to start penicillin production. Florey, as usual, was very determined, and after several meetings, the project finally got started. One compelling reason was the attack on Pearl Harbor, after which the American government started encouraging medical companies to cooperate and speed up the production of penicillin. At the end of World War II, there was enough penicillin to treat all the wounded soldiers in the Allied Forces.

The Nobel Prize in Physiology or Medicine 1945

"for the discovery of penicillin and its curative effect in various infectious diseases"



Sir Alexander
Fleming



Ernst B. Chain



Sir Howard Florey

[Read more about the discovery of penicillin and the Nobel Laureates ▶▶](#)

[Play the The Discovery of the Penicillin Game ▶▶](#)

Published with
the support of



[CONTACT](#)

[RATE THIS](#)

[TELL A FRIEND](#)

[BACK TO TOP](#)

First published January 15, 2003
Last modified March 11, 2004

The Official Web Site of The Nobel Foundation
Copyright© 2004 The Nobel Foundation