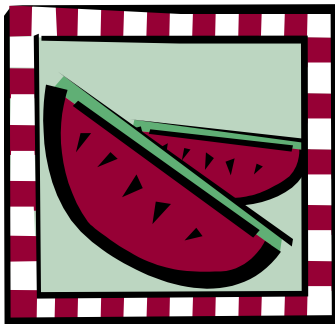


FOOD MICROBIOLOGY

Presentation prepared by Mindy Brashears, Ph.D.
Assistant Professor of Food Safety and HACCP



WHAT IS FOOD MICROBIOLOGY???

A Brief History



- Early Food Preservation
- 900 AD – “Food Poisoning” Recognized
- 1795-Appert Developed Canning
- 1854-1864-FOOD MICROBIOLOGY BECOMES A SCIENCE
 - Louis Pasteur



Why Study Food Microbiology?

- Provide Clean, Safe, Healthful Food to Consumer
 - Food Permits Growth
 - Control of Microbial Growth
- Prevent Food Spoilage
- Prevent Food-borne Illnesses
- Food Preservation and Production



Food-Borne Illness

- ERS Estimates
 - \$6.9 Billion/Year Cost of FBI
- CDC Estimates
 - 76 Million Cases of FBI Annually
 - 325,000 Hospitalizations
 - 5,000 Deaths

What Organism Causes the
Most Cases of Food-Borne
Illness Annually?

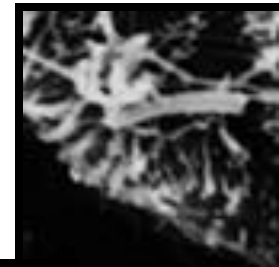
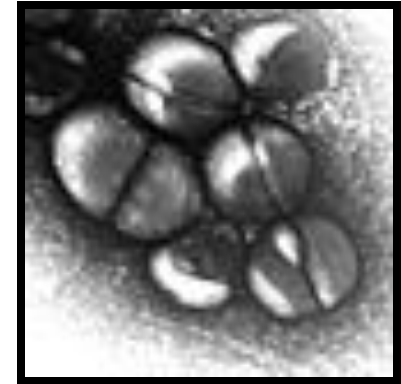
Campylobacter

What Organism Causes the
Most Deaths Due to Food-
Borne Illness?

Salmonella

Review of Microbiology

- Mostly Single Celled
- Groups
- Morphologies
- Gram Reactions
- Size
- Growth Rate

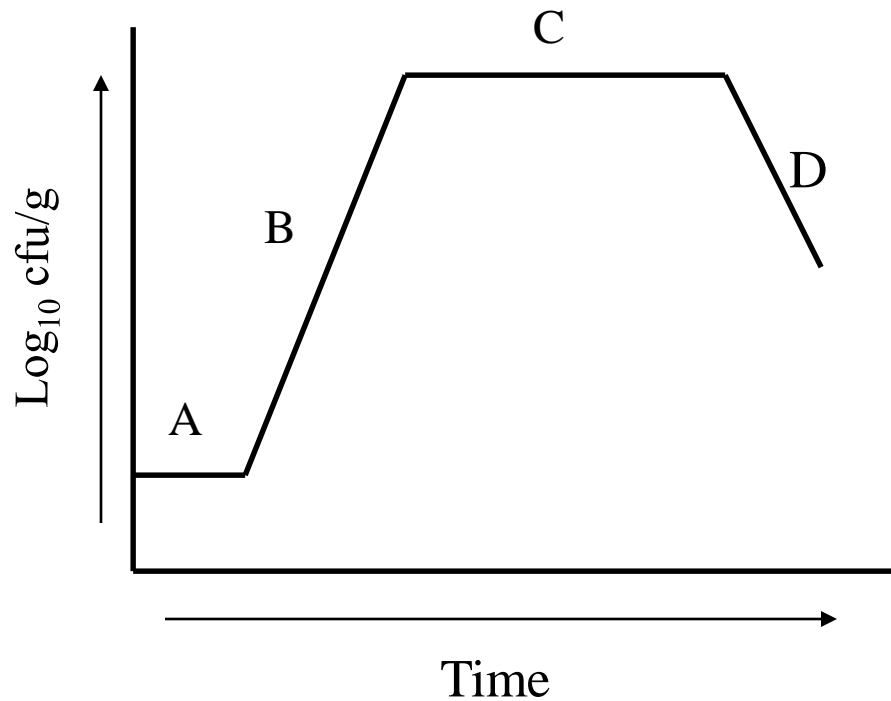


Exponential Growth

- 30 Minute Generation Time
 - Time 0 1000/g
 - 30 min 2000/g
 - 1 hour 4000/g
 -
 - 5 hours 1,000,000/g



Microbial Growth Phases



A=Lag Phase

B=Log/Exponential Phase

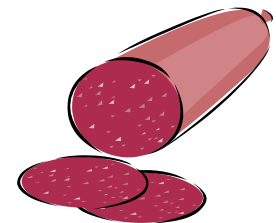
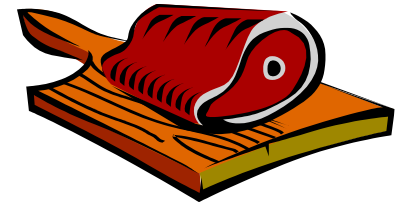
C= Stationary Phae

D= Death Phase

Intrinsic and Extrinsic Factors

- Intrinsic

- pH
- Moisture Content
- Oxidation-reduction Potential
- Nutrient Content
- Antimicrobial Constituents
- Biological Structures



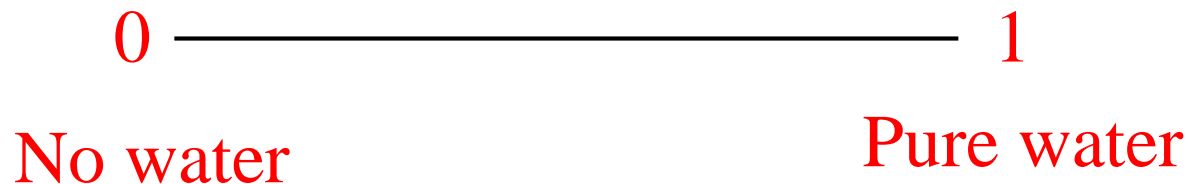
pH

- Effects of pH
 - Enzymes
 - Nutrients
- Other Environmental Factors
 - Temperature
 - Salt
 - Age
- No known pathogen grows below pH of 4.6
 - *Clostridium botulinum*



Moisture

- Remove and/or Bind Moisture
 - Humectants
 - Dehydration
- Water Activity – A_w
- Most Fresh Foods - $A_w > 0.99$



Microbial Growth and A_w

- Halophilic 0.75
- Xerophilic molds 0.61
- Osmophilic yeasts 0.61

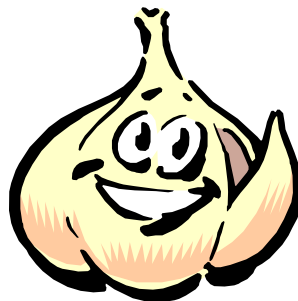
- Lowest A_w for Pathogen Growth
 - 0.86
 - *Staphylococcus aureus*

Oxidation- Reduction Potential

- O/R Potential - Eh
 - “...ease with which the substrate loses or gains electrons.”
- Loss of electrons – oxidized
- Gain of electrons – reduced
- Aerobic
- Anaerobic
- Microaerobic
- Facultative anaerobes

Others

- Nutrients
 - Fastidious vs non-fastidious
- Biological Structure
- Antimicrobial Factors
 - Naturally occurring factors

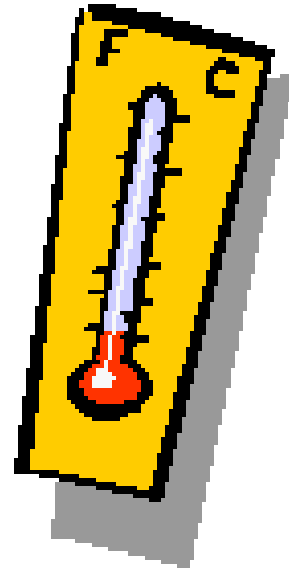


Extrinsic Factors

- Temperature
- Relative Humidity
- Gases in the Environment
- Presence of Other Microorganisms

Temperature

- Microorganisms grow over a wide range of Temperatures
- Psychrotrophs
- Mesophiles
- Thermophiles
- Psychroduric
- Thermoduric



Other Factors

- Relative Humidity of Environment
 - Can change the A_w
- Environmental Gasses
 - CO_2 , Ozone,

Presence of Other Microorganisms

- Competitive Exclusion
 - General microbial antagonism
 - Lactic Antagonism

Hurdle Concept

- Combine Intrinsic and Extrinsic Factors to Control Microbial Growth
- Combination requires less severe treatments to foods to get desired inhibition

