

Microbial Growth

The Requirements for Growth

- 1. The growth of a population is an increase in the number of cells.**
- 2. The requirements for microbial growth are both physical and chemical.**

Physical Requirements

3. On the basis of preferred temperature ranges, microbes are classified as psychrophiles (cold-loving), mesophiles (moderate temperature-loving), and thermophiles (heat-loving).
4. The minimum growth temperature is the lowest temperature at which a species will grow, the optimum growth temperature is the temperature at which it grows best, and the maximum growth temperature is the highest temperature at which growth is possible.
5. Most bacteria grow best at a pH value between 6.5 and 7.5.
6. In a hypertonic solution, most microbes undergo plasmolysis; halophiles can tolerate high salt concentrations.

Chemical Requirements

7. All organisms require a carbon source; chemoheterotrophs use an organic molecule, and autotrophs typically use carbon dioxide.
8. Nitrogen is needed for protein and nucleic acid synthesis. Nitrogen can be obtained from the decomposition of proteins or from NH_4^+ or NO_3^- ; a few bacteria are capable of nitrogen (N_2) fixation.
9. On the basis of oxygen requirements, organisms are classified as obligate aerobes, facultative anaerobes, obligate anaerobes, aerotolerant anaerobes, and microaerophiles.
10. Aerobes, facultative anaerobes, and aerotolerant anaerobes must have the enzymes superoxide dismutase ($2 \text{O}_2^- + 2 \text{H}^+ \rightarrow \text{O}_2 + \text{H}_2\text{O} + 2 \text{H}_2\text{O}_2$) and either catalase ($2 \text{H}_2\text{O}_2 \rightarrow 2 \text{H}_2\text{O} + \text{O}_2$) or peroxidase ($\text{H}_2\text{O}_2 + 2 \text{H}^+ \rightarrow 2 \text{H}_2\text{O}$).
11. Other chemicals required for microbial growth include sulfur,

phosphorus, trace elements, and, for some microorganisms, organic growth factors.

Biofilms

1. Microbes adhere to surfaces and accumulate as biofilms on solid surfaces in contact with water.
2. Biofilms form on teeth, contact lenses, and catheters.
3. Microbes in biofilms are more resistant to antibiotics than are free swimming microbes.

Culture Media

1. A culture medium is any material prepared for the growth of bacteria in a laboratory.
2. Microbes that grow and multiply in or on a culture medium are known as a culture.
3. Agar is a common solidifying agent for a culture medium.

Chemically Defined Media

4. A chemically defined medium is one in which the exact chemical composition is known.

Complex Media

5. A complex medium is one in which the exact chemical composition varies slightly from batch to batch.

Anaerobic Growth Media and Methods

6. Reducing media chemically remove molecular oxygen (O₂) that might interfere with the growth of anaerobes.
7. Petri plates can be incubated in an anaerobic jar, anaerobic chamber, or OxyPlate.

Special Culture Techniques

8. Some parasitic and fastidious bacteria must be cultured in living animals or in cell cultures.
9. CO₂ incubators or candle jars are used to grow bacteria that require an increased CO₂ concentration.
10. Procedures and equipment to minimize exposure to pathogenic microorganisms are designated as biosafety levels 1 through 4.

Selective and Differential Media

11. By inhibiting unwanted organisms with salts, dyes, or other chemicals, selective media allow

growth of only the desired microbes.
12. Differential media are used to distinguish different organisms.

Enrichment Culture

13. An enrichment culture is used to encourage the growth of a particular microorganism in a mixed culture.

Obtaining Pure Cultures

1. A colony is a visible mass of microbial cells that theoretically arose from one cell.
2. Pure cultures are usually obtained by the streak plate method.

Preserving Bacterial Cultures

1. Microbes can be preserved for long periods of time by deepfreezing or lyophilization (freeze-drying),

References': 1- Microbiology an introduction TENTH EDITION. Gerard. Tortora.2010.

2-Microbiology an introduction TWELFTH EDITION. Gerard. Tortora.2016