

APPLIED MICROBIOLOGY

Microbial Production of Antibiotics

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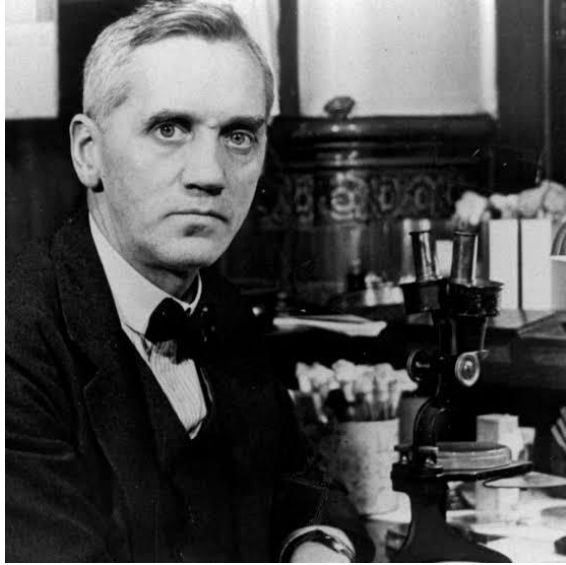
Antibiotics

Antibiotics are substances that **kill or inhibit the growth of bacteria.**

Antibiotics are **secondary metabolites** produced from microorganisms.

Antibiotic producing microorganisms are cultured in large fermenters in liquid culture medium.

The first antibiotic discovered was Penicillin



Penicillin was discovered by **Alexander Fleming** (1929).

Penicillium notatum had grown as a contaminant on an agar plate streaked with the bacterium *Staphylococcus aureus* and was lysing the bacteria.

Penicillin was effective against many Gram positive bacteria.

Penicillin : The wonder Drug

Howard Florey and Ernst Chain shared the 1945 Nobel Prize in Medicine with Alexander Fleming for their role in creating the first mass-produced antibiotic.

Penicillin became the "**wonder drug**" which saved literally millions of lives.

Antibiotics

Penicillin- *Penicillium notatum*, *Penicillium chrysogenum*

Ampicillin - *semisynthetic penicillin*

(active against cocci & some anaerobic bacilli)

Selman Waksman: Father of antibiotics



Graduate student Albert Schatz, left, and Selman Waksman in the laboratory in 1943.

Photo:Rutgers University archives

Selman Waksman won the Nobel Prize in physiology or medicine in 1952 “for his discovery of **streptomycin**.”

Streptomycin was the first antibiotic effective against **tuberculosis**.

Father of Antibiotics

The word '**antibiotics**' was first used by **Selman Waksman**, who discovered over 20 antibiotics.

This distinction earned him the title of “**Father of Antibiotics**”

Antibiotics

Streptomycin- *Streptomyces griseus* (Actinomycete)

(Active against acid fast and Gram -ve bacteria)

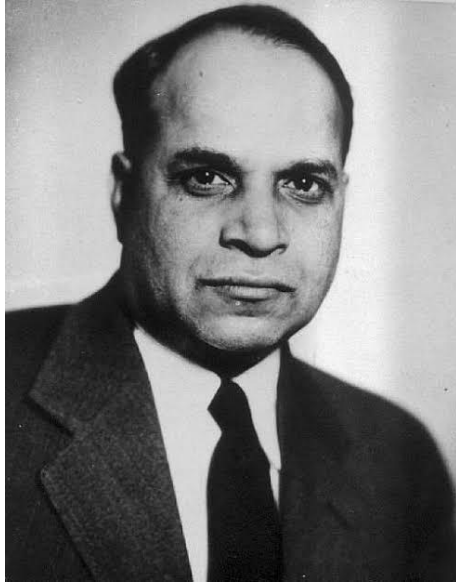
Variants of streptomycin are

Gentamicin- (active against some strains of *Pseudomonas*)

Neomycin- (used as ointments against skin & eye infections)

Kanamycin- (used to treat tuberculosis)

Antibiotics



Yellapragada Subbarao



Benjamin Duggar

Under Yellapragada Subbarao, Benjamin Duggar made his discovery of the world's first tetracycline antibiotic, chlortetracycline, in 1945.

Antibiotics

Tetracyclines (broad spectrum antibiotics) -*Streptomyces aureofaciens*

(Used for the treatment of infections caused by many Gram-ve & some Gram +ve bacteria).

Chlortetracycline is used to treat bacterial pneumonia, pertussis, scarlet fever, anthrax & other bacterial diseases).

Antibiotics

Chloromycetin (Chloramphenicol)- *Streptomyces venezuelae*

(active against Gram+ve & Gram-ve bacteria, used to treat typhoid, paratyphoid fevers, dysentery, trachoma etc.)

Erythromycin- *Streptomyces erythreus*

(effective against pneumonia, tonsillitis, sepsis, wound infections & diphtheria)

Antibiotics

Polymyxin- *Bacillus polymyxa*

(Used to treat meningitis, infections of air passages & urinary tract)

Bacitracin- *Bacillus subtilis*

(Bacitracin in combination with other antibiotics are used for prophylaxis and treatment of surgical infections)

Antibiotics

Cephalosporins (*Beta lactam group of antibiotics*)- *Cephalosporium acremonium*

(*active against typhoid,urinary and respiratory tract infections active against Gram ‘ +ve’ & Gram ‘-ve’ bacteria*).

Griseofulvin (a phenolic benzofuran cyclohexane)- produced from mutant strain of *Penicillium patulum*

(Griseofulvin has no antibacterial activity but is highly active against fungi, used in the treatment of superficial fungal infections of skin such as ringworms).

Antibiotic production

Antibiotics are produced by the process of **microbial fermentation**. The antibiotic producing microorganism is cultured in large fermenters (bioreactors) in a liquid culture medium.