OPEN ACCESS Freely available online

ISSN: 2167-1052
Advances in Pharmacoepidemiology and Drug Safety

Opinion Article

Penicillin Antibiotics: From Discovery to Future Perspectives

Li Jia*

Department of Engineering and Health, University of Southern Queensland, Queensland, Australia

DESCRIPTION

Penicillin, the first widely used antibiotic, revolutionized the field of medicine and saved countless lives since its discovery in 1928. This remarkable discovery was made by Scottish biologist Alexander Fleming, who observed the growth of a mold that produced a substance capable of killing bacteria. This chance observation laid the foundation for the development of penicillin, which has played a pivotal role in combating infectious diseases.

The discovery of penicillin can be traced back to September 1928 when Alexander Fleming, while working at St. Mary's Hospital in London, noticed a Petri dish contaminated with a mold called *Penicillium notatum*.

Around the mold, he observed a clear zone where bacterial growth was inhibited, indicating that the mold produced a substance with antimicrobial properties. Fleming named this substance "penicillin."

However, it was not until the 1940s that penicillin was successfully isolated and mass-produced for medical use by a team of scientists led by Howard Florey and Ernst Chain. Penicillin belongs to a class of antibiotics known as beta-lactams, which disrupt the synthesis of the bacterial cell wall. Bacterial cell walls consist of peptidoglycan, a complex structure that provides structural integrity.

Penicillin targets the enzymes involved in cross-linking the peptidoglycan chains, known as penicillin-binding proteins (PBPs).

By binding irreversibly to PBPs, penicillin prevents the cross-linking process, weakening the bacterial cell wall. As a result, bacteria become susceptible to osmotic pressure and ultimately burst, leading to cell death. The specificity of penicillin for PBPs and its low toxicity to human cells make it a highly effective and safe antibiotic.

Production of penicillin

The production of penicillin involves a complex and intricate process. Initially, the penicillin mold is cultivated in a nutrient-rich medium under controlled conditions. Fermentation tanks are used for large-scale production, where the mold is grown in a submerged culture. As the mold grows, it secretes penicillin into the culture medium. After a suitable period of growth, the culture is harvested, and the penicillin is extracted and purified using various techniques, including filtration, extraction, and chromatography. The purified penicillin is then formulated into different pharmaceutical preparations for administration.

Medical applications of penicillin

Penicillin has been a cornerstone in the treatment of various bacterial infections. It is highly effective against a wide range of Gram-positive bacteria, including *Streptococcus pneumoniae*, *Staphylococcus aureus*, and Group A *Streptococcus*. Penicillin has been instrumental in the management of infections such as pneumonia, meningitis, endocarditis, and skin and soft tissue infections. Over the years, different derivatives of penicillin, such as amoxicillin and ampicillin, have been developed to broaden the spectrum of activity and enhance stability against enzymes that can inactivate penicillin. Despite its remarkable success, the emergence of antibiotic resistance poses a significant challenge to the effectiveness of penicillin and other antibiotics. Bacteria can develop resistance through mechanisms such as the production of beta-lactamase enzymes that inactivate penicillin or alterations in the structure of PBPs, preventing penicillin from binding effectively. Penicillin is used to prevent recurrent episodes of rheumatic fever, a complication of untreated streptococcal infections. Regular penicillin injections or oral antibiotics can prevent the progression of rheumatic fever and its associated heart damage. Penicillin is frequently used in the treatment of infective endocarditis, an infection of the heart valves or inner lining of the heart. It is often administered intravenously for an extended period, sometimes in combination with other antibiotics.

Correspondence to: Li Jia, Department of Engineering and Health, University of Southern Queensland, Queensland, Australia E-mail: li.jia@gmail.com

Received: 10-May-2023, Manuscript No. PDS-23-21745; **Editor assigned:** 15-May-2023, Pre QC No. PDS-23-21745 (PQ); **Reviewed:** 29-May-2023, QC No. PDS-23-21745; **Revised:** 06-Jun-2023, Manuscript No PDS-23-21745 (R); **Published:** 13-Jun-2023, DOI: 10.35248/2167-1052.23.12.315

Citation: Jia L(2023) Penicillin Antibiotics: From Discovery to Future Perspectives. Adv Pharmacoepidemiol Drug Saf. 12:315.