Bacterial growth requirements

Nutrition Types

- Autotrophic Bacteria
  - Utilize simple inorganic substances, such as CO_2 and ammonium
  - None medical importance (independent in nutrition and not invasive)
- Heterotrophic Bacteria
  - Require complex organic substances (e.g., sugars, proteins)
  - Medically important (parasitic bacteria that rely on living hosts)

Respiration Requirements

- Obligate aerobes
  - Require oxygen (O_2), uses TCA cycle & ETC generating 38ATP
  - Producing ROS: (H2O2, superoxide (O2))
  - Examples: Pseudomonas aeruginosa
- Obligate Anaerobes
  - Perform anaerobic respiration, using alternative molecules (e.g., nitrate, sulfate, CO_2) instead of oxygen as final electron acceptors
  - Yields approximately 17 ATP per glucose, as anaerobic pathways are less efficient
  - Lacks enzymes like catalase and superoxide dismutase —> causes death in oxygenated environment
  - Example: Bacteroides fragilis
- Facultative Anaerobes (most bacteria)
  - Aerobic respiration when oxygen represents switch to fermentation in it's absence
  - Generates 38 ATP with (O2), but only 2 ATP through fermentation without (O2)
  - in Absence of Oxygen, Fermentation produces acids and alcohols
  - Example: Staphylococcus aureus
- Micro-aerophilic Bacteria
  - Require low oxygen levels (2–10%), higher [O2] is harmful
  - more efficiently at low [O2] due to limited ROS enzymes activity.
  - Example: Campylobacter, Helicobacter
- Aero-tolerant Anaerobes
  - Typically use anaerobic pathways and tolerate low oxygen, limited ability to manage ROS
  - Produce energy anaerobically
  - Example: Clostridium perfringens
- Capnophilic Bacteria — CO_2 Requirements
  - CO_2 (0.03%): Present in the air and sufficient for most bacteria.
  - CO_2 (5–10%) (Capnophilic): Required by capnophilic bacteria for optimal growth. — Examples: Neisseria, Brucella

pH Preferences

- Acidophilic Bacteria — Examples: Lactobacillus PH:4
- Neutrophil bacteria (most bacteria) PH: (7.2-7.4)
- Alkaliphilic Bacteria — Examples: Vibrio cholerae PH:9

Temperature Preferences

- Psychrophilic Bacteria — Temperature Range: 0–15°C.
- Mesophilic Bacteria — Temperature Range: 20–45°C (most bacteria fall in this category)
- Thermophilic Bacteria — Temperature Range: 55–65°C.