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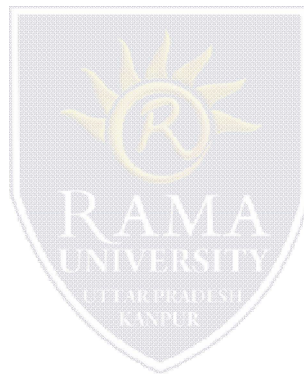
FACULTY OF ENGINEERING & TECHNOLOGY  
DEPARTMENT OF BIOTECHNOLOGY


## Microbial control: Antibiotics and chemotherapy

Microbial growth can be controlled by creating conditions unsuitable for bacteria. These conditions can be created by several means.

These means can be broadly classified into two types:

- ❖ Physical control
- ❖ Chemical control





**Physical control:** Heat and other physical agents are normally used to control microbial growth and sterilize objects. The four most frequently employed physical agents are heat (Dry heat and moist heat, incineration), low temperatures, filtration (using several membrane filters), and radiation (UV rays and  $\gamma$  rays).

**Chemical control:** Using various synthetic chemicals for killing or restricting the growth of bacteria. Chemicals are more often employed in disinfection and antisepsis.

**Antibiotics:** Antibiotics are certain chemicals or biochemicals that are used to either kill bacteria or slow down the growth of bacteria. Antibiotics are usually microbial products or their derivatives.

**Antimicrobial chemotherapy:** Chemical agents that are used to treat disease by killing disease causing microbes.

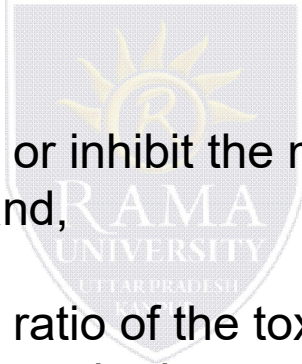
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## Antimicrobial agent

The drug used to prevent the pathogenicity of microorganism is called an

**antimicrobial agent.** Antimicrobial agents are used to prevent infections and diseases caused by pathogens. The effectiveness of chemotherapeutic agent is measured by two parameters:

- (1) **selective toxicity:** it must kill or inhibit the microbial pathogen while damaging the host as little as possible and,
- (2) **The therapeutic index** is the ratio of the toxic dose to the therapeutic dose. The larger the therapeutic index, the better the chemotherapeutic agent (all other things being equal)



Different types of antimicrobial drugs are commonly available.  
These are as follows:

**Antibacterial drug:** A drug which is used to inhibit the pathogenic activity of bacteria is called as antibacterial drugs. Example: Zithromax.

**Antifungal drug:** A drug which is used to prevent the fungal activity in the host is called an antifungal drug. Example: Miconazole

**Antiviral agent:** A drug which is used to stop the pathogenic action of a virus is called as antiviral agents. Example: Tamiflu.

**Antiparasitic drug:** A drug which is used to prevent the growth of pathogenic parasites. Example: Anthelmintics

## Antibiotics

- ❖ Antibiotics are the substances which are derived from one microorganism in order to kill another microorganism.
- ❖ Antibiotics are effective against bacterial, fungal and parasitic infections.
- ❖ But, antibiotics are not helpful against viral infections.
- ❖ The development of chemical synthesis has helped to produce the synthetic components which act as an antimicrobial agent against the pathogenic bacteria.
- ❖ These synthetic components are also called as antibiotics. Pathogenic bacteria can be killed by synthetic components at low concentrations. Examples: Ampicillin and amoxicillin.

In 1908, a German bacteriologist, Paul Ehrlich had developed a synthetic component from an arsenic-based structure for the treatment of syphilis, which is called as arsphenamine or salvarsan.


Then, in 1929, Alexander Fleming discovered Penicillin from the fungus *Penicillium notatum*.

Penicillin is used to treat different type of bacterial infections.

Two types of antibiotics are commonly available. These are as follows:

**Bactericidal antibiotics** –These antibiotics are have killing effects on bacteria. Example: Penicillin, Aminoglycosides, Ofloxacin.

**Bacteriostatic antibiotics:** These antibiotics have an inhibitory effect on bacteria. Example: Erythromycin, Tetracycline, Chloramphenicol.

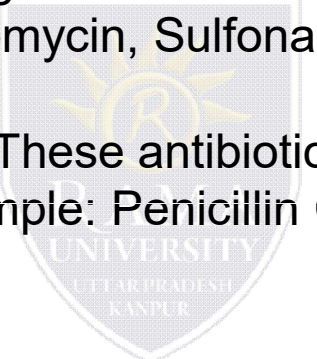


Depends on the spectrum of action, antibiotics are further classified into three types. These are as follows:

**Broad-spectrum antibiotics:** These antibiotics are widely used to kill or inhibit the Gram-positive and Gram-negative bacteria. Example: Chloramphenicol, Ampicillin, Ciprofloxacin, Streptomycin, Sulfonamide

**Narrow spectrum antibiotics:** These antibiotics are widely effective against specific groups of bacteria. Example: Penicillin G, Bacitracin, Clindamycin, Vancomycin

**Limited spectrum antibiotics:** These antibiotics are effective against a single organism or a single disease. Example: Dysidazine.



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## Measuring the effectiveness of chemotherapeutic agent towards microbes

Some idea of the effectiveness of a chemotherapeutic agent against a pathogen can be obtained from the **minimal inhibitory concentration (MIC)**.

The MIC is the lowest concentration of a drug that prevents growth of a particular pathogen.

The **minimal lethal concentration (MLC)** is the lowest drug concentration that kills the pathogen.

A cidal drug kills pathogens at levels only two to four times the MIC, whereas a static agent kills at much higher concentrations.