

A report on penicillium, its benefits and global impact

[Science](#), [Biology](#)



There are around 99 thousand organisms that are known within the fungi kingdom, such as mould, rust and mushrooms. Some fungi are found living freely in either water or soil, while others choose to form parasitic relationships with animals or plants. There are large amounts of fungi absolutely everywhere. They can be found in the air, soil, lakes, seas, rivers, animals, plants, clothing, food and even the human body. Alongside bacteria, fungi break down organic matter and release carbon, oxygen, nitrogen, and phosphorus into the soil and the atmosphere.

Fungi are needed in a large amount of household and industrial processes, notably the making of wine, bread, beer, and some cheeses. Fungi can even be used as food; for example, some truffles, morels, and mushrooms are world-renowned delicacies, and mycoproteins (fungal proteins), obtained from the mycelia of certain types of fungi, which is used to create foods high in protein. Fungi are of great importance within medical and environmental fields. One in particular is responsible for saving countless lives. There are several species belonging to penicillium, a genus of green or blue mold fungi, that are used in penicillin, the first ever antibiotic, a medicine that stops the growth of or destroys microorganisms. I will be focusing on *Penicillium chrysogenum* (also known as *Penicillium notatum*), the main source of penicillin.

In 1928, the Scottish bacteriologist, alexander fleming, was rummaging some old bacterial plates, to wash up his work a small amount, when he discovered this mouldy plate. He was about to toss it into the bin when he detected one thing uncommon. Round the colony of mold, the bacteria,

Staphylococcus aureus, a bacteria that causes a wide range of illnesses, weren't growing as well. It seems that it had been releasing a compound that might kill bacteria in an attempt to own extra space to grow and additional nutrients to itself. When a microorganism produces a substance which will kill alternative microorganisms, it's referred to as antibiosis. The antibiotic-producing mold was identified as a member of the genus penicillium, and its antibacterial compound was eventually isolated and named penicillin. Within the early Nineteen Forties, Howard Florey and Ernst Chain carried out the first clinical trials of penicillin, just in time for the drug to be used on wounded troopers within the final stages of World War II. From that point forward, antibiotics have created a large impact on human history and drastically reduced the infectious disease burden within the world. Drugs within the antibiotic category work by indirectly bursting bacterial cell walls. They do this by acting directly on peptidoglycans, almost like the backbone of the cell wall, providing structure to the cell.

Peptidoglycans produce a mesh-like structure around the plasma membrane of bacterial cells, that will increase the strength of the cell walls and prevents external fluids and particles from coming into the cell. When a bacterium multiplies, tiny holes open up in its cell walls as the cells divide. Newly-produced peptidoglycans then go onto fill in these holes to recreate the walls. Penicillins block the protein struts that link the peptidoglycans together. This prevents the bacterium from closing the holes in its cell walls. As the water concentration of the encompassing fluid is higher than within the bacterium, water rushes through the holes into the cell and the

bacterium bursts. Penicillin has had huge impacts on the economy. A 2011 US Census showed that for every 1, 000 people, about 5. 5 people die due to illnesses. This is a significant difference when compared to 200 per 1, 000 in 1918. People who were sick or dying due to bacterial infections were becoming a major loss to the global workforce. Penicillin managed to shorten the duration of such diseases. Death rates worldwide started to decline. This helped the economy in many ways. For example, health care costs were reduced, which allowed workers to get back to work faster, and early retirements due to diseases could be avoided. As well as this, because of Penicillin's effect on certain bacteria, people lived longer lives, and could contribute (work) to the economy for longer. People working longer equates to earning more money, which allows them to spend more money. Earning and spending more money in turn grows the economy.

Penicillin along with other antibiotics has also become a big part of the global economy. One example being Americans citizens spend a whopping 300 billion dollars on antibiotics every year. A huge drawback to Penicillin is that it is not available for everyone simply because it costs money. Penicillin is, in fact, rarely available in developing countries like Nigeria and Namibia, and cost 12-30 US Dollars. In areas that have a GDP per capita of just 500 US Dollars, 12-30 dollars is certainly a lot of money. Because of this, there are many people in developing countries not able to obtain penicillin, thus leaving many uncured of bacterial infections or animal bites. Penicillin has also become a big expenditure for governments to produce all over the

world. The EU alone spends close to 300 million Euros funding projects that manufacture penicillin.

Penicillin has vastly improved humans overall quality of life as well as saving countless lives too. This is because penicillin manages to treat a large variety of infections. Antibiotics have forever changed medicine, but their impact on the environment is now starting to become a big concern. The effects of antibiotic residues entering the environment is starting to get worrying.

Pharmaceutical industry wastewater, antibiotics that have been unused and not disposed of correctly as well as non-metabolised antibiotics excreted by humans could all enter the sewage system at very low concentrations. Due to plants that treat sewage rarely being equipped to remove or even detect these drugs from wastewater, antibiotics may be released into the water system where they can then enter the environment and, ultimately, the drinking water supply. A variety of prescription and over-the-counter drugs have been detected in the water supplies of at least 41 million Americans throughout the United States.

Veterinary antibiotics that are used in livestock are another huge source of contamination. Agricultural waste such as manure and water runoff (water, from rain, snowmelt, or other sources, that flows over the land surface,) can carry antibiotics into the soil and groundwater. With all that said, it is still too early to say what could happen and the effects of antibiotics on the environment are still poorly understood. A larger issue at hand is antibiotic resistance. The use of antibiotics and continued to increase rapidly over the past few decades, as shown when the guardians reports that “ Calls to rein in

antibiotic use after study shows 65% increase worldwide, ". With penicillin and other antibiotics becoming cheaper and more available all the time, developing countries are getting access to antibiotics and starting to use them. This is the main cause for the increase of antibiotic use. This leads to a major concern being the development of antibiotic-resistant strains of bacteria that can critically disturb natural bacterial ecosystems and lead to a serious threat to human health. Antibiotic resistance is increasing to hazardously high levels in all areas of the globe. New resistance mechanisms are springing up and spreading globally, threatening our ability to treat common infectious diseases. A growing list of infections - like respiratory disease, tuberculosis, blood poisoning, gonorrhoea, and foodborne diseases - are getting more durable, and typically not possible, to treat as antibiotics become less effective. Where antibiotics may be bought for human or animal use without a prescription, the emergence and spread of resistance is made worse. Similarly, in countries that lack standard treatment guidelines, antibiotics are usually over-prescribed by medical examiners and veterinarians and over-used by the general public. If we don't act soon, we are heading towards a post-antibiotic era, during which common infections and minor injuries will once again kill.

Based on the information I have gathered, I have made an informed decision that Penicillium benefits far outweigh the cons, for now. Penicillin has not only saved many lives but even improved the economy. It has made our lives much easier and manageable while also increasing our life span, and has been doing this since its discovery 90 years ago. However, the reason I say

for now is antibiotic resistance is starting to become a serious concern. It is constantly becoming harder to treat infectious diseases and this is expected to become increasingly harder as the use of penicillin continues to skyrocket upwards. As well as this, antibiotic resistance leads to higher medical costs, prolonged hospital stays, and increased mortality. For the time being we still don't quite understand antibiotic resistance and it has yet to have a huge impact on our lives so that does not take away from the extraordinary amount of good penicillin has done for us. Penicillin has been one of the most important discoveries in all of medicine and to put it into perspective, penicillin has saved approximately 200 million lives. That's 50 times over. 200... million.