علم الأحياء الدقيقة

Microbiology

Introduction to Bacteriology

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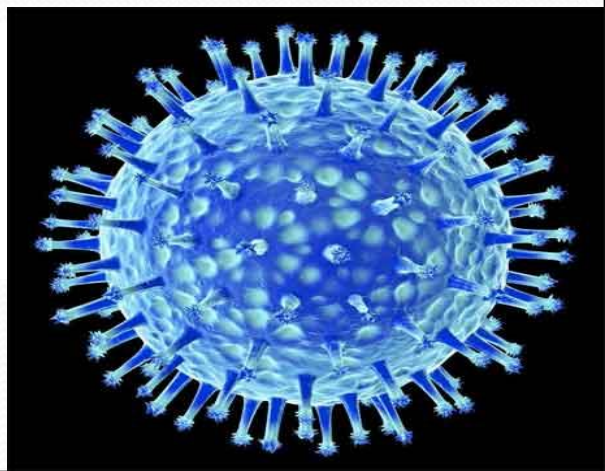
مكتب ٢ ب ٤٥



Factors affecting bacterial growth

- Many factors affect the generation time of the bacterium:
    - Temperature.
    - pH.
    - Oxygen.
    - Nutrient.
    - Salt concentration.
- Most bacteria grow best when these parameters are optimum.

Mode of living in Bacteria

- If we consider the mode of nutrition, bacteria can be divided into two categories:

- **Autotrophic**. They can build up complex organic substances such as carbohydrates from simple inorganic sources (CO_2 and water).

- **Heterotrophic**. They cannot build up carbohydrates from simple inorganic sources. They depend on ready made organic materials derived from plants , animals of humans. They can live on such compounds , break it down , enzymatically.

Mode of living in Bacteria

- Heterotrophic Bacteria:

- Parasites on plants, animals and humans causing serious diseases.

- Saprophytes on dead organic matter.

- Symbionts with other living organisms sharing benefits.

Salinity

- **Halophile:** organisms that grow well in high salt concentrations.
- Halophiles are categorized as slight, moderate, or extreme.
- **Slight halophiles**- 1.7 to 4.8%.
- **Moderate halophiles** -4.7 to 20%.
- **Extreme halophiles**- 20 to 30%.
- **Halotolerant** organisms-can grow under saline conditions but do not require it.

Controlling of Microbial Growth

- The control of microbial growth is necessary in many practical situations, and significant advances in agriculture, medicine, and food science .
- Control of microbial growth means to inhibit or prevent growth of microorganisms.
- This control is affected in two basic ways:

By **killing** microorganisms

Agents which kill cells are called **cidal** agents

Inhibiting the growth of microorganisms

Agents which inhibit the growth are called **static** agent

Controlling of Microbial Growth

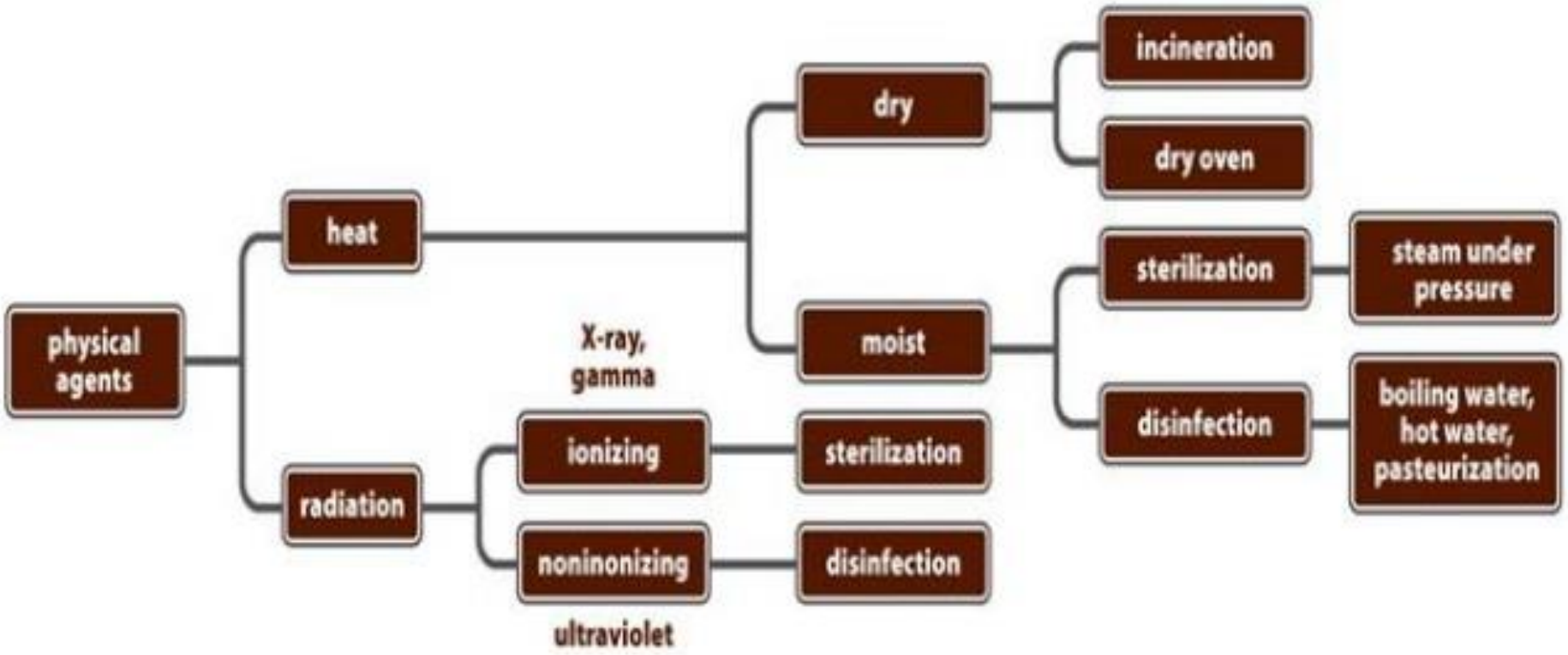
Table 7.1 Terminology Relating to the Control of Microbial Growth

	Definition	Comments
Sterilization	Destruction or removal of all forms of microbial life, including endospores but with the possible exception of prions.	Usually done by steam under pressure or a sterilizing gas, such as ethylene oxide.
Commercial Sterilization	Sufficient heat treatment to kill endospores of *Clostridium botulinum* in canned food.	More-resistant endospores of thermophilic bacteria may survive, but they will not germinate and grow under normal storage conditions.
Disinfection	Destruction of vegetative pathogens.	May make use of physical or chemical methods.
Antisepsis	Destruction of vegetative pathogens on living tissue.	Treatment is almost always by chemical antimicrobials.
Degerming	Removal of microbes from a limited area, such as the skin around an injection site.	Mostly a mechanical removal by an alcohol-soaked swab.
Sanitization	Treatment intended to lower microbial counts on eating and drinking utensils to safe public health levels.	May be done with high-temperature washing or by dipping into a chemical disinfectant.

Methods For Controlling Microbial Growth

There are **three major methods** for controlling microbial growth

- **Physical**
- **Mechanical**
- **Chemical**

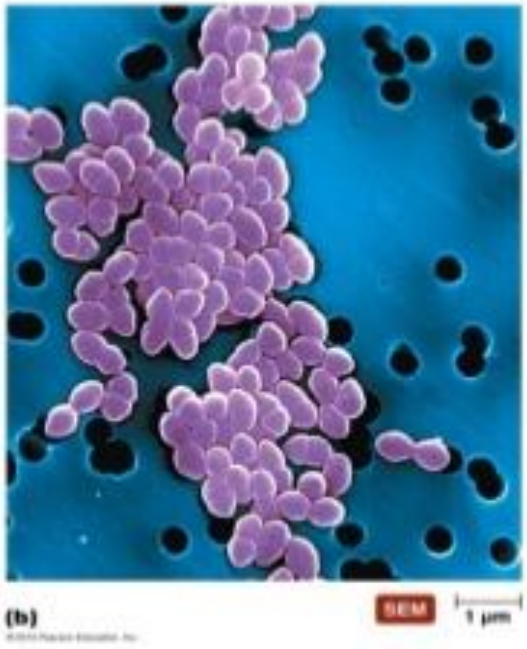


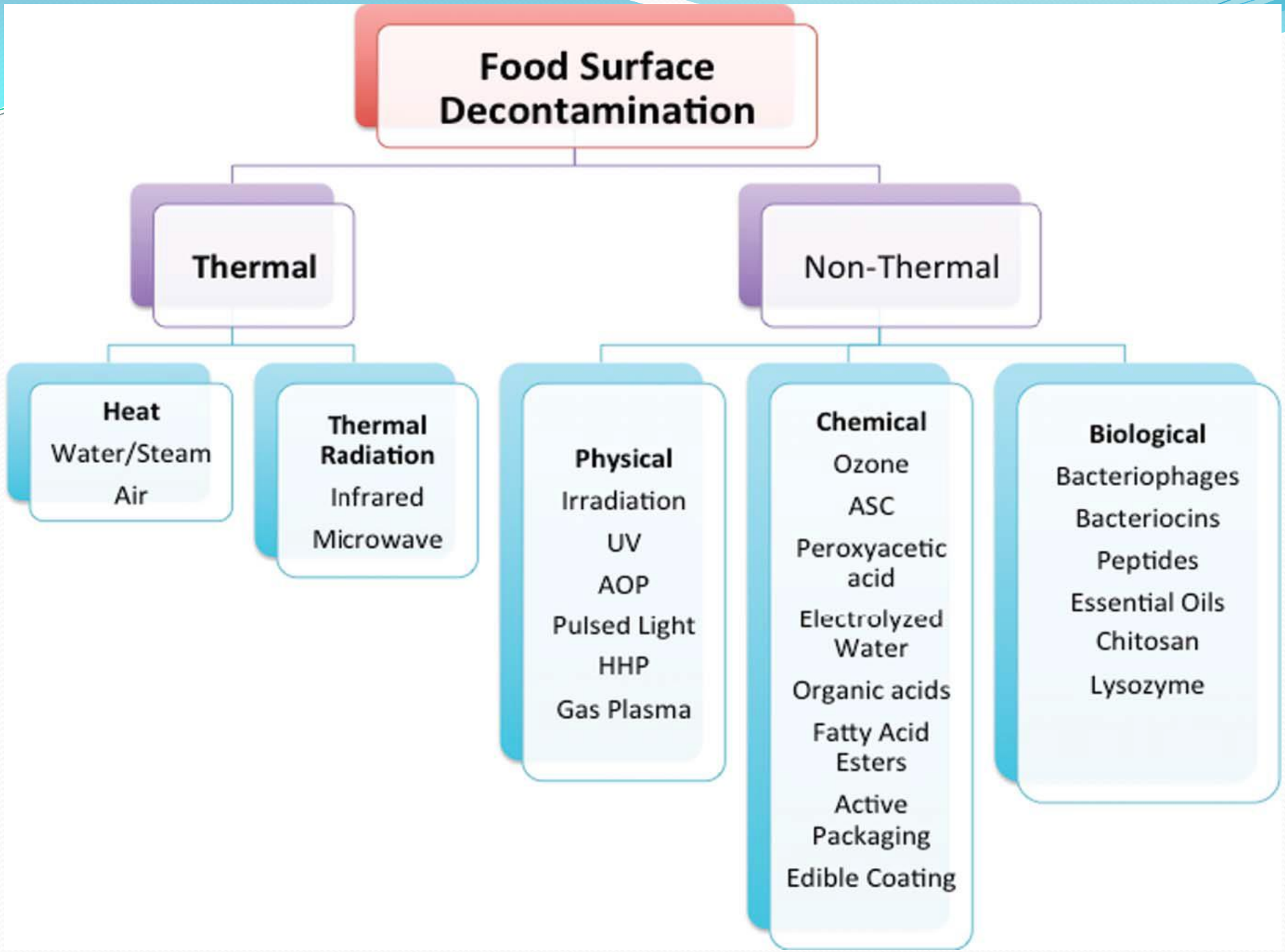
Mechanical Methods For Controlling Microbial Growth

- **Filtration**
  - To sterilize heat-sensitive materials

- **Culture media,**

drugs, vitamins, enzymes, antibiotic solutions or vaccines




Food Surface Decontamination
Thermal
Non-Thermal
Heat
Water/Steam
Air
Thermal Radiation
Infrared
Microwave
Physical
Irradiation
UV
AOP
Pulsed Light
HHP
Gas Plasma
Chemical
Ozone
ASC
Peroxyacetic acid
Electrolyzed Water
Organic acids
Fatty Acid Esters
Active Packaging
Edible Coating
Biological
Bacteriophages
Bacteriocins
Peptides
Essential Oils
Chitosan
Lysozyme

Controlling of Microbial Growth

- Low temperature (cooling and freezing):
- Most organisms grow very little or not at all at $0^{o}C$. Perishable foods are stored at low temperatures to slow rate of growth.

- Drying is often used to preserve foods (e.g. fruits, grains, etc.).
- Most microorganisms cannot grow at reduced water activity.

Chemical Agents

1. Antiseptics

- Cidal agents.
- Harmless enough to be applied to the skin and mucous membrane.
- Should not be taken internally.
- Examples include alcohols, silver nitrate, iodine solution, alcohols, detergents.

2. Disinfectants

- Cidal agents.
- Not safe for application to living tissues.
- Used on inanimate objects such as tables, floors, utensils, etc.
- Examples: hypochlorites, chlorine compounds, copper sulfate, formaldehyde, phenolic compounds and LTGP (Low Temperature Gas Plasma).

3. Preservatives

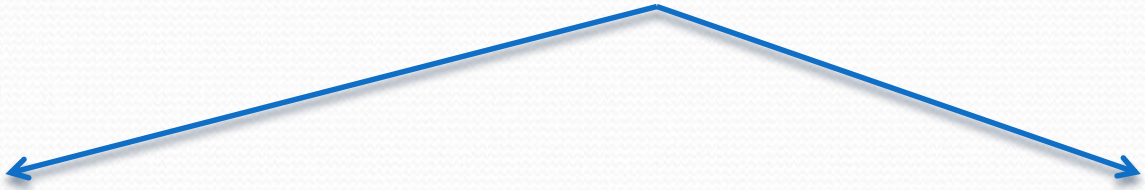
- Static agents.
- Used to inhibit the growth of microorg-anisms.
- Most often in foods.
- If eaten they should be nontoxic.
- Examples are calcium propionate, sodium benzoate, nitrate and sulfur dioxide, ethylene oxide (ETO) and ozone.

Used to prevents microbial Reproduction For Medical and pharmaceutical products

Used as a disinfectant for water and food

Biological Agents

- The biological agents are antimicrobial agents that kill (cidal effect) or inhibit (static effect) the growth microorganisms.
- Antimicrobial agents may be of natural or synthetic origin:



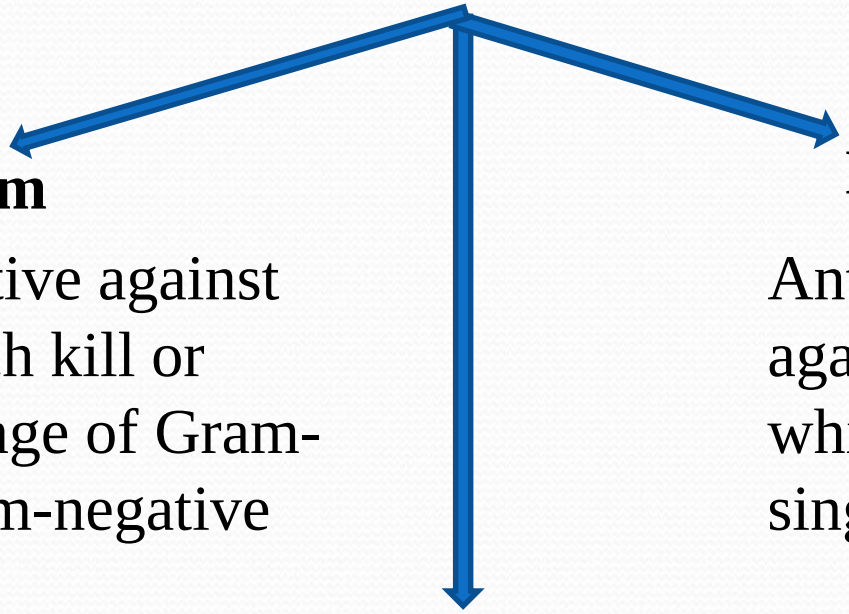
Natural

- Antimicrobial agents produced by microorganisms that kill or inhibit other microorganisms.
- Examples are Penicillin and its relatives.

Semi-synthetic

- Molecules produced by a microbe that are subsequently modified to enhance their antimicrobial properties or to render them unique for a pharmaceutical patent.
- Examples are Sulfonilamides and Chloramphenicol.

Efficiency of Antibiotics



Broad spectrum

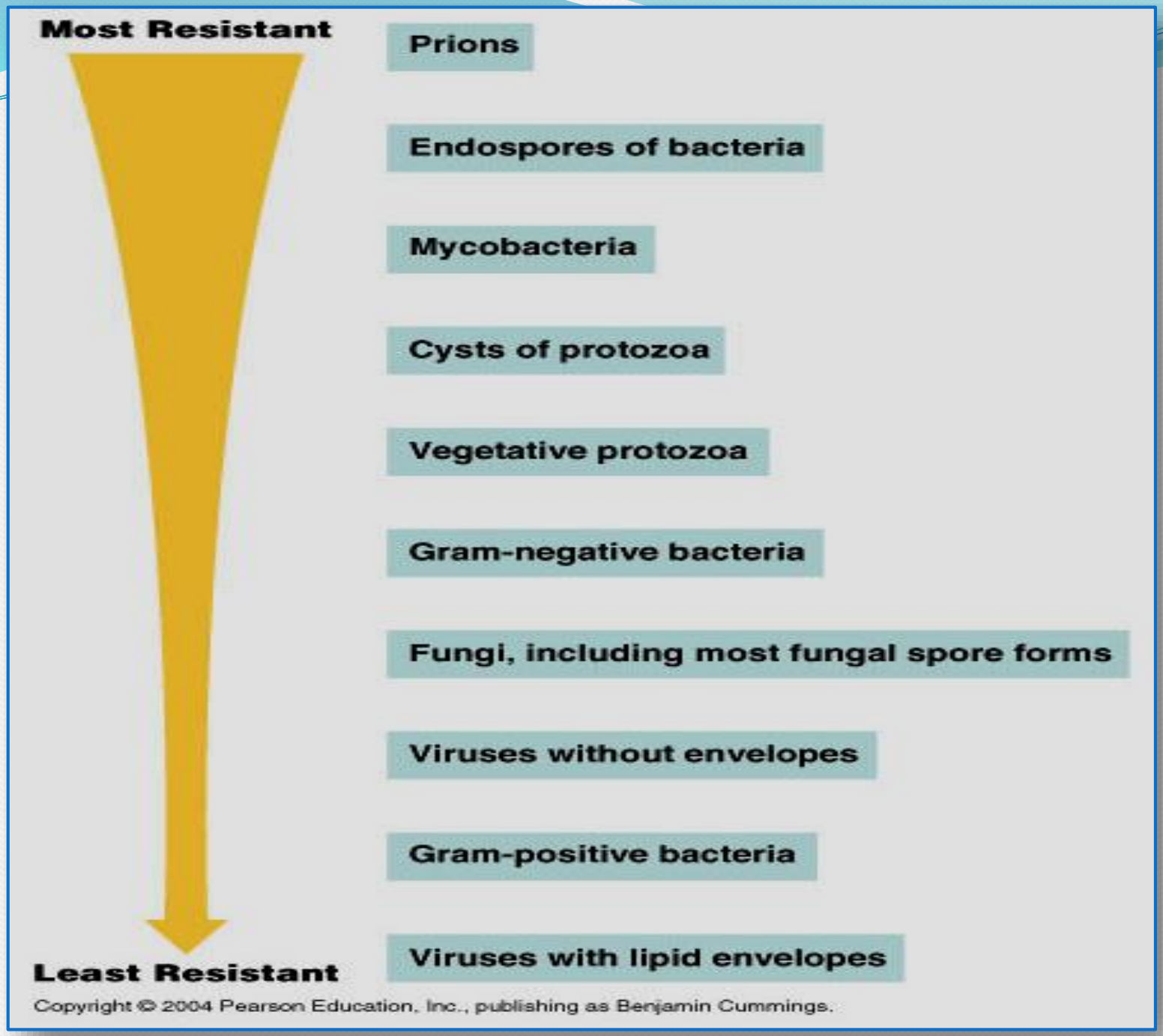
Antibiotics effective against prokaryotes which kill or inhibit a wide range of Gram-positive and Gram-negative bacteria.

Limited spectrum

Antibiotics effective against prokaryotes which kill or inhibit a single organism.

Narrow spectrum

Antibiotics effective against prokaryotes which kill or inhibit specific families of bacteria.



QUESTIONS??