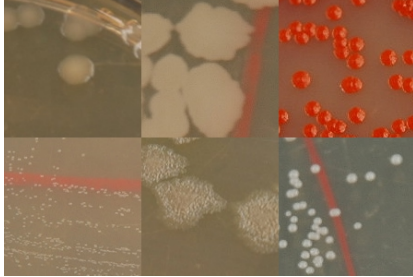
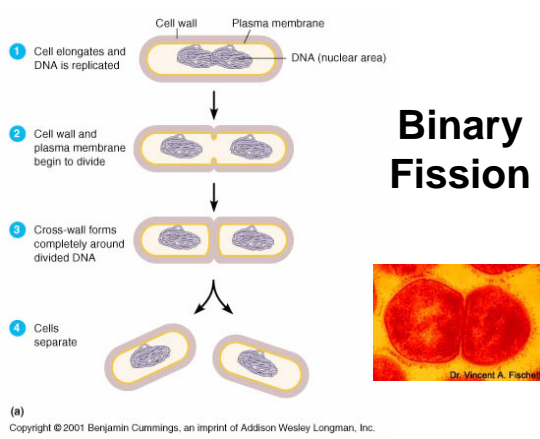


Bacterial Growth





Generation Time



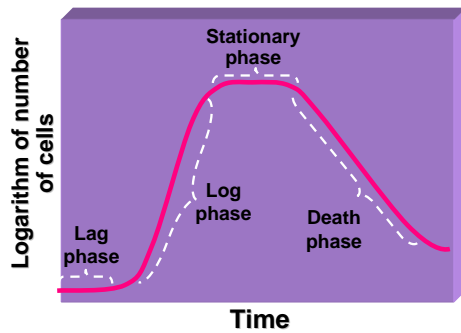
- Species
- Environment

Generation Time

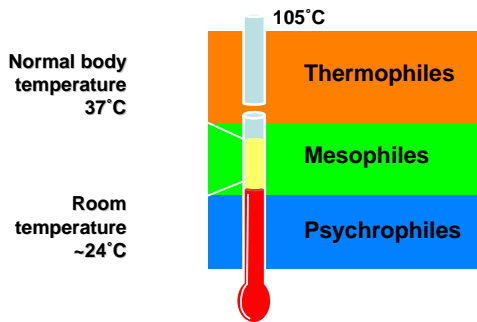


- Optical density
- Plate count
- Direct microscopic count

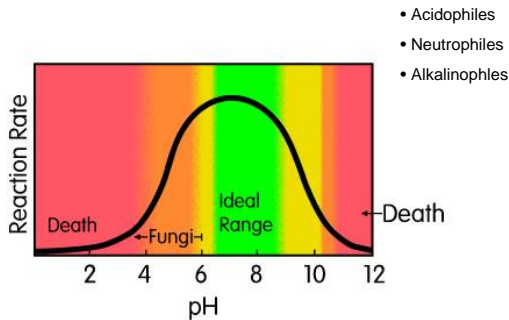
Growth phases



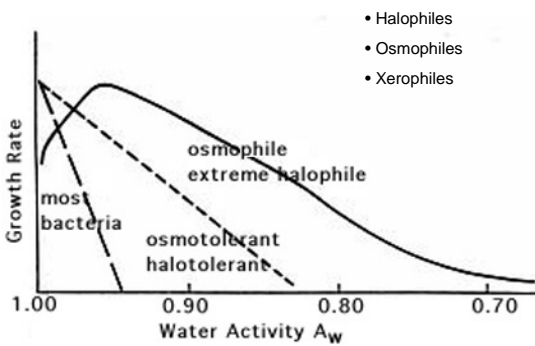
Temperature Requirements



pH Requirements



Moisture Requirements



- a_w Microorganisms generally inhibited by a_w at this point Examples of foods within this range of water activity.
- 0.950 Pseudomonas, Escherichia, Proteus, Shigella, Klebsiella, Bacillus, Clostridium perfringens, some yeasts Highly perishable foods (fresh and canned fruits, vegetables, meat, fish) and milk; cooked sausages and breads; foods containing up to 4oz (w/w) sucrose or 7%NaCl
- 0.910 Salmonella, Vibrio parahaemolyticus, C. botulinum, Serratia, Lactobacillus, Pediococcus, some molds, Rhodotorula, Pichia Some cheese (Cheddar, Swiss, Muenster, Provolone); cured meat (ham); some fruit juice concentrates; foods containing 55% (w/w) sucrose or 12%NaCl

- 0.870 Many yeasts (*Candida*, *Torulopsis*, *Hansenula*), *Micrococcus* Fermented sausage (salami); sponge cakes; dry cheese; margaring; foods containing 65% (w/w) sucrose (saturated) or 15%NaCl
- 0.800 Most molds (mycotoxigenic penicillia), *Staphylococcus aureus*, most *Saccharomyces* (*baillii*) spp., *Debaryomyces* Most fruit juice concentrates; sweetened condensed milk; chocolate syrup; maple and fruit syrups; flour; rice; pulses containing 15-17% moisture; fruit cake; country style ham; fondants; high-sugar cakes
- 0.750 Most halophilic bacteria, mycotoxigenic aspergilli Jam, marmalade; marzipan; galcé fruits; some marshmallows
- 0.650 Xerophilic molds (*Aspergillus chevalieri*, *A. Candidus*, *Wallemia sebi*), *Saccharomyces bisporus* Rolled oats containing ~10% moisture; grained nougats; fudge marshmallows; jelly; molasses; raw cane sugar; some dried fruits; nuts

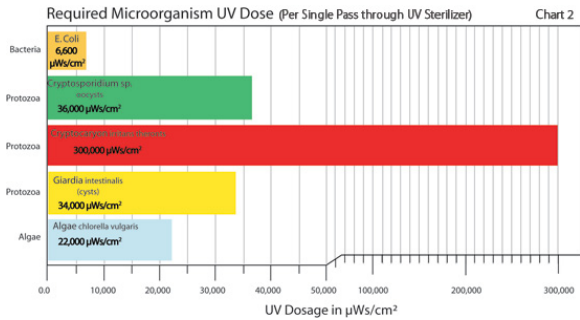
- 0.600 Osmophilic yeasts (*Saccharomyces rouxii*), few molds (*Aspergillus echinulatus*, *Monascus bisporus*) Dried fruits containing 15-20% moisture; some toffees and caramels; honey
- 0.500
- No microbial proliferation Noodles, spaghetti, etc. containing ~12% moisture; spices containing ~10% moisture
-
- 0.400 Whole egg powder containing ~5% moisture
- 0.300 Cookies, crackers, bread crusts, etc. containing 3-5% moisture
- 0.030 Whole mild powder containing 2-3% moisture; dried vegetables containing ~5% moisture; corn flakes containing ~5% moisture; dehydrated soups; some cookies and crackers

UV Light

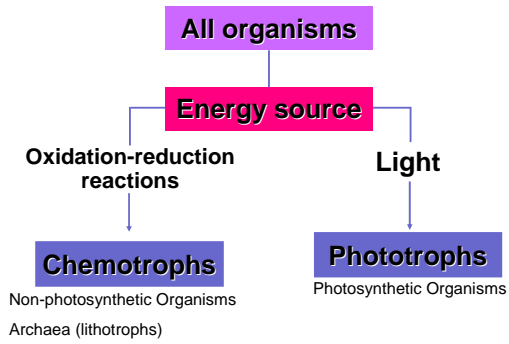
- Photosynthetic bacteria
 - Cyanobacteria
 - Green & purple sulfur bacteria
- Photosynthetic protists
 - Red, Brown & Green Algae
 - Euglenoids
 - Dinoflagellates
 - Diatoms



UV Sterilization

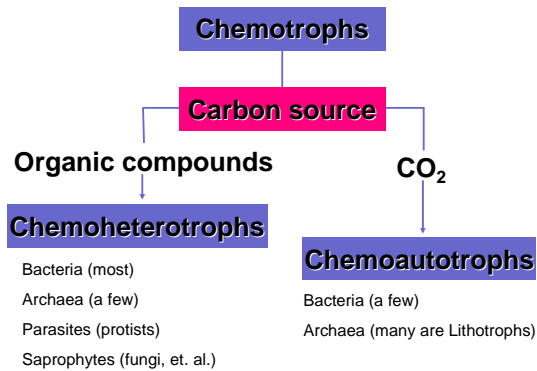


Nutritional classification



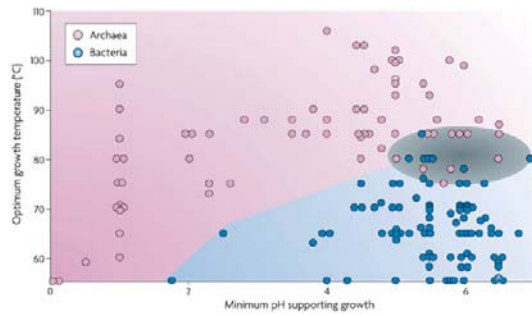
after Tortora, et al. *Microbiology: An Introduction* Fig. 5.26

Nutritional classification

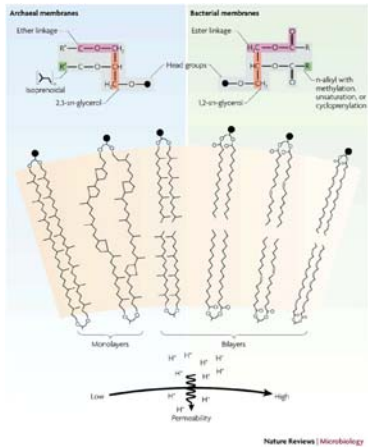


after Tortora, et al. *Microbiology: An Introduction* Fig. 5.26

Optimal temp & pH



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