Bacterial Growth and Nutrition

Chapter 4 - Pages 92 - 95; 97 - 103

1. Optimal Growth Requirements and Environmental Stress

   A. Binary Fission (Figure 4.1)

   B. Generation Time

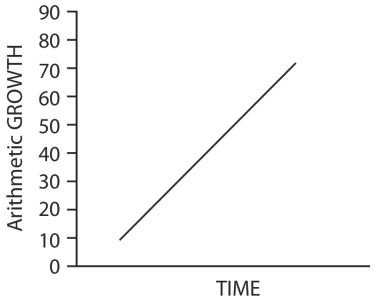
      - Escherichia coli = 20 minutes
      - Staphylococcus aureus = 30 minutes
      - Mycobacterium tuberculosis = 18 hours
      - Treponema pallidum = 33 hours (Syphilis)

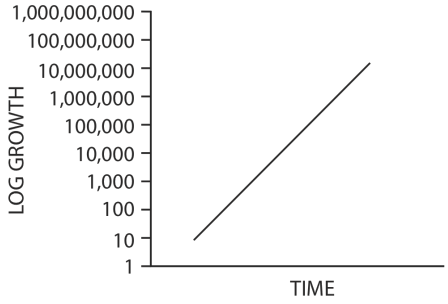
   C. Growth Potential (see handout) (also pages 92 - 94)

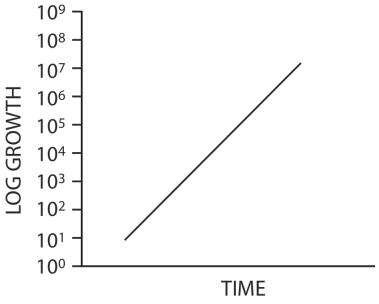
   D. Growth Potential Graphical Representation

      i. Arithmetically

      ii. Logarithmically







2. Biofilms (See animations on web) (Pages 94 - 95)

   A. Community Cells

   B. Structure of Community

   C. Medical Examples

      i. Dental Plaque

      ii. Indwelling tubes

      iii. Respiratory Infections

      iv. Etc.

3. Growth Curves **See Growth Curves Handout**

   A. General Growth Curve

   B. Growth Phases Closed System (Pages 97 - 98)

      i. Lag Phase

      ii. Exponential or Log Phase

      iii. Stationary Phase

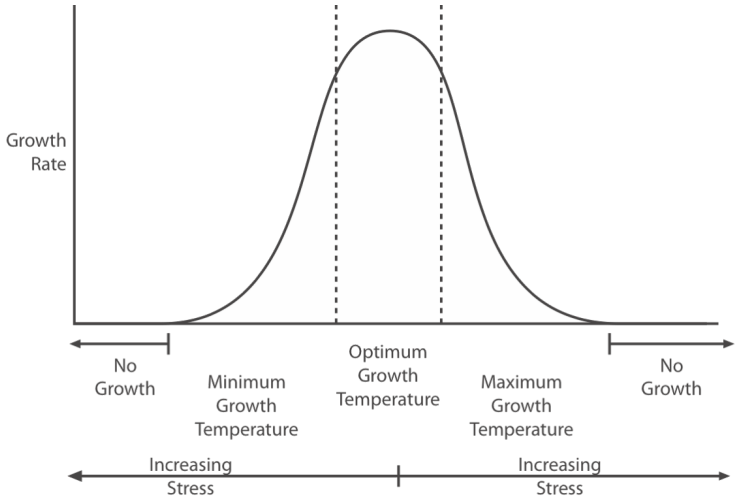
      iv. Death Phase

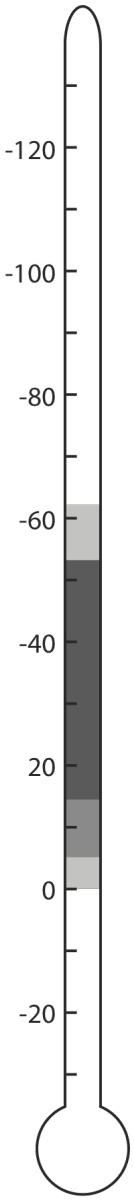
      v. Effect of Endospores

         - Clostridium sp.
         - Bacillus sp.

C. Growth Phases Open System **See Growth Curves Handout**

4. Temperature and Growth (p 99 - 100)





A. Bacterial Classifications

i Psychrophiles (0° - 20°c)

ii. Mesophiles (20° - 40°c)

a. *Salmonella Incident*

iii. Thermophiles (40° - 90°c)

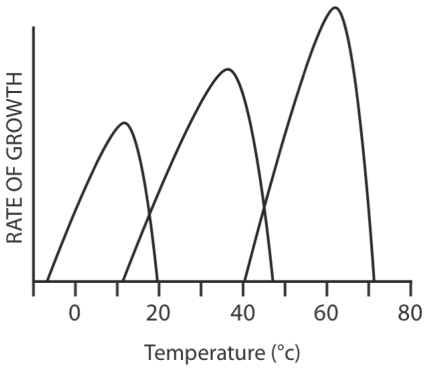
B. Temperature Growth Range (Page 100; Figure 4.8))

Adopted from
Text: Microbiology, An Indroduction
By Tortora, Funle, Case

i. Minimum Growth Temperature

ii. Optimum Growth Temperature

iii. Maximum Growth Temperature



Adopted from
Text: Microbiology, An Indroduction
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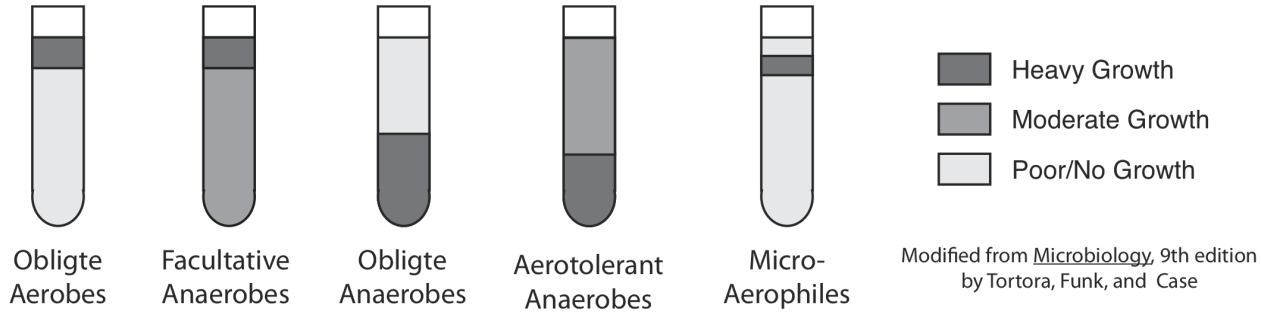
C. Temperature and Food (Page 100)

D. Inflammation and Pyrogen

5. Oxygen (p 100 - 101)

A. Oxygen Toxicity (Free Radicals and Singlet Oxygen)

B. Microbial Growth and Oxygen



C. Mechanism for Microbial Growth in the presence of oxygen (Page 101)

i. Detoxification of metabolic byproducts relative to Oxygen

$$O_2^- + O_2^- + 2H^+ \xrightarrow{\text{Superoxide Dismutase}} H_2O_2 + O_2$$

$$H_2O_2 + 2H^+ \xrightarrow{\text{Peroxidase}} 2H_2O$$

$$2H_2O_2 \xrightarrow{\text{Catalase}} 2H_2O + O_2$$

D. Select Examples

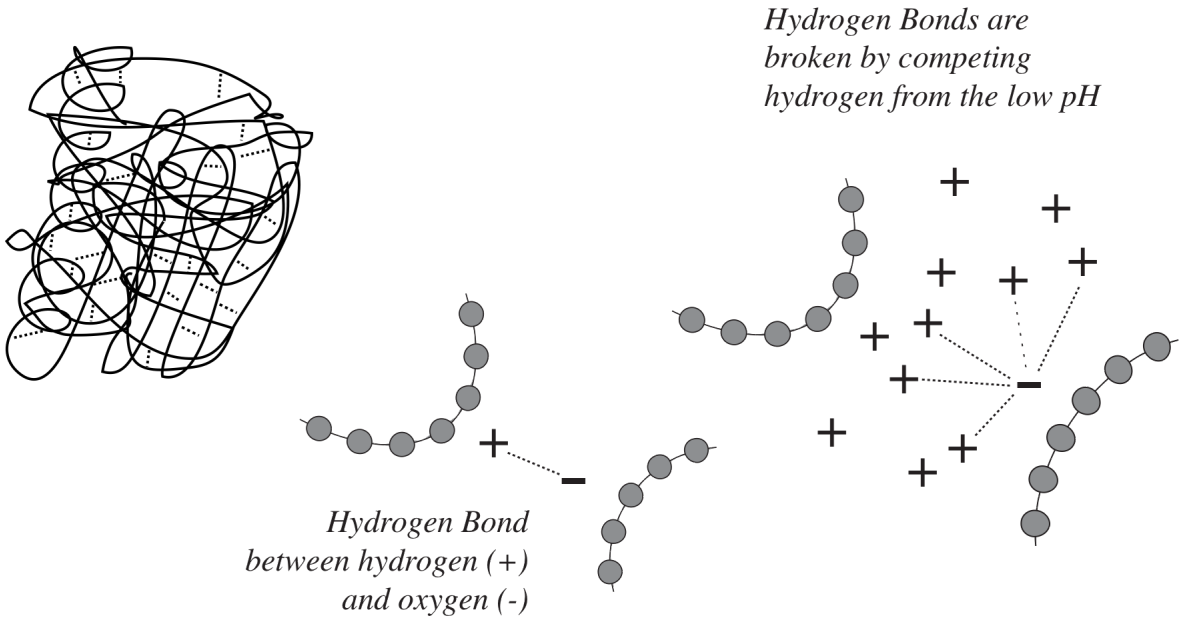
i. Obligate Aerobes

ii. Facultative Anaerobes -

iii. Obligate Anaerobic

- *Clostridium botulinum*
  - * incident(s)
- Clostridium Tetani

6 pH (Pages 101 - 102)



A. Optimal pH Ranges for Most Bacteria

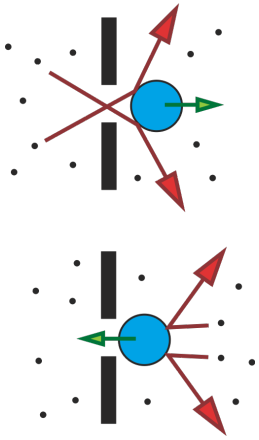
B. Mechanism of Microbial Growth Inhibition in Food

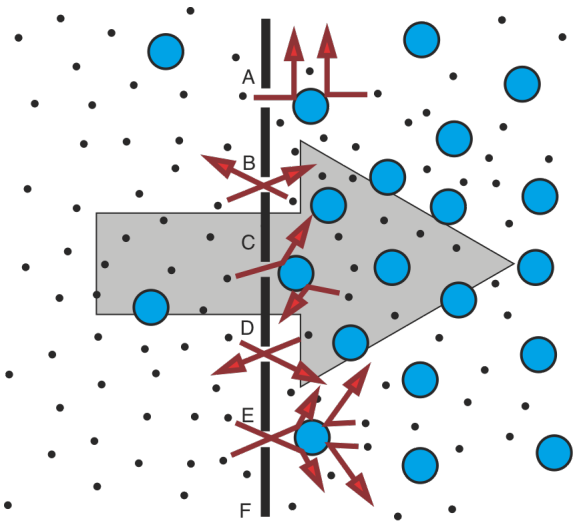
C. In Non-specific Host Defense

D. Acidophiles

E. *Helicobacter pylori*

7. Osmotic Pressure (Page 102)





A. Osmosis Review

i. Mechanism

ii. Hypertonic

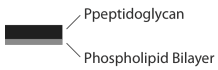
iii. Hypotonic

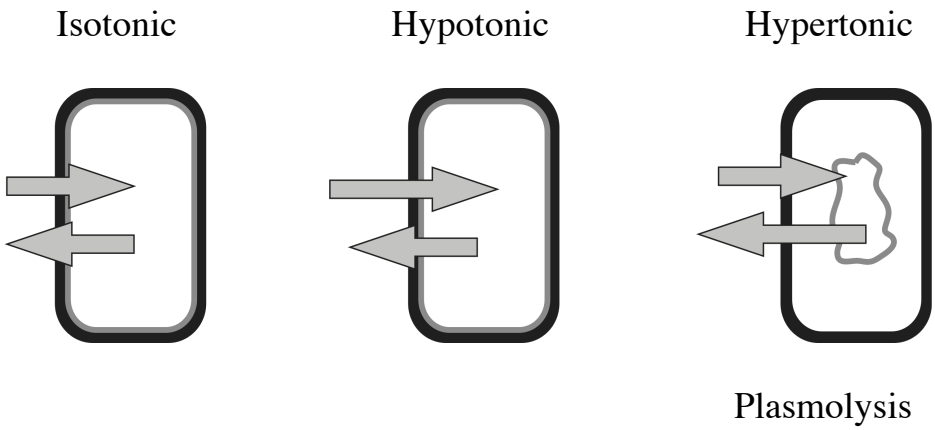
iv. Isotonic

B. Osmotic Pressure and the Cell Wall (Page 102)

i. Salt

ii. Sugar





C. Halophiles (p. 158)

i. Obligate Halophiles

ii. Facultative Halophiles