

Chapter 6:

1. Classify microbes into 5 groups on the basis of preferred temperature range.
 - **Psychrophiles:** polar regions (-10-20°)
 - **Psychrotrophs:** spoilage of refrigerated foods (-10-30°)
 - **Mesophiles:** most pathogens and spoilage organisms (10-50°)
 - **Thermophiles:** compost piles, spoilage of canned goods (40-70°)
 - **Hyperthermophiles:** hydrothermal vents (□□□□), hot springs (65-110°)
2. Discuss the importance of pH of culture media.
 - a. Microbes have an **ideal pH range**. Bacteria grow best btw 6.5 and 7.5 moles while yeast and molds best btw 5 and 6 moles. Media outside the range will have little or no growth. Buffers are added to culture media to maintain a specific culture media pH.
 - b. **Culture medium:** Nutrients prepared for microbial growth, and **Must** contain proper nutrients (C, N, energy sources), proper pH and salt concentration. Temperature and oxygen requirements must be met.
 - c. **Sterile:** No living microbes (including endospores)
 - d. **Inoculum:** Voluntary Introduction of microbes into medium
 - e. **Contamination:** Involuntary introduction of microbes into medium
 - f. **Culture:** Microbes growing in/on culture medium
3. Explain the importance of osmotic pressure on microbial growth.
 - **Osmotic Pressure**
 - Microbes obtain nutrients from their environment
 - Hypertonic environments (increased salt or sugar) cause plasmolysis
 - Extreme or obligate halophiles (□□□□□) require high (NaCl) osmotic pressure (Dead Sea bacteria)
 - Facultative halophiles (□□□□□) tolerate high osmotic pressure (Staphylococci)

Morphology:

- Coccus (cocci) – spherical
- Bacillus (bacilli) – rod shaped
- Spiral – twisted
- Unusual shapes: Star-shaped _ **Stella**; Square _ **Haloarcula**

Arrangement:

- Single
- Pairs: diplo-cocci, diplo-bacilli
- Chains: strepto-cocci, strepto-bacilli
- Clusters: staphylo-cocci

4. Why do cells need Carbon, Nitrogen, Sulfur, Phosphorus, and Trace Elements? Provide examples for the use of each.

- **Carbon**
 - Used for structural organic molecules, energy source
 - Heterotrophs use organic carbon sources
 - Autotrophs use CO₂ to make sugars
- **Nitrogen**
 - In amino acids, proteins, nucleic acids
 - Most bacteria decompose proteins
 - Some bacteria use NH₄⁺ or NO₃⁻
 - A few bacteria use N₂ in nitrogen fixation
- **Sulfur**
 - In amino acids (cys, met), thiamine and biotin (□□□)
 - Most bacteria decompose proteins
 - Some bacteria use SO₄²⁻ or H₂S
- **Phosphorus**
 - In DNA, RNA, ATP, and membranes (phospholipids)
 - PO₄³⁻ is a source of phosphorus
- **Trace elements (□□□□)**
 - Inorganic elements required in small amounts
 - Usually as enzyme cofactors
 - Examples: zinc, iron, magnesium, iodine

5. Describe the classes of microbes based on oxygen requirements.

- **Obligate aerobe:** requires molecular oxygen to live
- **Facultative anaerobe:** can grow w/wo molecular oxygen
- **Obligate anaerobe:** does not use molecular oxygen and is killed in its presence
- **Aerotolerant anaerobes:** does not use molecular oxygen but is not affected by its presence
- **Microaerophiles:** grows best in an environment with less molecular oxygen than is normally found in air

6. What are the roles of superoxide dismutase, catalase, and peroxidase (□□□□)?

a) **Superoxide free radicals: O₂⁻**



b) **Peroxide anion: O₂²⁻ → Toxin (does not produce O₂)**



c) **Catalase: 2 H₂O₂ → 2 H₂O + O₂**

d) Singlet oxygen: O₂ boosted to a higher-energy state; very reactive.

e) Hydroxyl radical (OH•); very reactive

7. Distinguish between chemically defined and complex media.
 - **Chemically Defined Media:** Exact chemical composition is known
 - **Complex Media:** Extracts and digests of yeasts, meat, or plants (nutrient broth, nutrient agar)
8. When would you need reducing media?
 - **Reducing media** → Anaerobic Culture Methods
 - Contain chemicals (thioglycollate or oxyrase) that combine O₂
 - Heated to drive off O₂

9. Describe the use of selective media and differential media.

Selective media

- Clinical specimens are often contaminated by other microbes
- **Suppresses unwanted microbes and encourages growth of desired microbes.**
- Examples:
 - Media containing antibiotics (only resistant ones grow)
 - Sabouraud's Dextrose Agar (**low pH** suppresses bacteria and favors yeasts)

Differential media

- Makes it easy to distinguish colonies of different microbes from each other
- Examples:
 - Blood agar (clear zones around *Streptococcus pyogenes* from throat swabs)
 - X-gal plates (lactose positive colonies appear blue; lactose negative colonies appear white) – Pg. 255

10. Why is agar () used and what makes it a good choice?

- Complex polysaccharide
- Used as **solidifying agent** for culture media in Petri plates, slants, and deeps
- Generally not metabolized by microbes
- Liquefies at 100°C
- Solidifies ~40°C

*** Terminology

Broth: large number of cells in a small place

Agar slant (): transport and sustaining of cultures

Agar deep: motility and O₂ requirement

Agar plate: isolated colonies

11. Define colony.

- A pure culture contains only one species or strain.
- A colony is a population of cells arising from a single cell or spore (or from a group of attached cells).
- A colony is often called a colony-forming unit (CFU).

12. What is Binary Fission? What is Generation Time?