جامعة الملك سعود
King Saud University

OPTO425 MICROBIOLOGY I

GAMAL EL-HITI

Microbial Growth Control

OPTO425
Lecture Ten

Learning Outcomes

Outcomes

- How to preserve cultures?
- How to control the spread of microbes?
- What are the common methods for microbes destruction?
- What is the effect of temperature on microbes?
- What is the effect of osmotic pressure and pH on microbes?

Microbial Growth Control

- How to preserve cultures?
- Refrigeration: Stores for short periods of time.
- Deep-freezing: It use a deep freezer (–85 °C) to store cells for years.
- Lyophilization
- It is a dehydration process.
- Typically used to store cultures for decades.
- One of the best ways to store a fungal, bacterial, yeast or other microorganism.

Microbial Growth Control

- Freeze-drying works by freezing the material.
- The surrounding pressure was reduced.
- The frozen water in the material was sublimated directly from the solid phase to the gas phase.

A freeze-drier

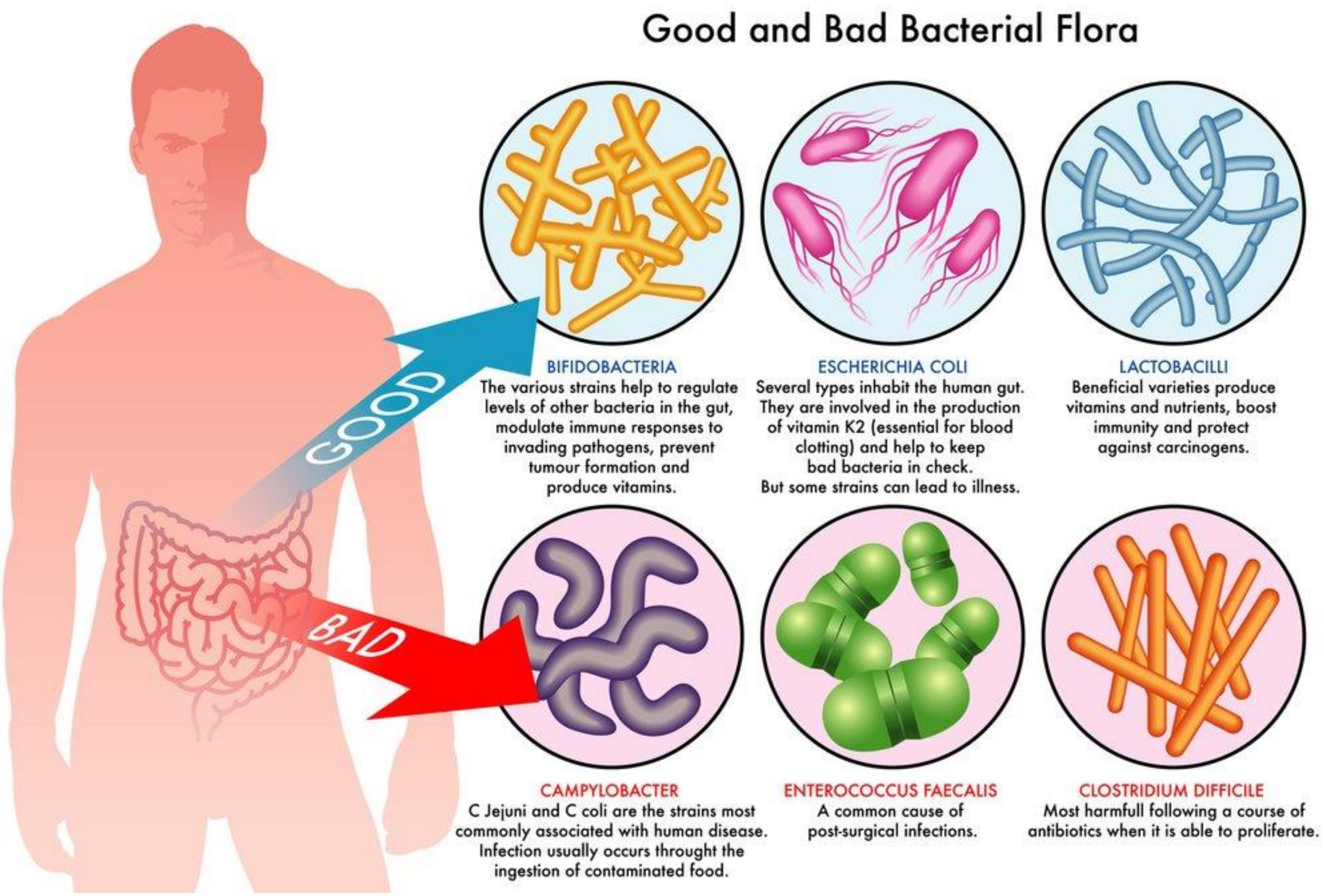
Microbial Growth Control

- Microbial growth means increase in number of cells, not cell size.
- One cell becomes colony of millions of cells.
- The control of microbial growth is necessary in many practical applications.
- Microbial growth control is important for:
    - Infection control
    - Growth of industrial and biotech organisms

Microbial Growth Control

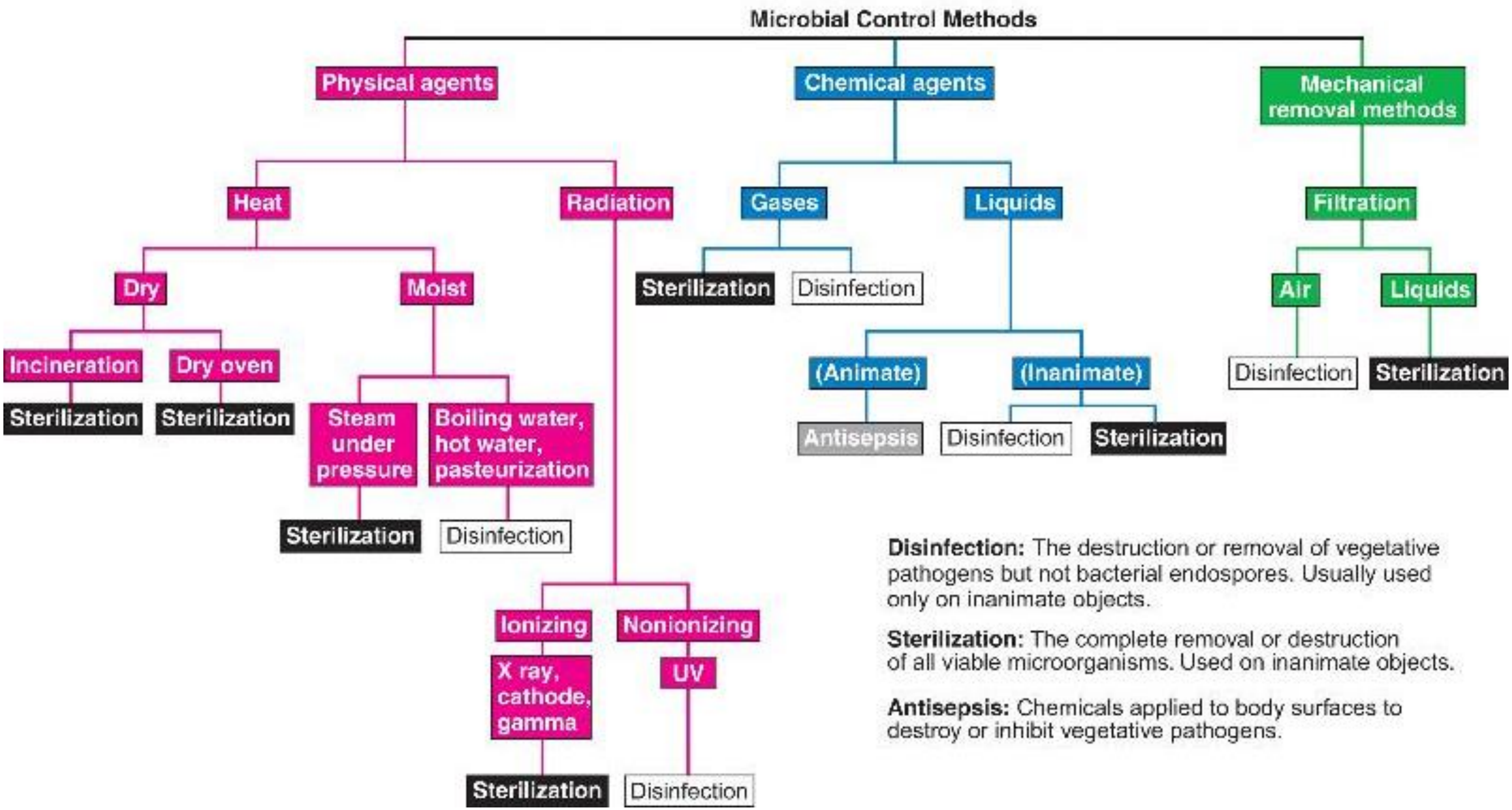
- Most bacteria are harmless.
- Some bacteria are helping in food digestion, killing microbes and fitting viruses.
- Less than 1% of bacteria are pathogenic and cause illness.

Microbial Growth Control



Microbial Growth Control

Microbial Growth Control



Microbial Growth Control

- How to control the spread of microbes and the methods of destruction?
- Three common practices are used to prevent the growth and the spread of microorganisms in community and hospitals which they are different in their power and the way to use.
- Antiseptics
- Disinfection
- Sterilization

Microbial Growth Control

- Antiseptics
- Solutions applied directly to skin.
- Prevent or slow down the growth of microorganisms.
- Alcohol and betadine are often used.
- Dettol (chlorinated phenols) used as a household antiseptic.
- Not useful against control of all microorganisms.

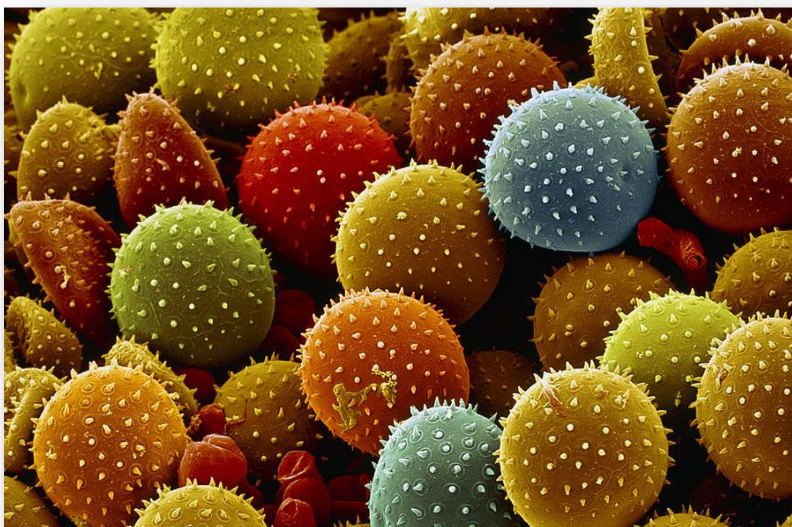
Microbial Growth Control

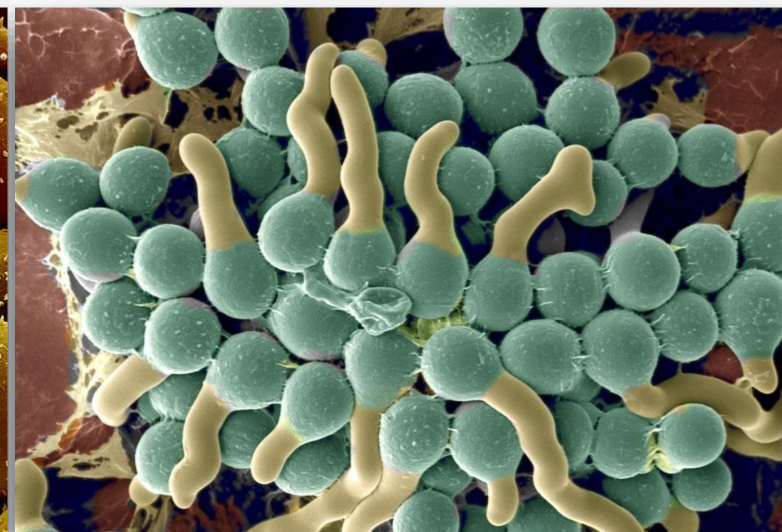
- Disinfection
- Uses strong chemicals such as bleach solution to kill many pathogens

- Used mainly on objects and not on the skin because they may cause skin irritation and trauma.

Microbial Growth Control

- Disinfectants and antiseptics have limited effects against viruses and spores.
- Spores are cells produced by bacteria either to reproduce or to be resistant to a harsh environment.





Microbial Growth Control

- Sterilization
- It is the best way to kill all microbes and their spores.
- Used to sterilize medical instruments.
- Uses steam under pressure.


Microbial Growth Control

- Other methods include use of chemicals, radiation and gas.

- Not all microbes require sterilization to become nontoxic or non-pathogenic.
- Many microbes can be eliminated by disinfecting procedures.

Microbial Growth Control

- Various factors affect the growth of microorganisms.
- The most important factors are:
- Temperature
- pH
- Osmotic pressure
- Oxygen
- Generation time
- Nutrients
- Others, *e.g*. radiation

Microbial Growth Control

- Requirements for microbial growth are divided into two categories, physical and chemical.
- Physical requirements for the growth of microbes includes the following:

1– Temperature

- Optimal temperature for microbes growth.

2– pH

- Optimal pH for enzyme operation.

3– Osmotic pressure

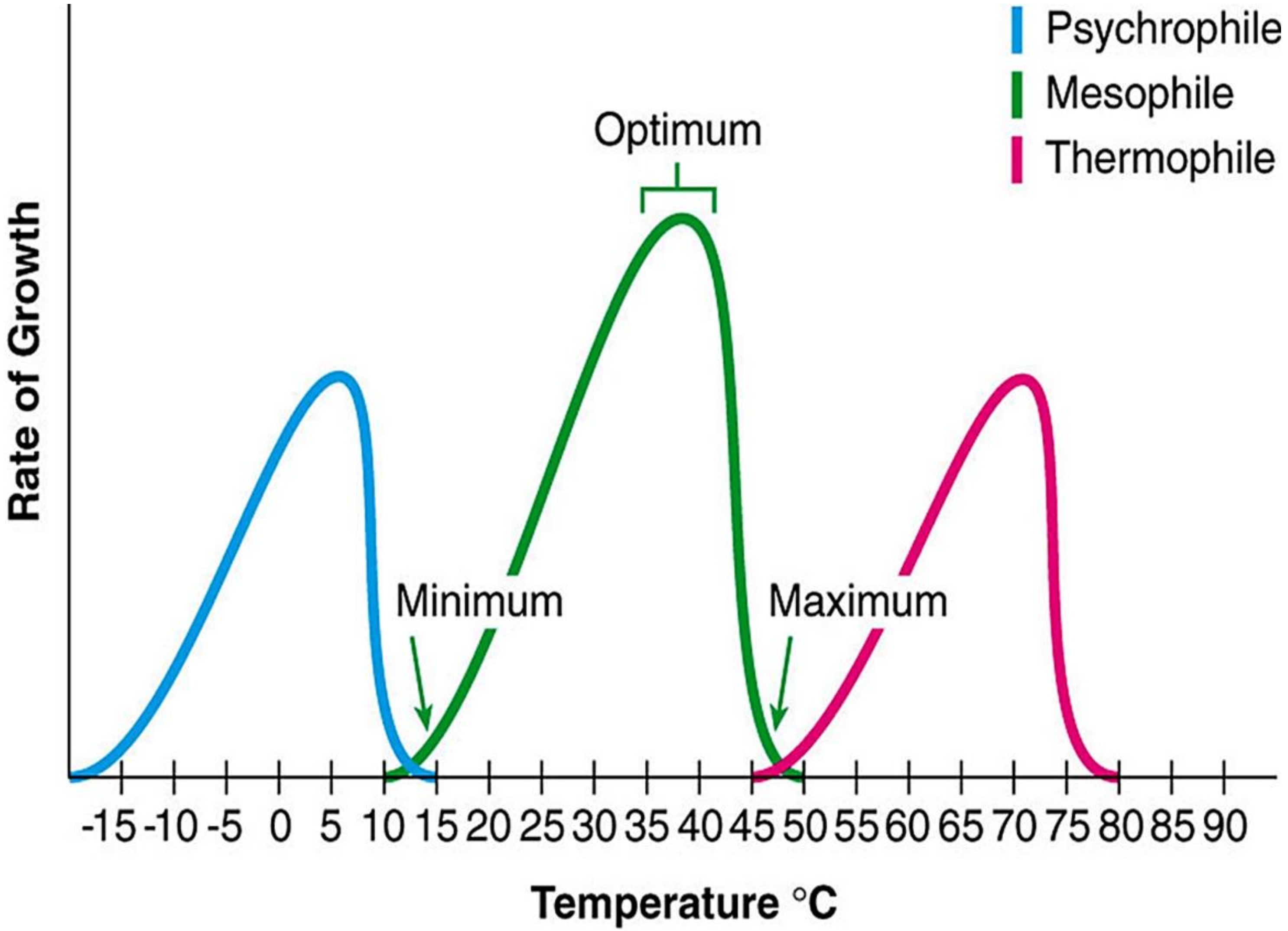
Microbial Growth Control

- Microorganisms have been found growing in virtually all environments.
- Such environments should contain liquid water, regardless of its temperature.

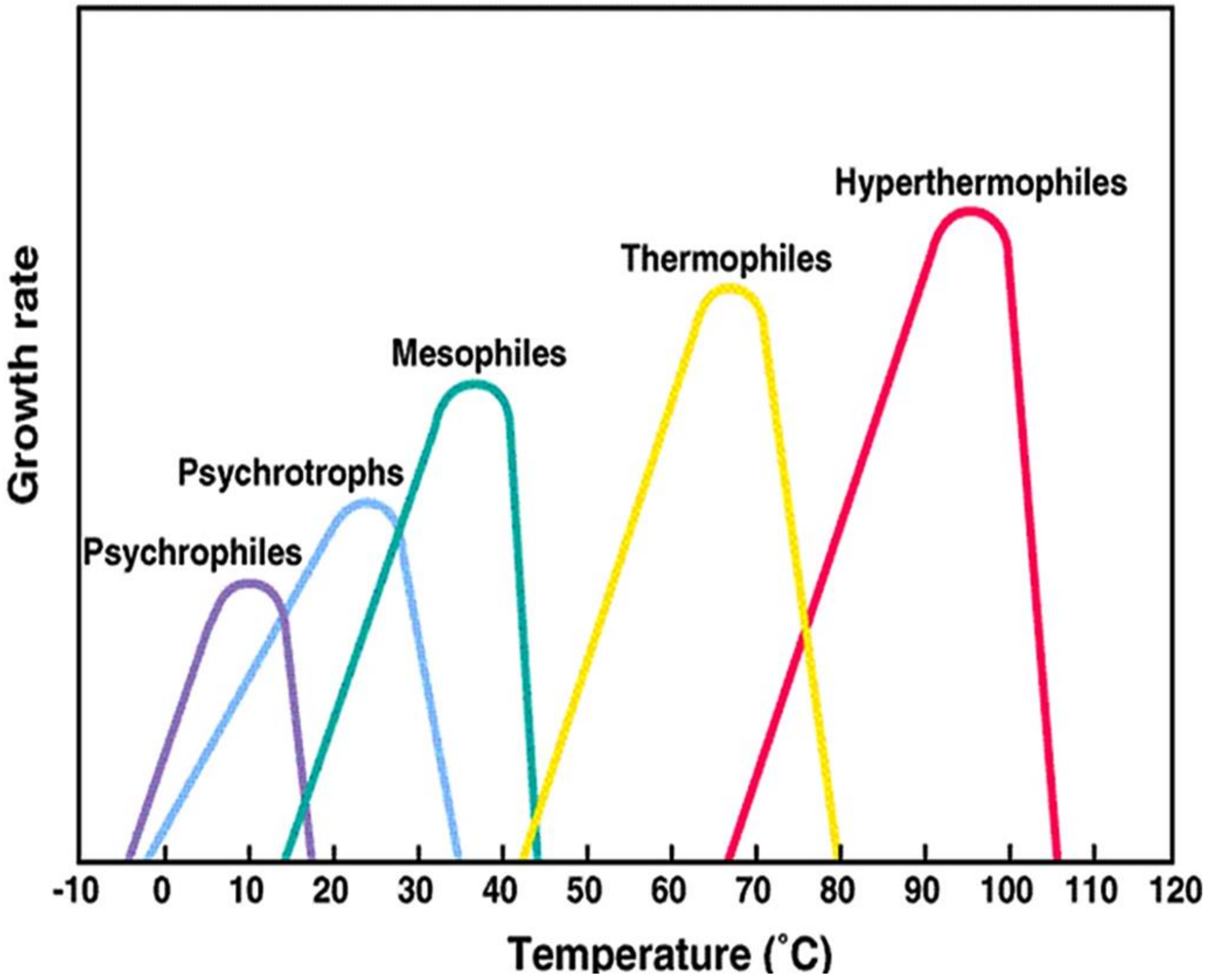
1– Temperature (optimal enzyme operation)

- Psychrophiles (cold–loving)
- Mesophiles (moderate temperature–loving)
- Thermophiles (heat–loving)
- Each has a minimum, optimum and maximum growth temperature.

Microbial Growth Control



Microbial Growth Control

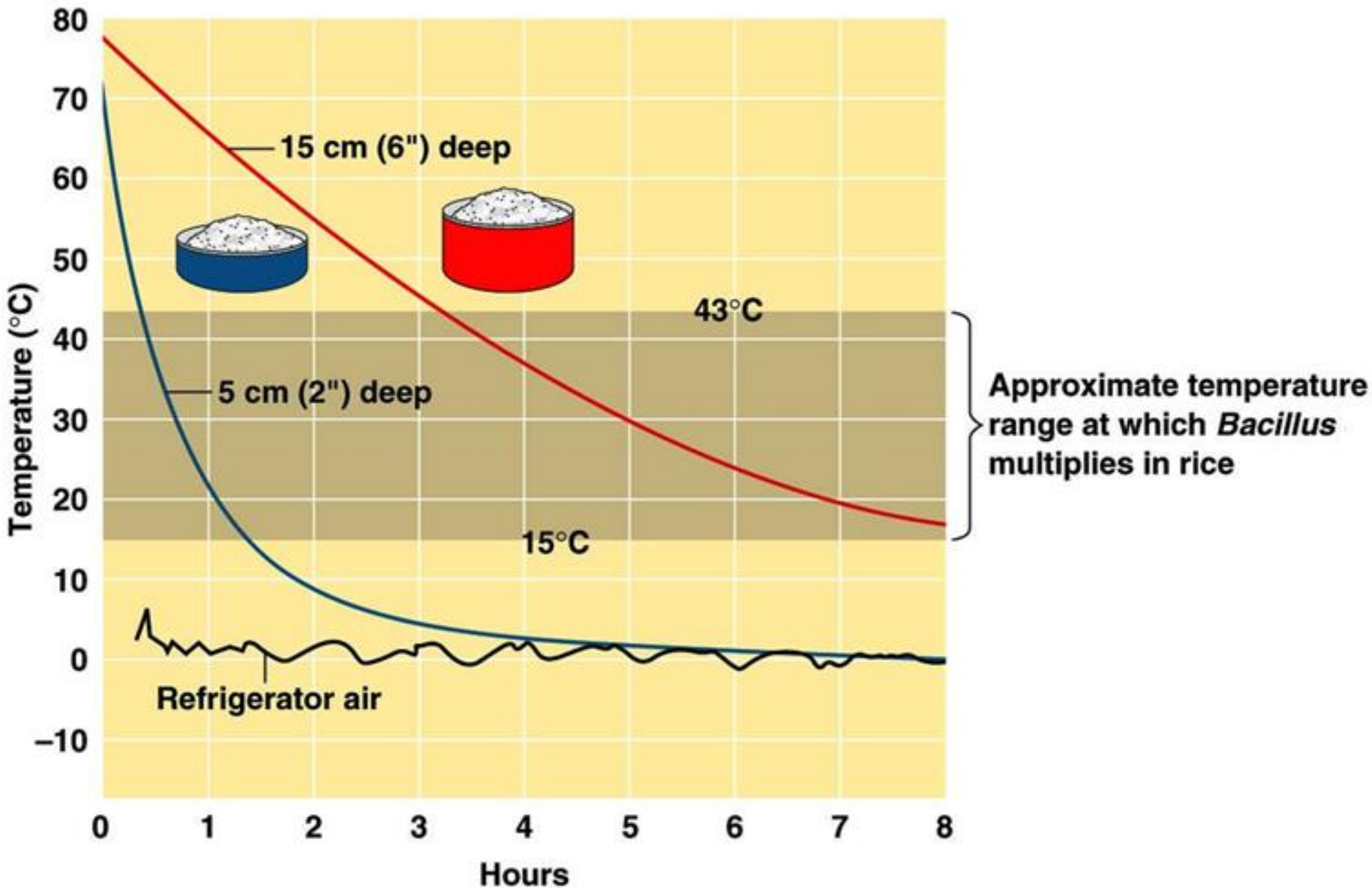


Microbial Growth Control

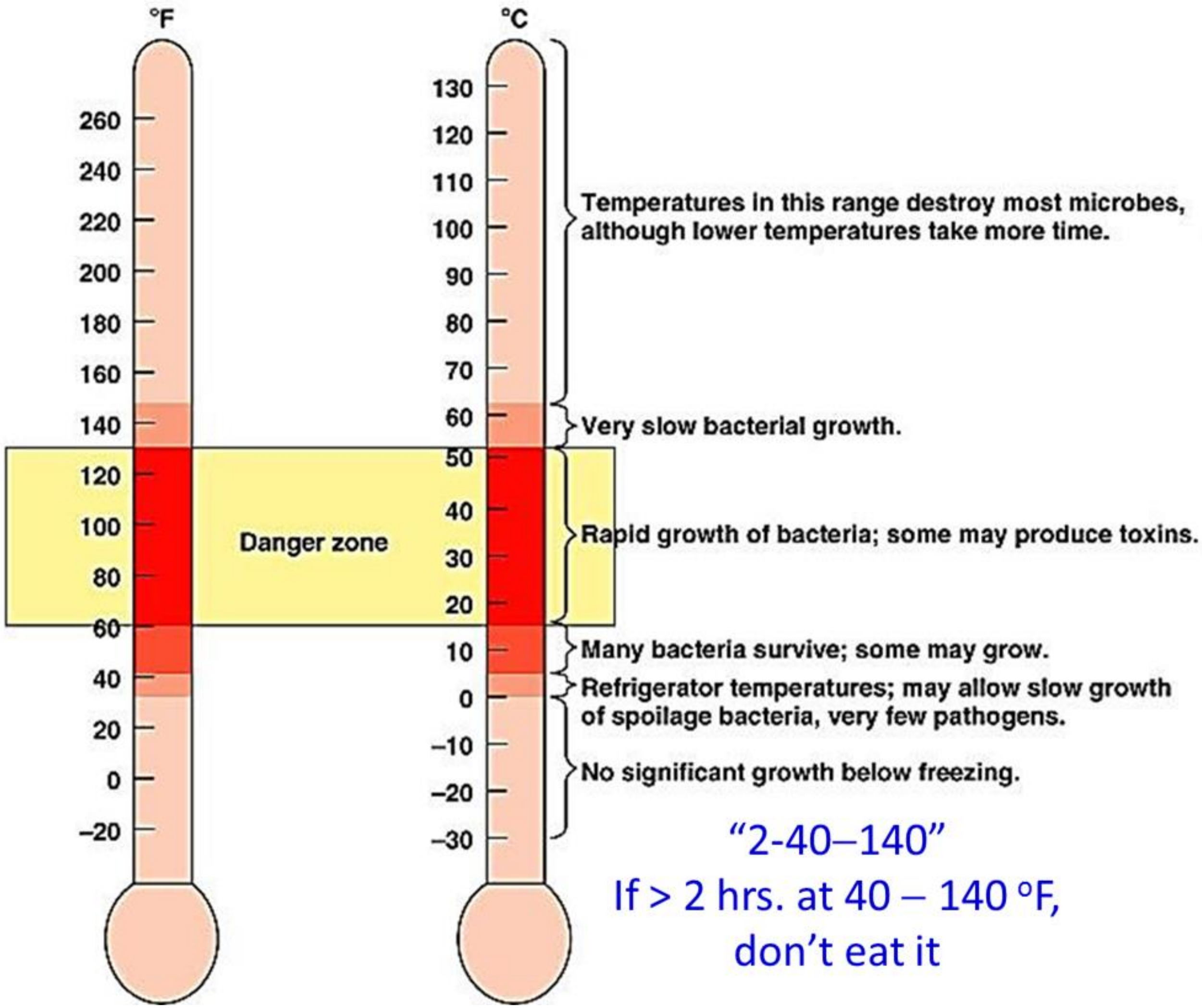
- Optimum temperature is the temperature at which an organism will grow at the most stable healthy rate.
- Optimum growth temperature is usually near the top of the growth range.
- Death above the maximum temperature comes from enzyme inactivation.
- Mesophiles (moderate temperature–loving) most common group of organisms.
- 40 °F (5 °C) slows or stops growth of most microbes.

Microbial Growth Control

Effect of amount of food on its cooling rate



Microbial Growth Control



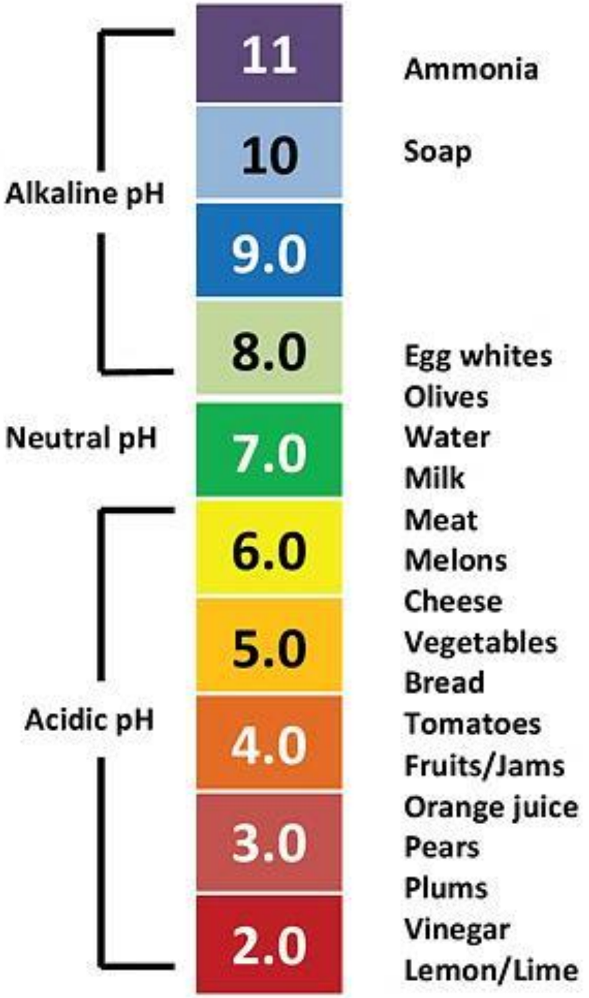
"2-40–140"

If > 2 hrs. at 40 – 140 °F, don't eat it

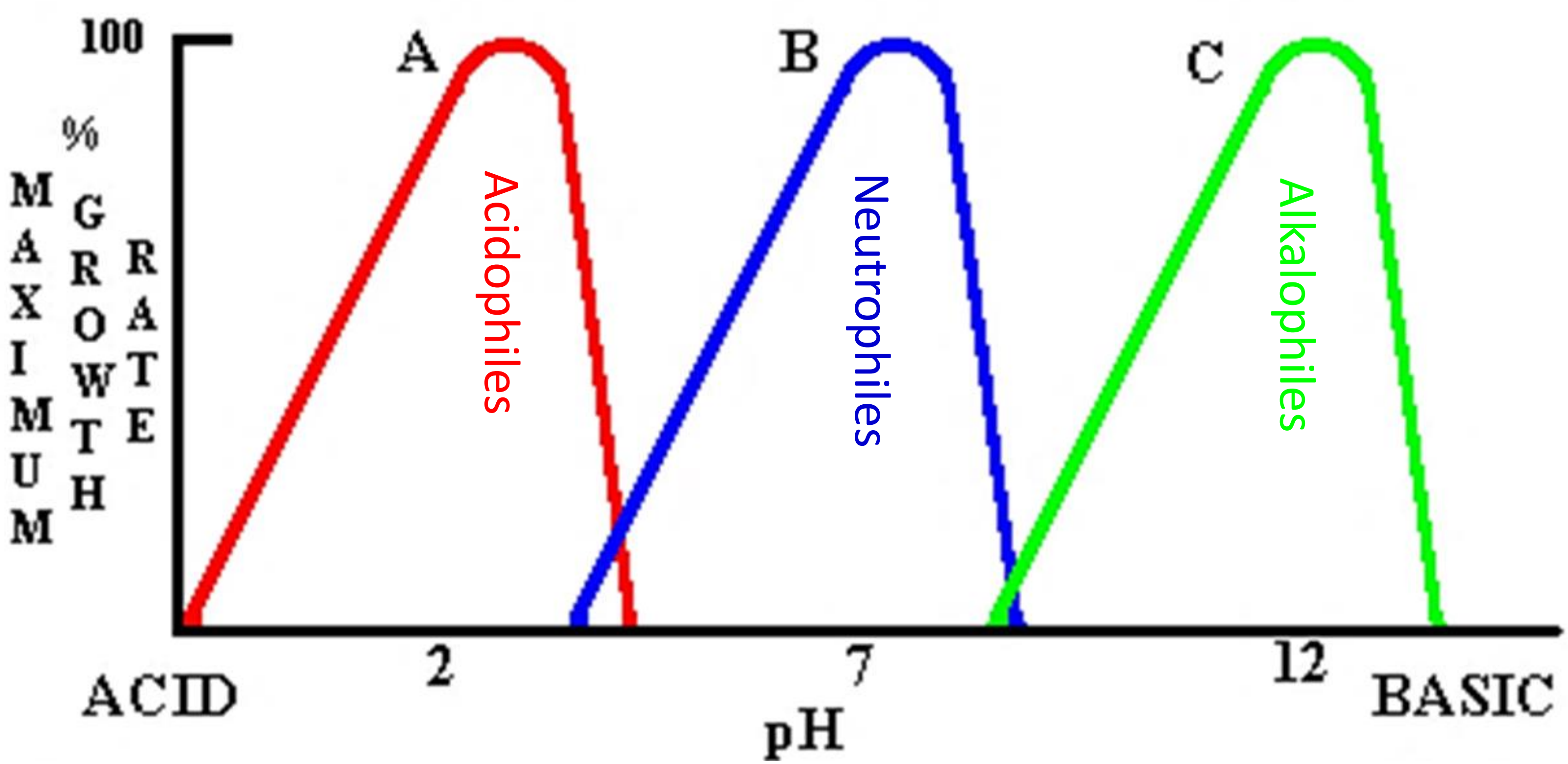
Microbial Growth Control

2– pH

- Using buffers in media.
- Molds, yeasts, versus and bacteria are highly affected by pH.
- Microorganisms have an optimal pH range at which growth is possible and an optimum pH at which growtl is at its highest.



Microbial Growth Control



- Most bacteria grow between pH 6.5 and 7.5.
- Molds and yeasts grow between pH 5 and 6.

Microbial Growth Control

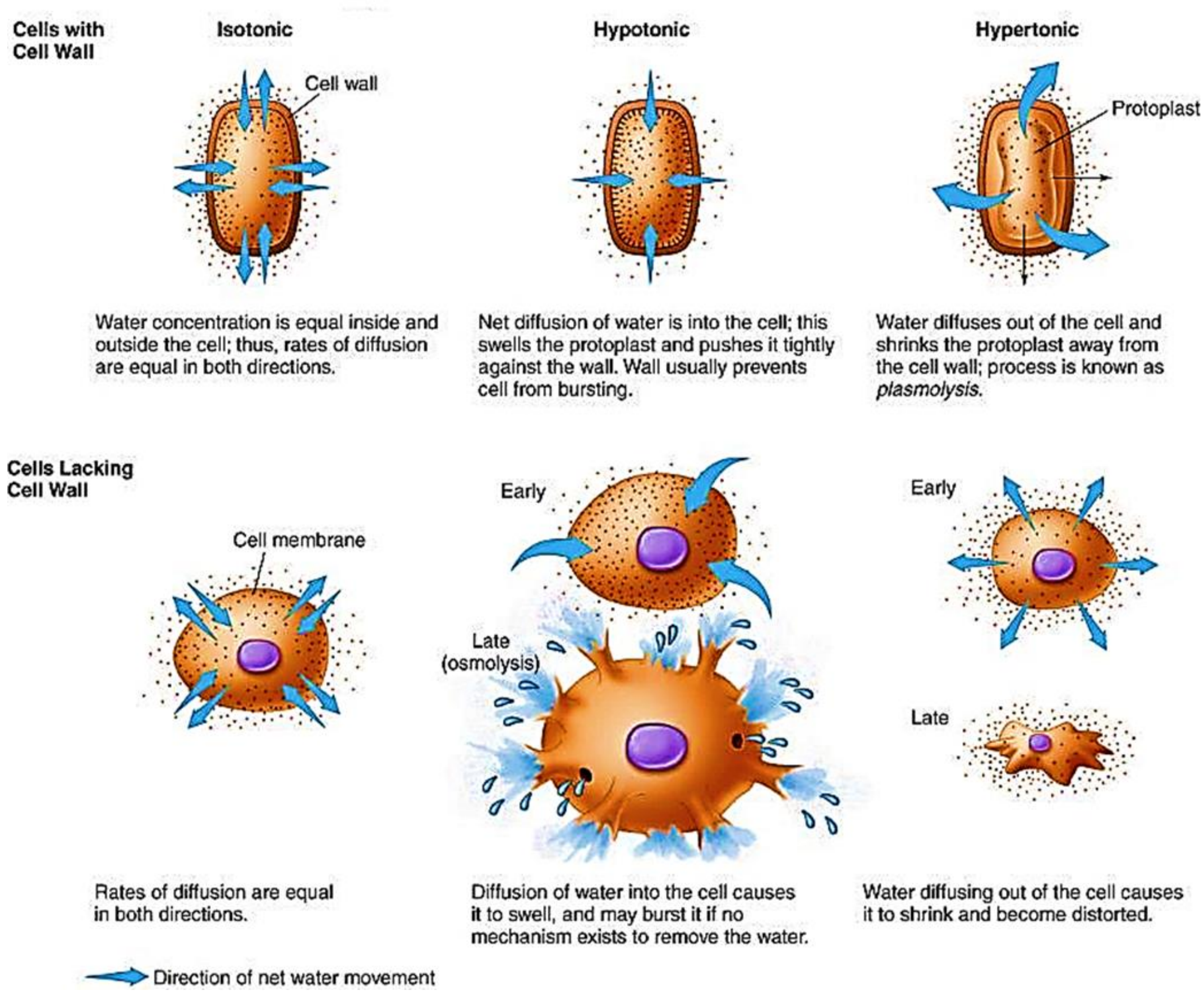
3– Osmotic pressure

- Microbial growth proceeds best when the osmotic pressure is ideal.
- Normally, the salt concentration of microbial cytoplasm is about 1%.
- If the external environment also has a 1% salt concentration, then the osmotic pressure is optimum.
- When the external salt concentration rise water will flow out and the microbes shrink.

Microbial Growth Control

- If exterior water is free of salt, it will flow into the cell and then swell and burst.
- Isotonic, hypotonic and hypertonic are known.
- Marine microorganisms can tolerate high salt concentrations (halophilic).
- Obligate halophiles require high osmotic pressure.
- Facultative halophiles tolerate high osmotic pressure.

Microbial Growth Control



Microbial Growth Control