

Control of Microorganisms and Antimicrobial Chemotherapy

1. Define:

Bactericidal – A cidal treatment is one designed to kill the cells or organisms present, and an agent that is bactericidal is one expected to kill bacteria. Other examples of cidal substances include insecticides, herbicides and fungicides.

Disinfectant – A disinfectant is a chemical substance used to kill or inhibit the growth of pathogenic microorganisms on non-living surfaces. Disinfectants are often significantly more toxic than antiseptics because they are not designed for use on living surfaces. The disinfectant used in the laboratory is applied to bench surfaces on a regular basis.

Antibiotic – An antibiotic is a type of antimicrobial agent, i.e., a chemical designed for systemic application (for use inside the body), and expected to kill or inhibit the growth of pathogenic microorganisms, especially bacteria. Antibiotics differ from other antimicrobial agents in that they are initially produced by some type of living organisms; usually fungi or bacteria (e.g., Penicillin and Streptomycin).

Penicillinase – A Penicillinase is a specific type of beta-lactamase enzyme that degrades Penicillins and allows organisms producing the enzymes to be drug-resistant (Penicillin-resistant). Like other β -lactamase enzymes, Penicillinases break β -lactam rings, rendering antibiotics with this molecular structure inactive. These enzymes are usually secreted into the environment by drug resistant cells.

Aminoglycoside – Aminoglycosides are antibiotics produced by bacteria in the genera *Streptomyces* (Streptomycin, Neomycin, Kanamycin, Tobramycin, etc.), and *Micromonospora* (Gentamicin, Netilmicin, Amikacin, etc.). They are bactericidal and kill bacteria by binding permanently to the 30S subunits of ribosomes and inhibiting protein synthesis. Some can also disrupt the integrity of cellular membranes.

2. Cidal/sterilized
3. Sterilized
4. Static/ freezing (Filtration can also be considered as static.)
5. These processes will kill most vegetative cells, but will not kill hyperthermophiles (stearothermophiles) or the endospores formed by such bacteria. If any cells remain viable within a sample of liquid, that liquid cannot be considered sterile.
6. Tyndallization/ autoclave/ bacteristatic
7. Ionizing radiation (x-ray or gamma ray)/ poses a hazard to individuals that must apply it.
8. Filtration
9. Disinfectants/ antimicrobial

10. Effective within a reasonable time period/ biodegradable
11. If the chemical was going to be effective in controlling the pathogens present. If or not the chemical might be hazardous to handle, apply or come in contact with. If the chemical was likely to damage the surface or material it was being used on. If the chemical might accumulate in the environment and cause toxic side effects.
12. Disinfectant
13. Antiseptic/ disinfectant
14. Matching letter sequence is - G, I, K, B, J, C, F, E, D, A
15. Surfactants/ halogens
16. Antimicrobial/ antibiotics
17. *Streptomyces*, *Bacillus*, *Pseudomonas*, *Paenibacillus*, *Micromonospora*, and others.
18. Therapeutic/ If present in too low a concentration, the drug will not be effective in controlling the pathogens. If present in too high a concentration, the drug may cause toxic side effects that damage host cells, tissues, or organs.
19. Narrow spectrum
20. Differential toxicity/ broad spectrum/ A broad spectrum drug will kill many of the bacteria making up the normal microbiota (flora). These bacteria play an important role in defending the body against potential pathogens, and their removal will have a negative impact on immune function. Antimicrobial drugs can also damage mitochondria.
21. Acting as competitive inhibitors of an enzymatic pathway essential for prokaryotic cell growth (the conversion of para-aminobenzoic acid or PABA into folic acid).
22. Sulfa drugs/ para-aminobenzoic acid (PABA) into folic acid
23. Penicillins and Cephalosporins (beta-lactam antibiotics)/ inhibiting protein synthesis
24. Peptidoglycan cell walls/ differential toxicity
25. Inhibit the formation of peptidoglycan, a component necessary to cell wall synthesis./ penicillinase or beta-lactamase
26. Aminoglycosides/ Tetracyclines
27. Tetracyclines and aminoglycosides/ cell membrane
28. Tetracyclines/ static/ If these drugs remain within the body for an extended period of time (the recommended treatment period) they can prevent the bacteria from reproducing and give the body a chance to eliminate them. Human WBCs such as monocytes and neutrophils will eliminate bacteria over time if the bacteria cannot reproduce rapidly.

29. Binding permanently to ribosomes and blocking translation/ *Streptomyces*
30. *Paenibacillus*/ acting on cell membranes (increasing their permeability) and by interfering with the function of the outer membrane of the cell wall.
31. Messenger-RNA (m-RNA) synthesis (nucleic acid synthesis)
32. Rifampin and Actinomycin D
33. If these recommendations are not followed, the concentration of the drug within the body or the length of time the drug is present will not be sufficient to control the pathogens. If the pathogen population is continually exposed to low concentrations of antimicrobial drugs, any drug resistant mutants will be selected for, i.e., if such mutants arise within the population, their competition will be reduced and they will grow more readily. This could ultimately lead to the development of pathogenic strains that are entirely drug resistant.
34. Most antimicrobial drugs are not effective against viruses because their mechanisms of action involve components that viruses do not have (e.g., cell walls, cell membranes, enzymatic pathways and ribosomes).