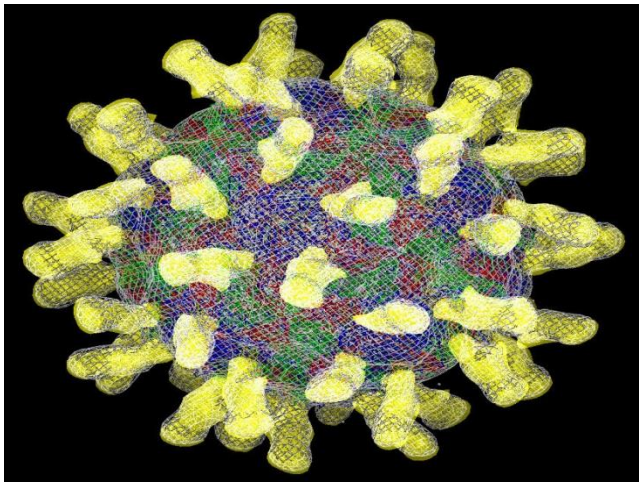
Chapter 20

Bacteria and Viruses!

Virus

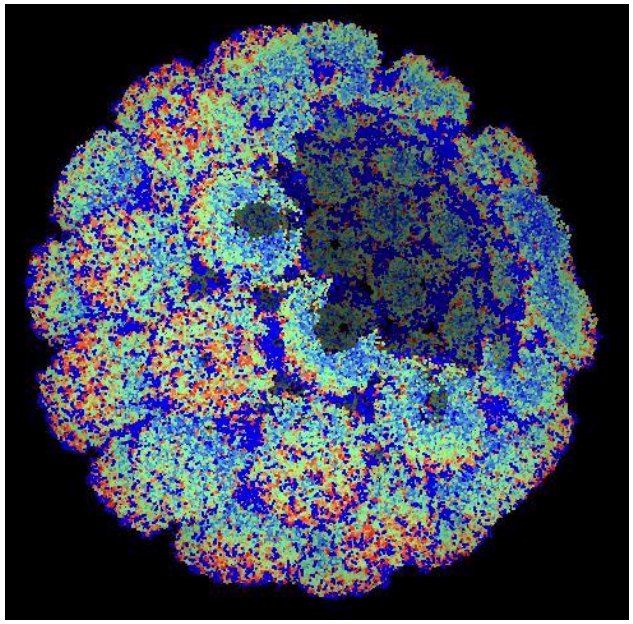
Latin for "poison"



A **virus** is a <u>particle</u> that can only be seen with an <u>electron microscope</u>.

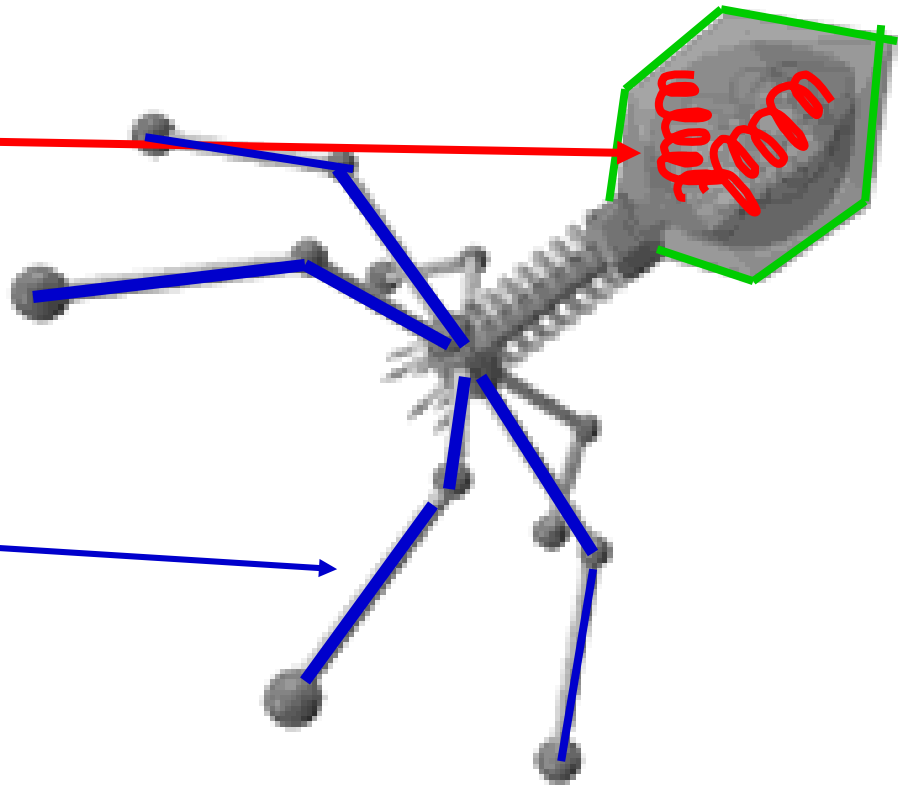
Viruses are not cells and are not made-up of cells. They don't…

- Contain a nucleus or cytoplasm
- Eat
- Grow
- Carry on respiration
- Or reproduce on their own



A virus is surrounded by a **capsid** (protein coat) which determines the shape of the virus.

The capsid contains **nucleic acids** (either DNA or RNA).

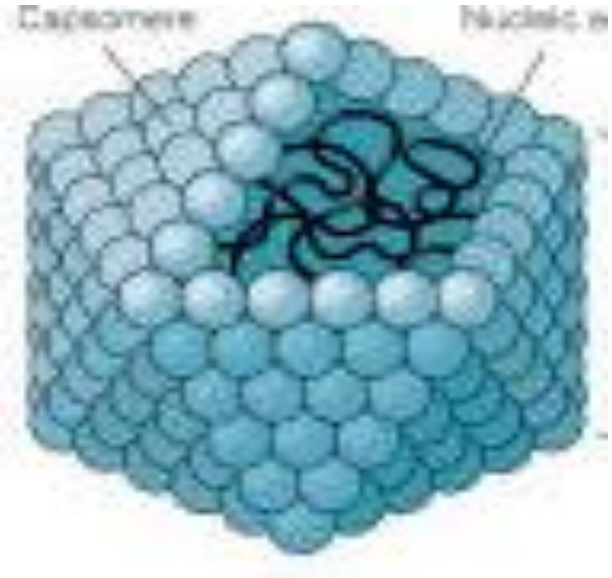


Tail fibers

for attachment to host cell.

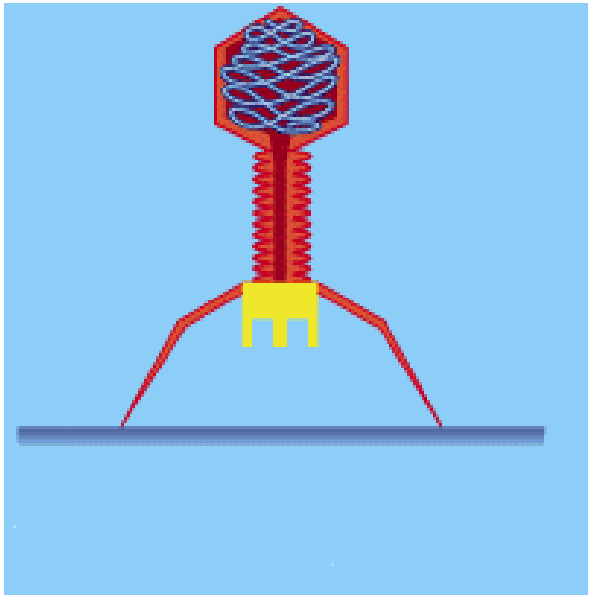
Viruses are classified by:

- **type of host cell**
- **presence of DNA or RNA (retroviruses)**
- **shape:**



Polyhedral

Binal



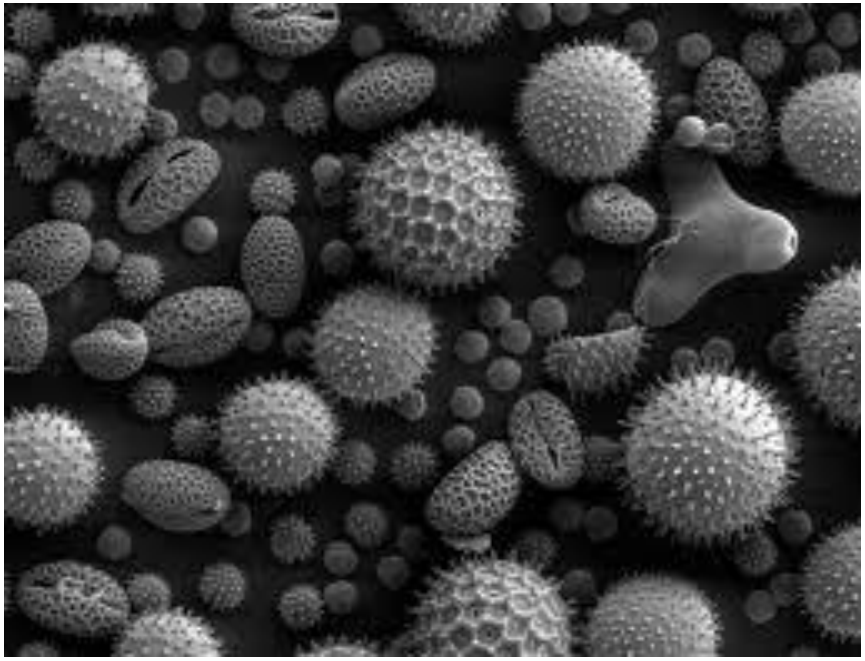
Filo

Examples: VIRAL DISEASES

Disease	Transmission	Symptoms
AIDS/HIV	Sexual contact; contaminated blood or needles	Immune system failure; fatal
Common Cold	Inhalation, direct contact	Sinus congestion, muscle aches, cough, fever
Smallpox	Inhalation	Blisters, lesions, fever, blindness, scars; often fatal
Influenza (Flu)	Inhalation	Headache, muscle ache, sore throat, cough, fatigue, fever, chills
Warts	Direct contact	Lumps on skin or mucus membranes
Herpes	Direct contact	Open sores on mucus membranes

Viral Habitat = EVERYWERE
No energy use required.

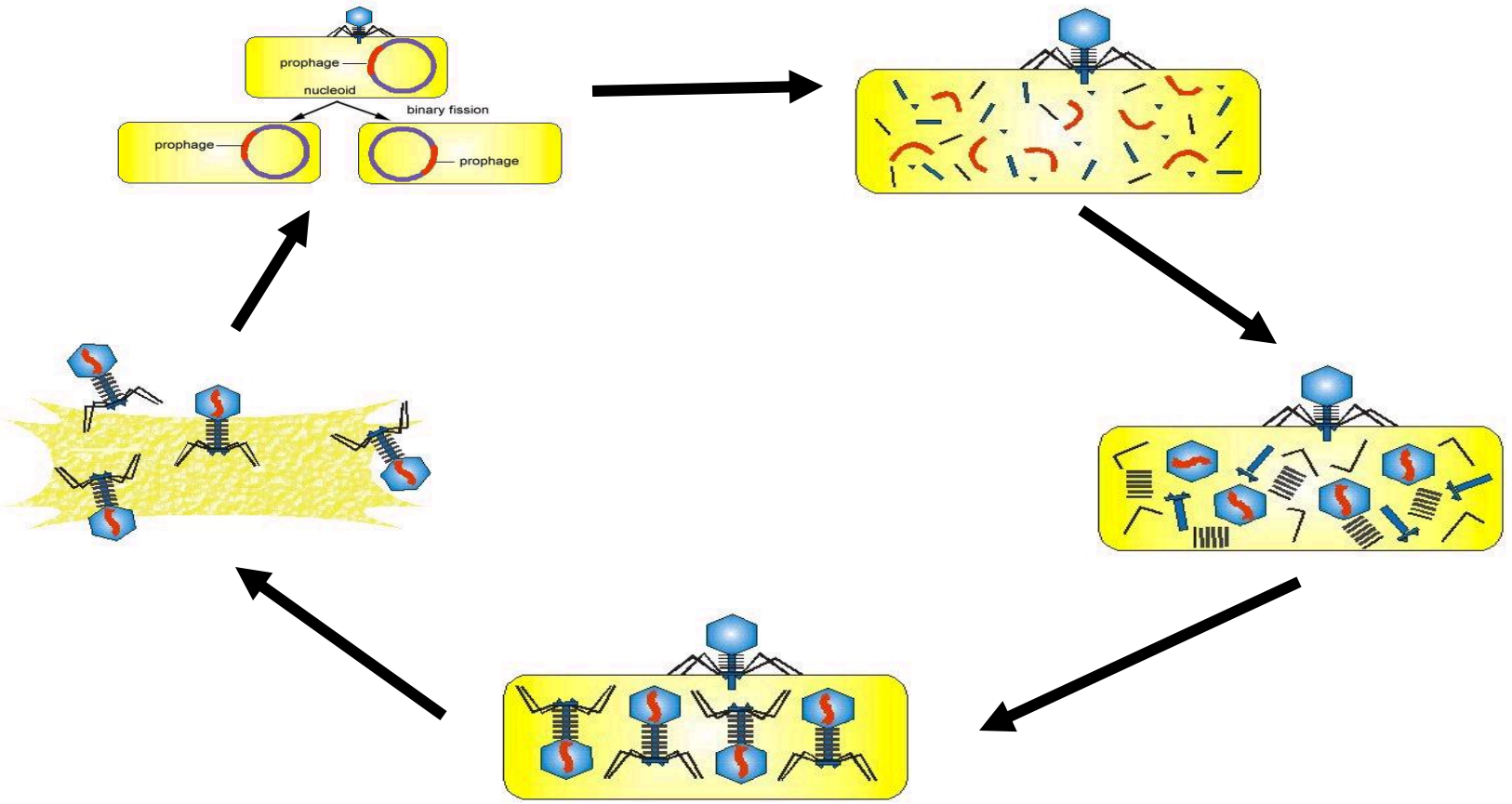
- lay dormant for years
- Some hide in a vector or reservoir host animal then spread to other animals
- Because they are non-living, they don't require energy or air



VIRAL REPLICATION

Viruses replicate in one of two ways:

- Lytic
- Lysogenic



Viral Reproduction always requires a host—cannot reproduce on their own.

LYTIC CYCLE:

Virus infects a host cell, hijacks its reproductive pathways and makes copies of itself.

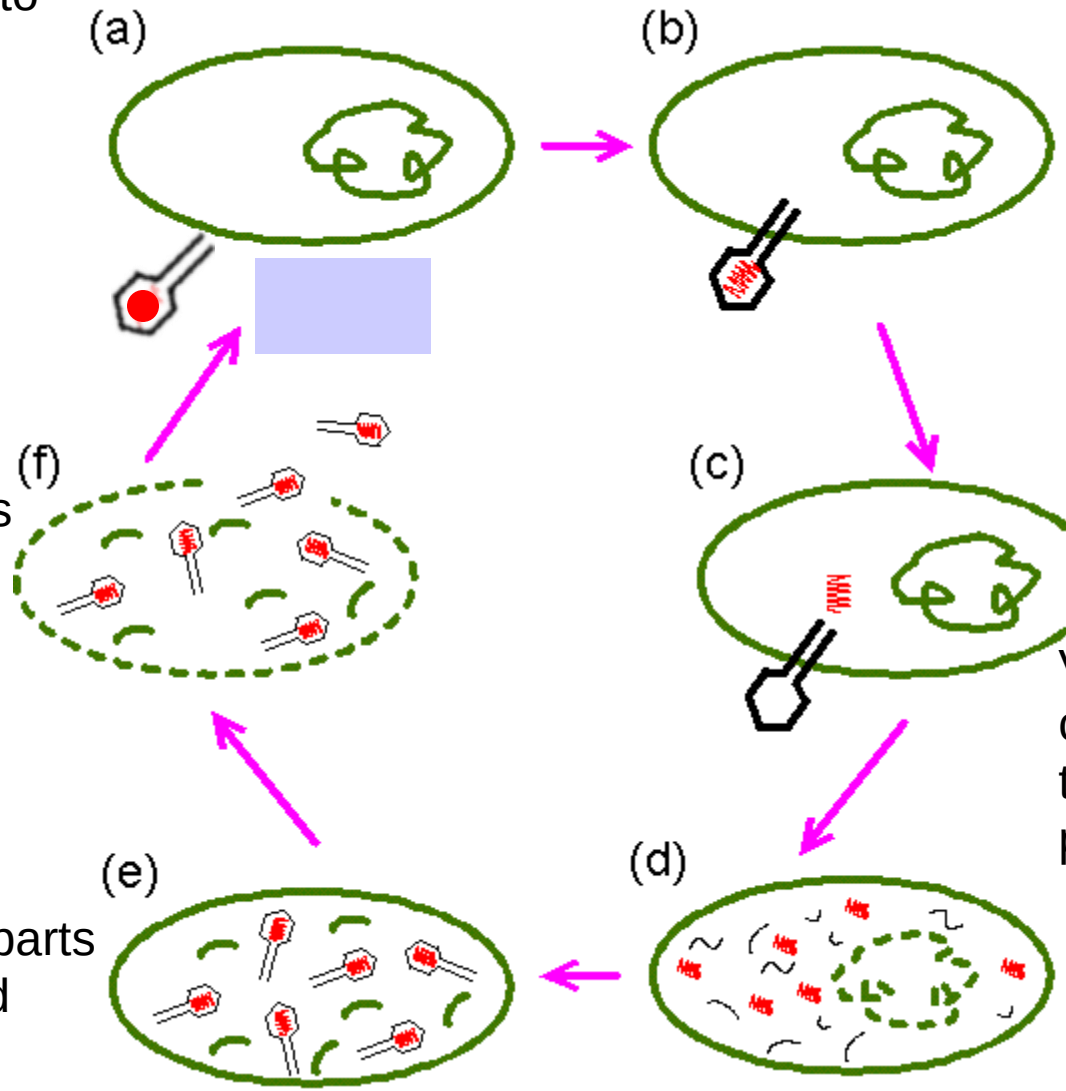
Bursts out, killing the host.

LYSOGENIC CYCLE:

- **Does not begin immediately**
- **Viral DNA (*called a prophage)* attaches to the host cell's chromosomes – lies dormant.**
- **Environmental stimulus sends viral DNA into lytic cycle.**

LYTIC CYCLE

Virus attaches to host cell.



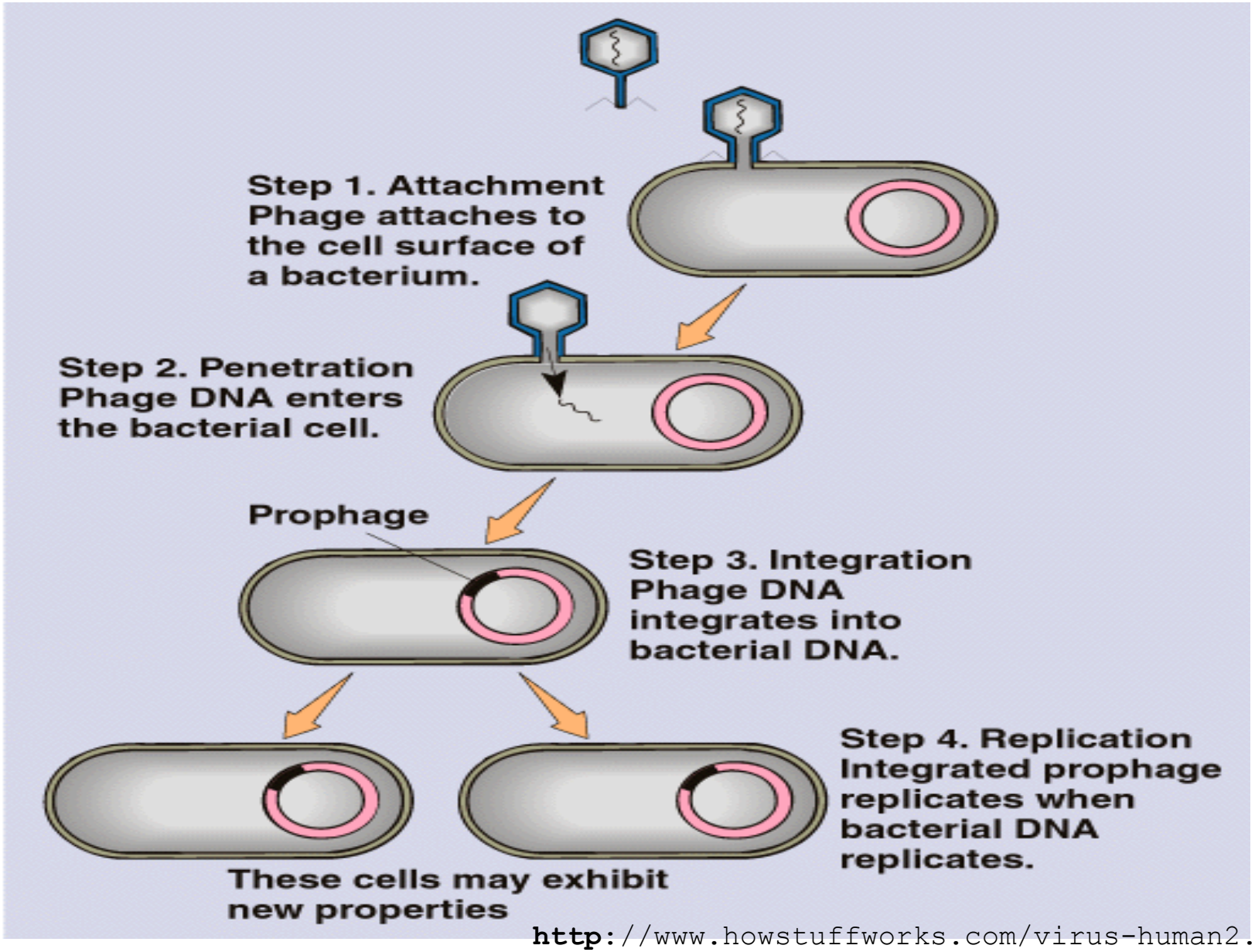
Virus injects its DNA

Virus DNA commands host cell to make new viral parts

New viral parts assembled

Cell *lyses* (breaks apart) and new viruses are released

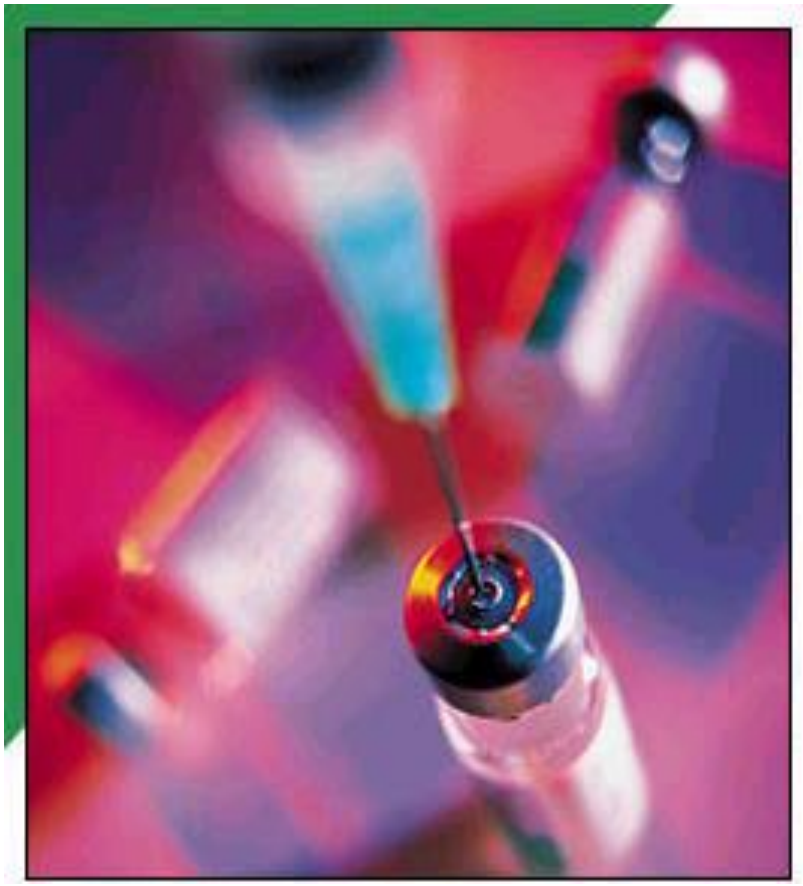
LYSOGENIC CYCLE



http://www.howstuffworks.com/virus-human2.htm

Human Concerns:

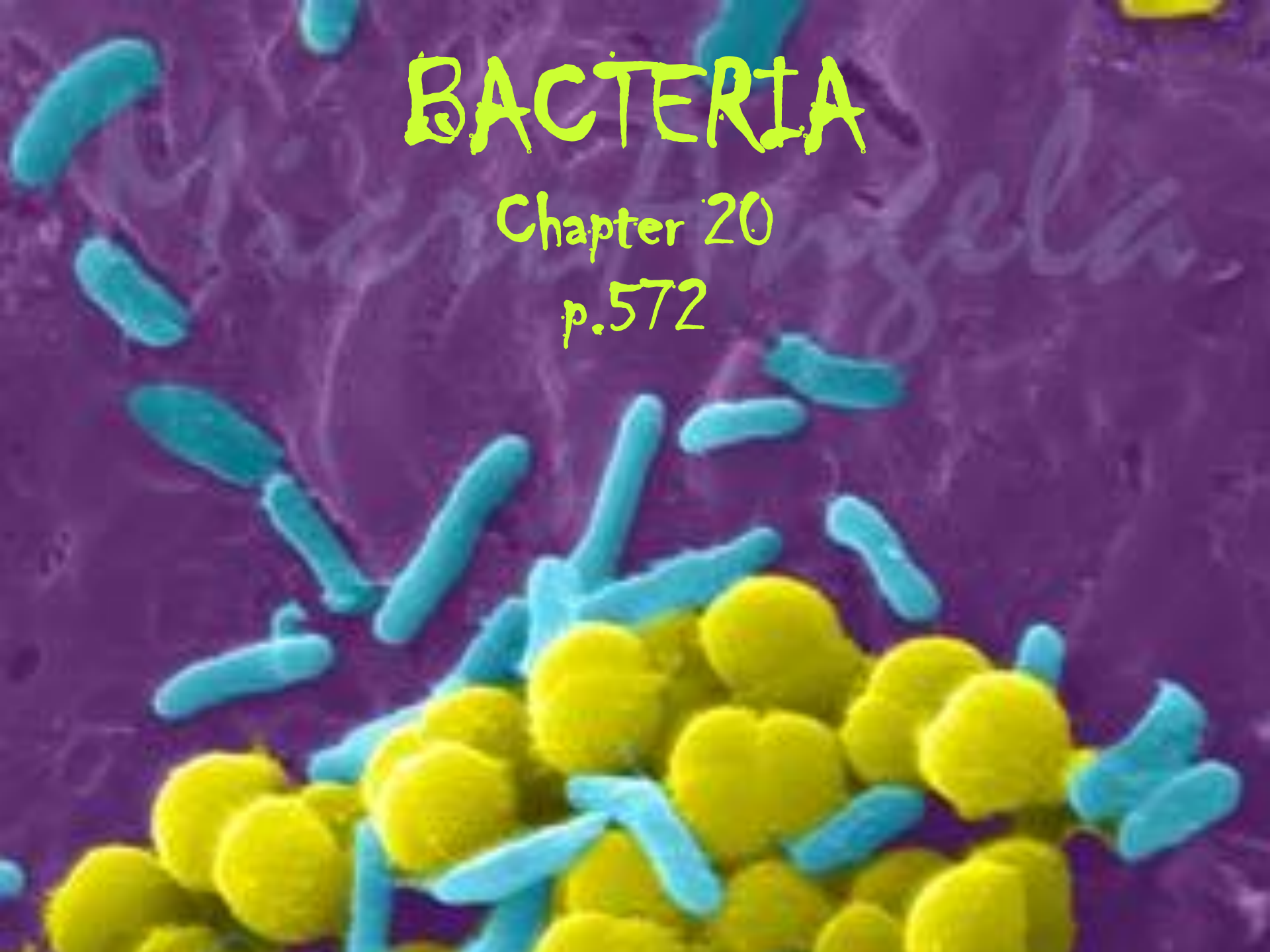
Most viruses have **NO** cure (Influenza, & HIV), but some viruses like Small-pox have vaccines.



Vaccines contain a weakened or killed virus that provides immunity to the disease.

How do viruses spread?

- 1918 Influenza Pandemic: http://www.youtube.com/watch?v=rbYwNOcKqqc&feature=related
- NPR animation: http://www.youtube.com/watch?v=Rpj0emEGShQ&feature=related


BACTERIA
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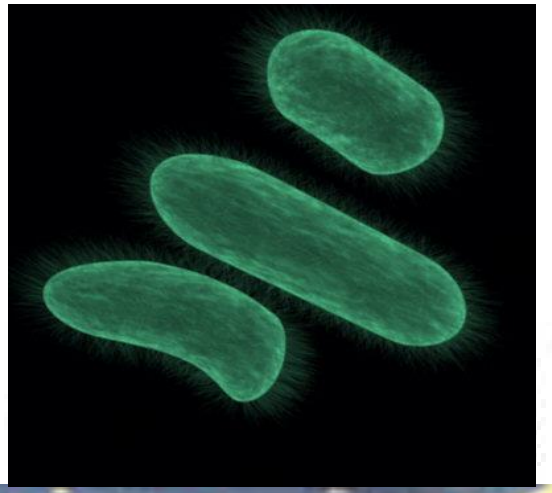
Characteristics of Bacteria

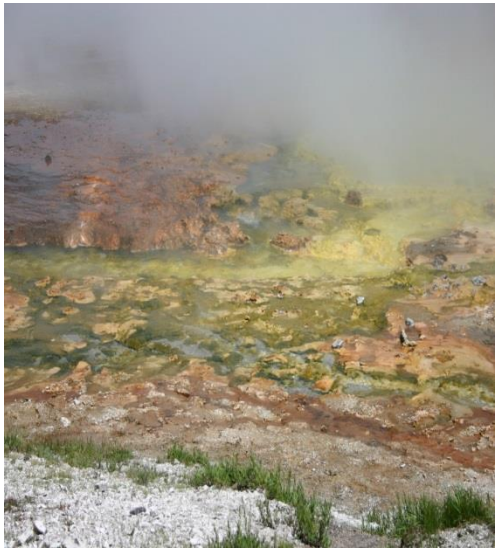
- Size: **Small**
  - few micrometers (um) long
- Cell Type: **Prokaryotic**
- Body Type: **Unicellular**
- Found: Everywhere!!
- Are they bad?
  - Many Cause Disease
  - Many are Useful



Archaebacteria vs. Eubacteria

Archaebacteria

- Are ancient.
- Lack peptidoglycan.
- Live mostly in harsh environments
  - Salty lakes
  - Thick mud
  - Deep ocean vents
  - Guts of animals

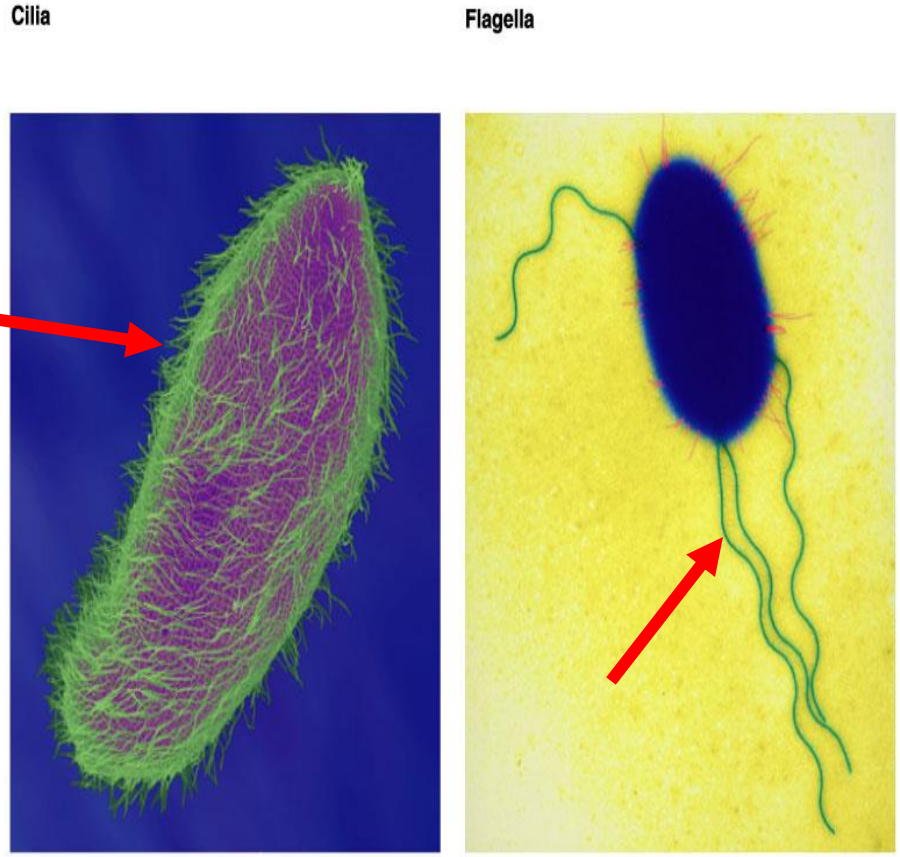


Eubacteria

- Considered "true bacteria"
- Have peptidoglycan.
- Live almost everywhere.

Characteristics Continued

- Body Structure:
  May have **flagella (whips) or cilia (hairs)**



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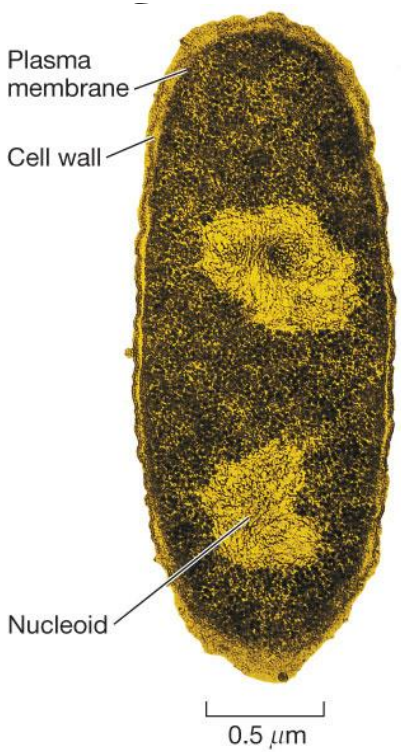


- Have a cell wall
  May contain **peptidoglycan**
  (a sugar & protein

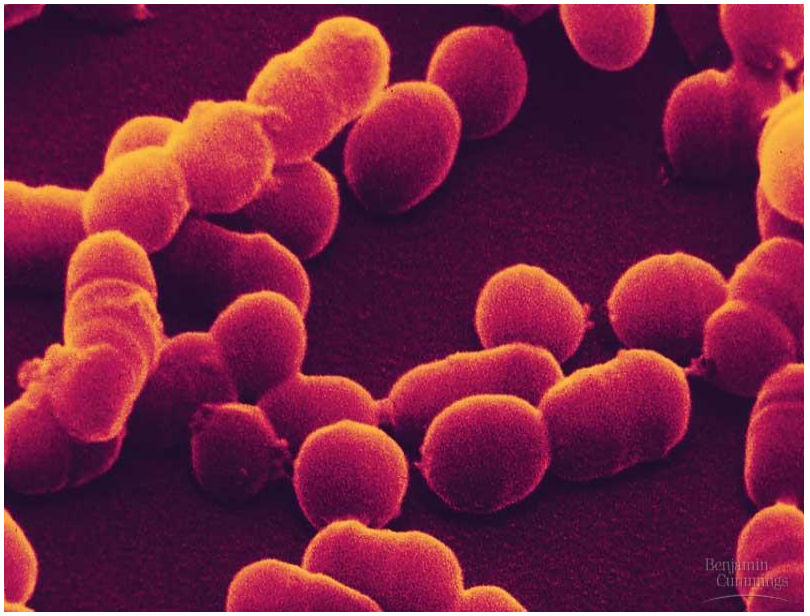
Characteristics Continued

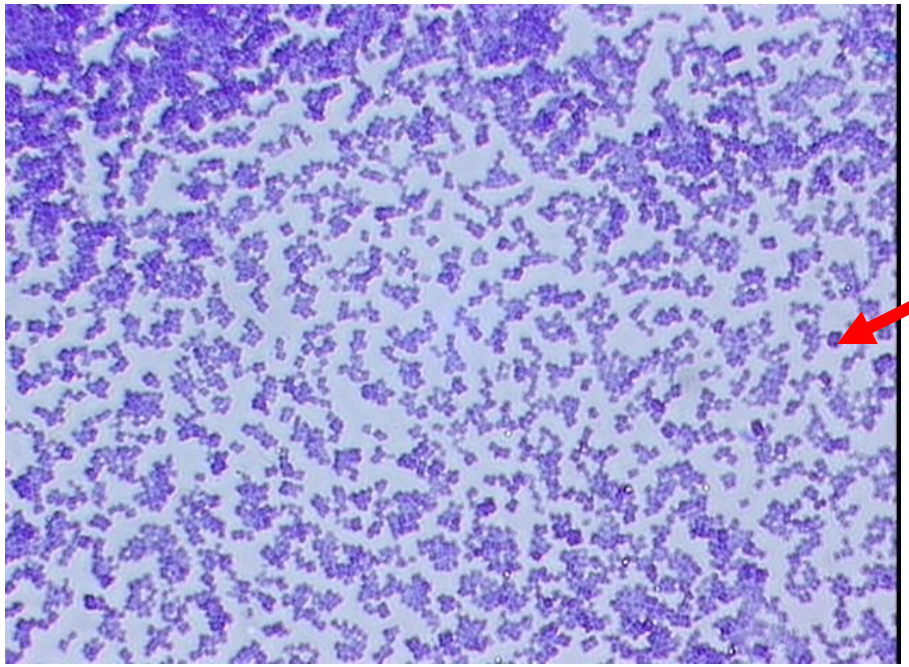
3 Possible Shapes:

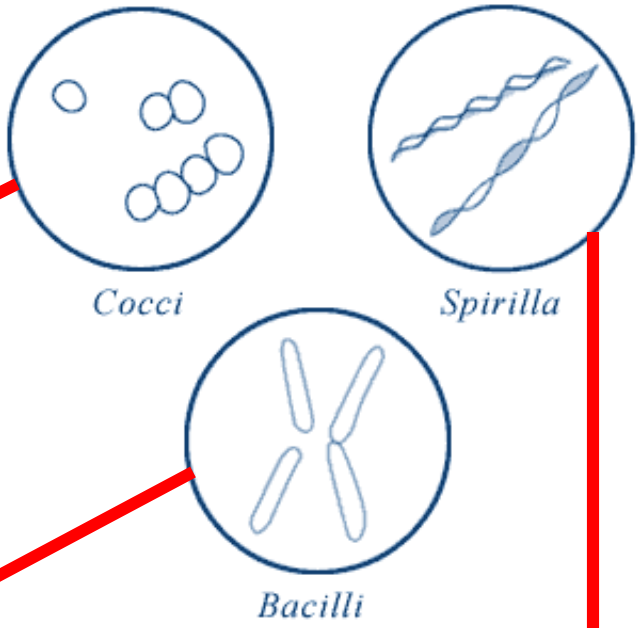
Coccus (Cocci)- round

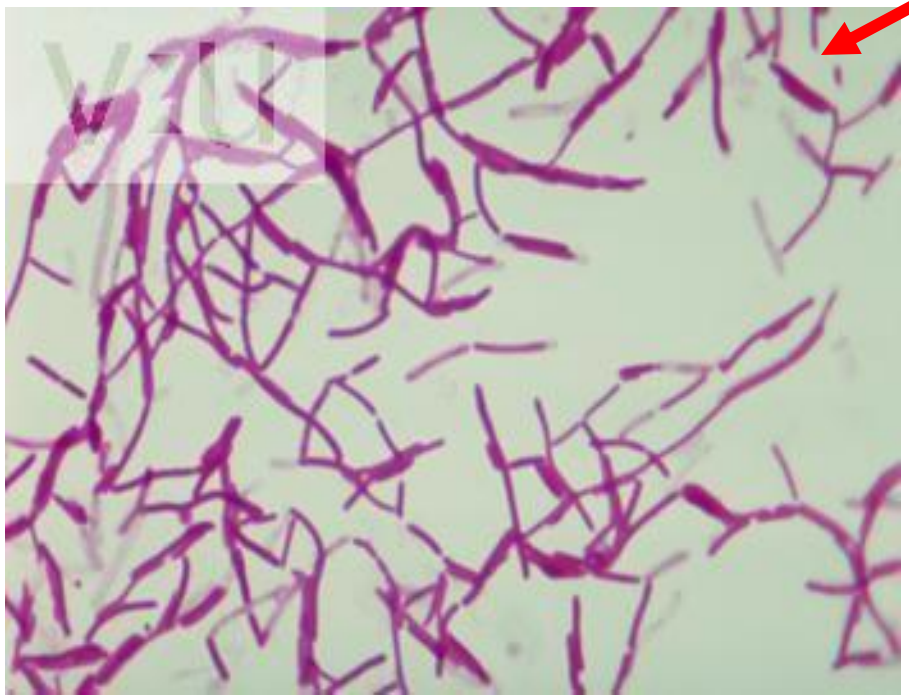
Bacillus (Bacilli)- rod shaped

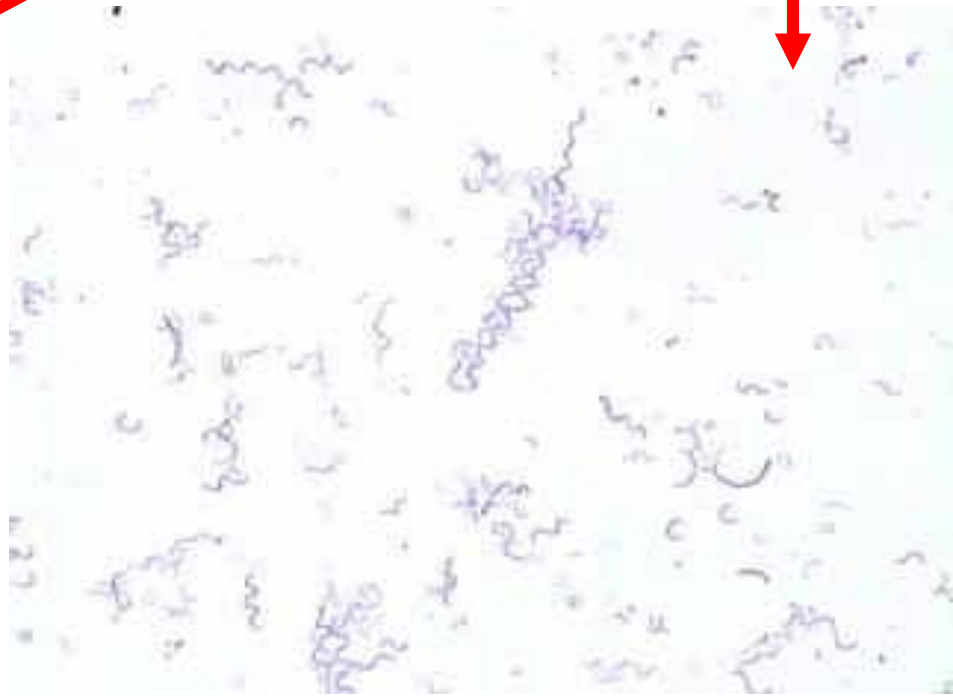
Spirillum (Spirilla)- spiral





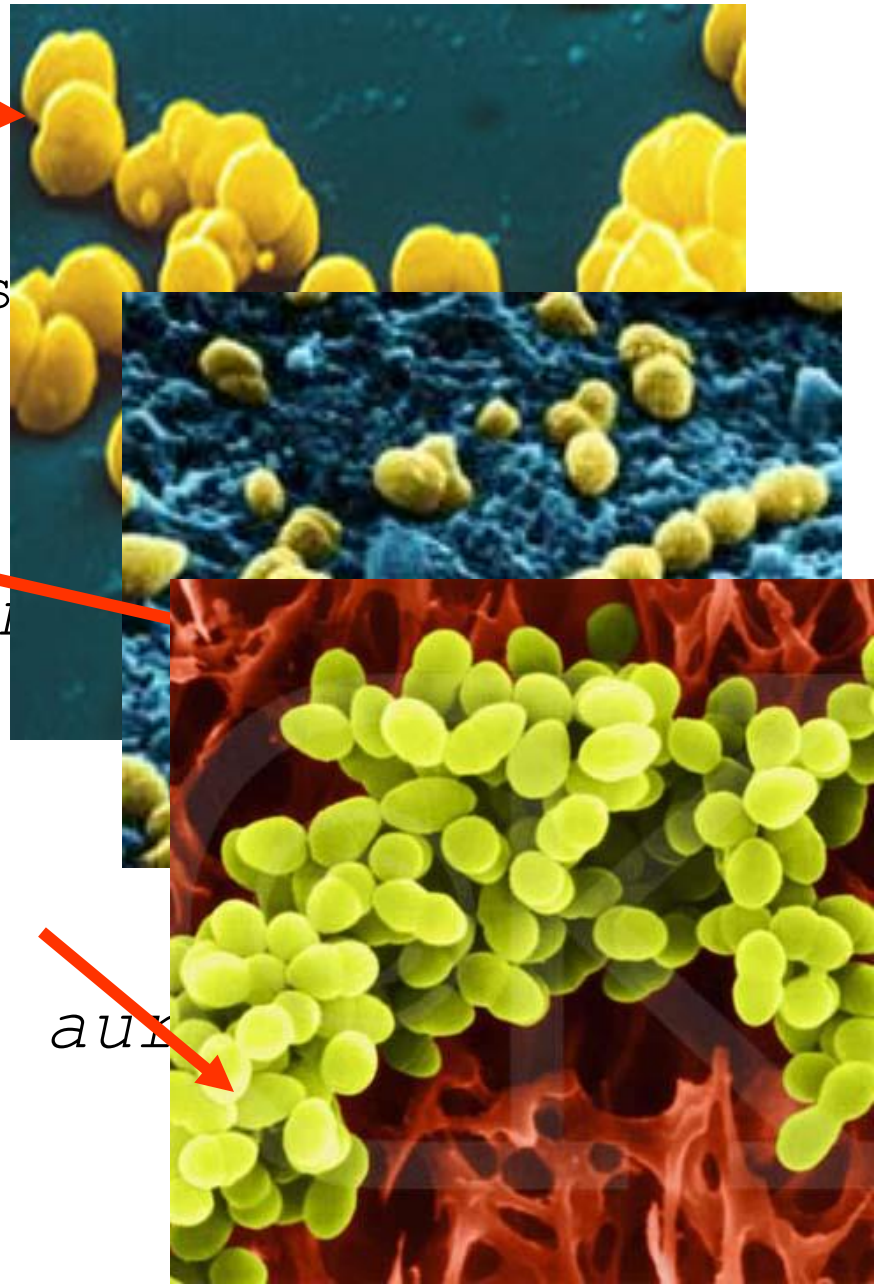

Cocci
Spirilla
Bacilli





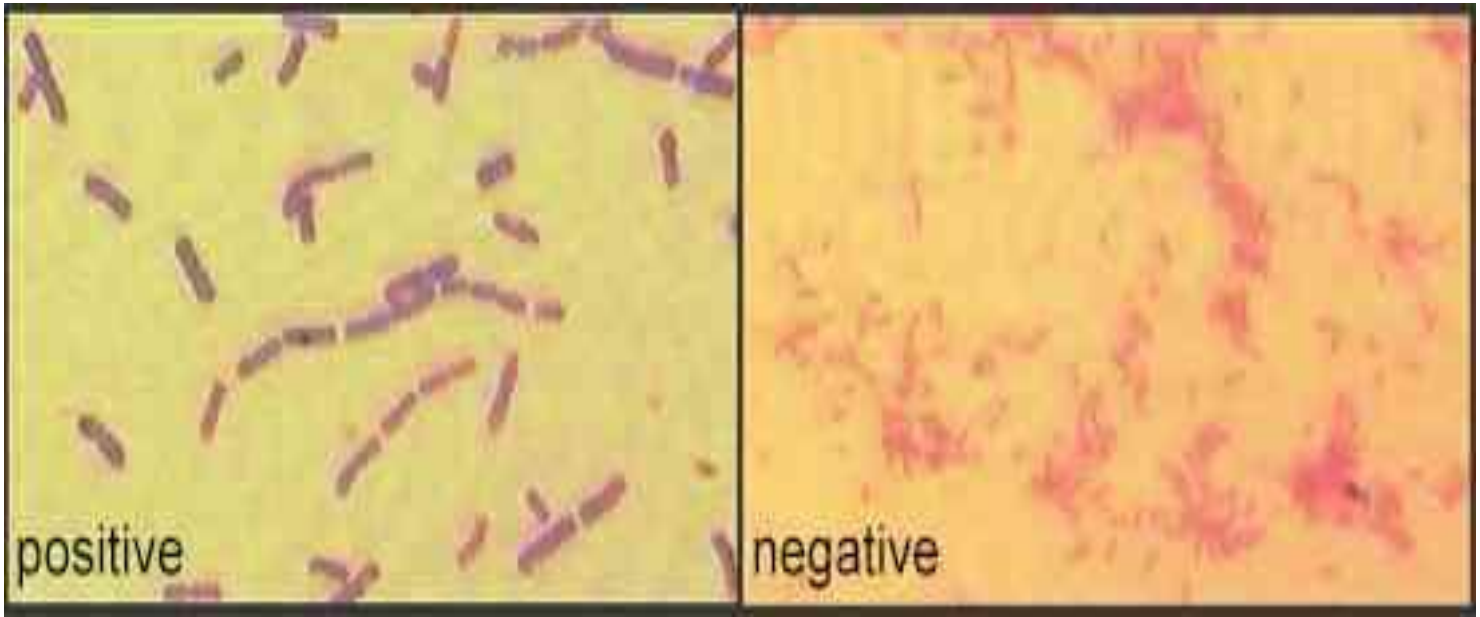
Prefixes Used to Describe & Identify Bacteria:

- Diplo = 2
  - *Neisseria meningitidis*
  - (aka diplococcus
- Strepto =chain
  - *Streptococcus pneu*
- Staphylo =clumps
  - Ex: *Staphylococcus au*



http://www.kimicontrol.com/edu-e.html

- **Gram Staining** - used to identify bacteria with extra membranes
  - Extra membrane helps them to better resist damage.
  - Gram **+ stain purple** (have peptidoglycan)
  - Gram **– stain red** (extra membrane)

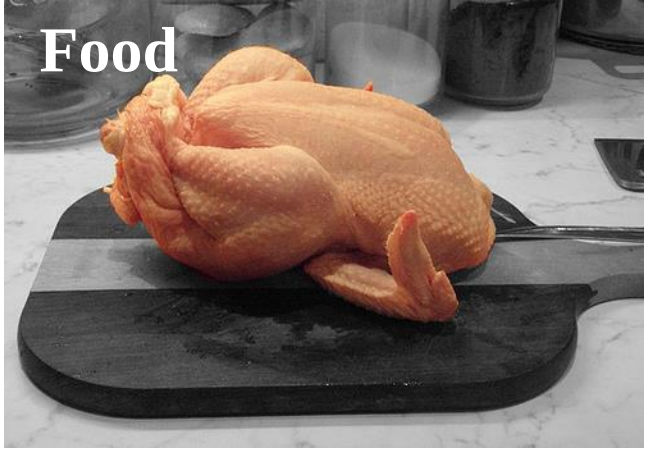


Archaea

Deep Ocean Vent

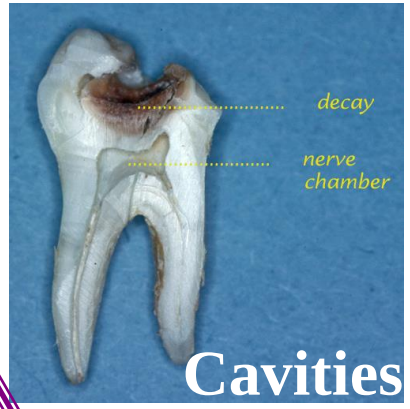
Hot Spring Pool @ Yellowstone

Food



Compost

Eubacteria



Cavities

Sources of Energy

- Can be autotrophs or heterotrophs

-*Autotrophs*:

Photoautotrophs - use light to make food

ex: *Cyanobacteria* (blue-green algae)

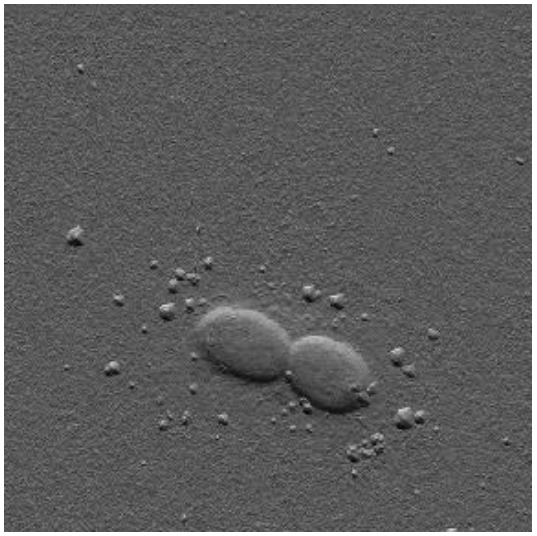
Chemoautotrophs -use chemical to make food

ex: *Anabaena* (nitrifying bacteria)

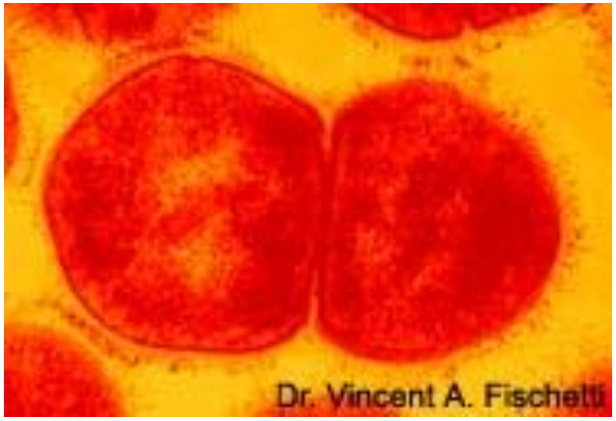
-*Heterotrophs*:

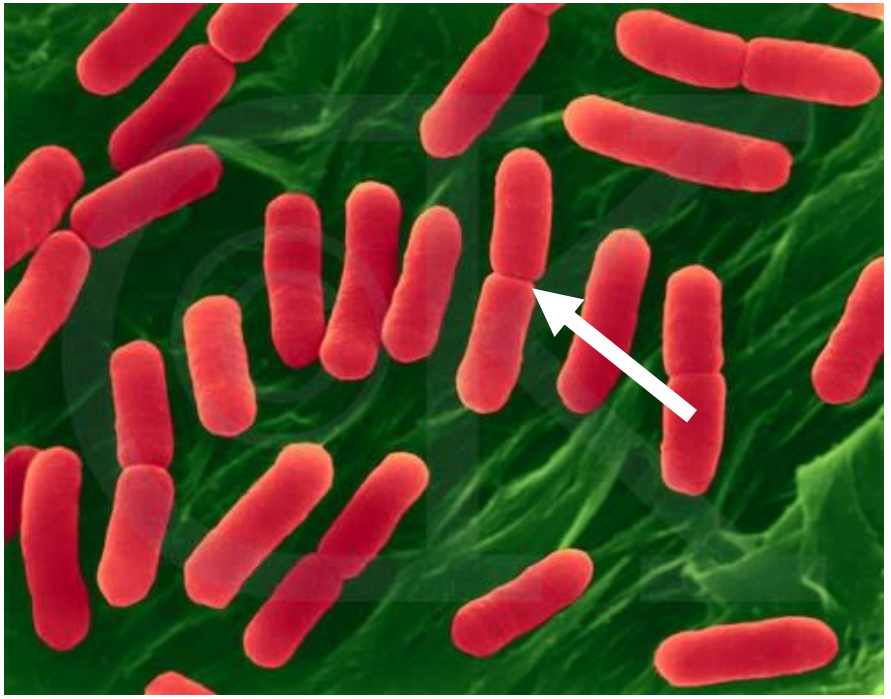
* Chemoheterotrophs - require nutrition; no photosynthesis (includes many parasites)
* Photoheterotrophs - photosynthetic; but also require nutrition

Growth & Reproduction

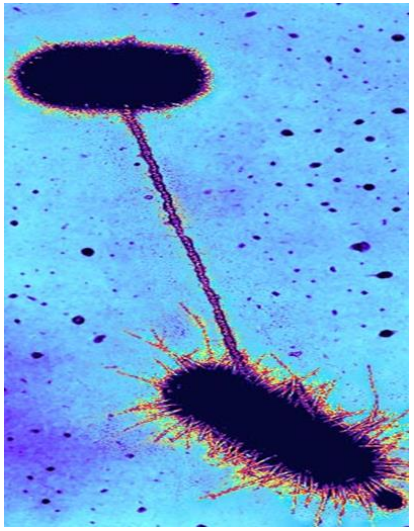


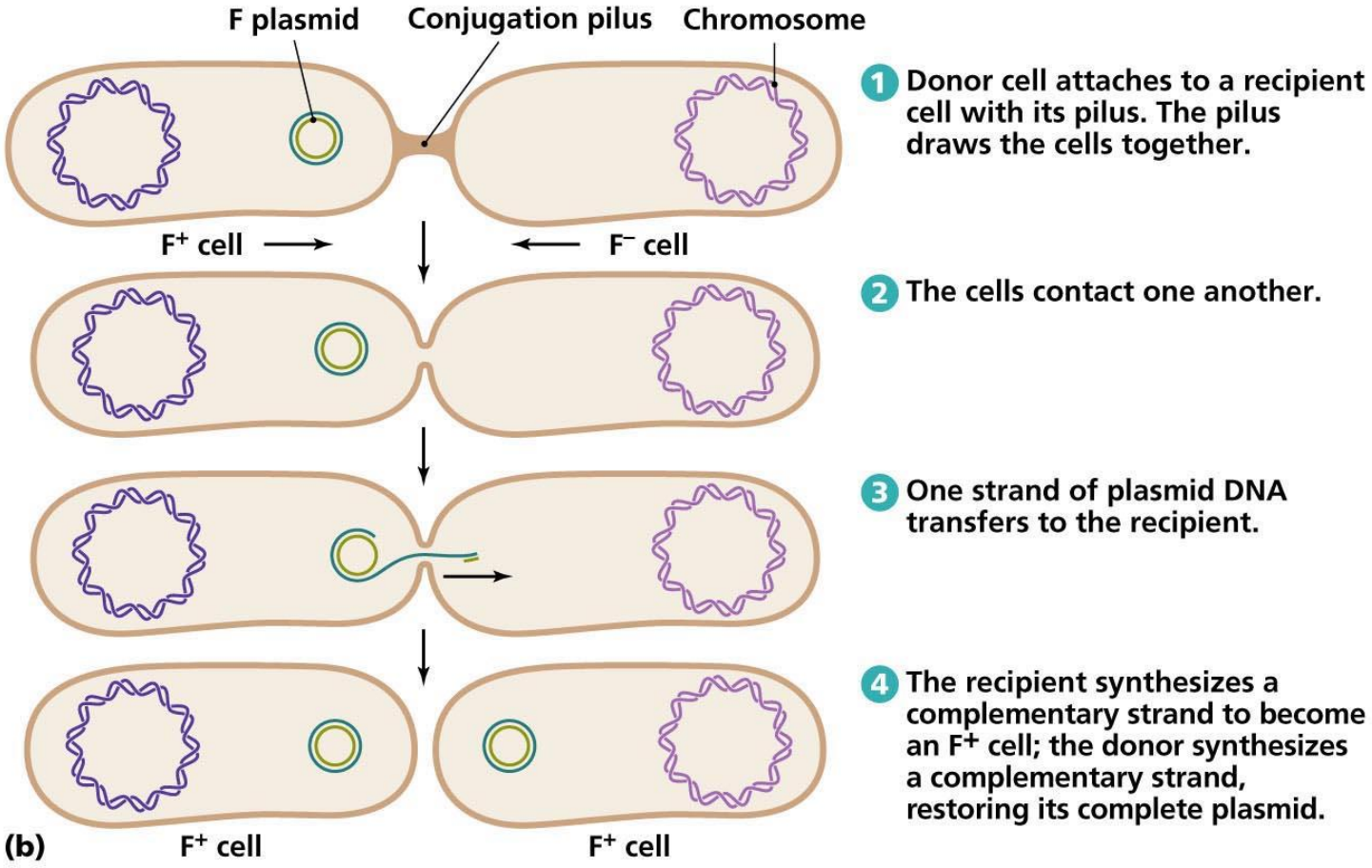
- They can reproduce in 3 ways:
  - **1. Binary Fission**: splitting in half





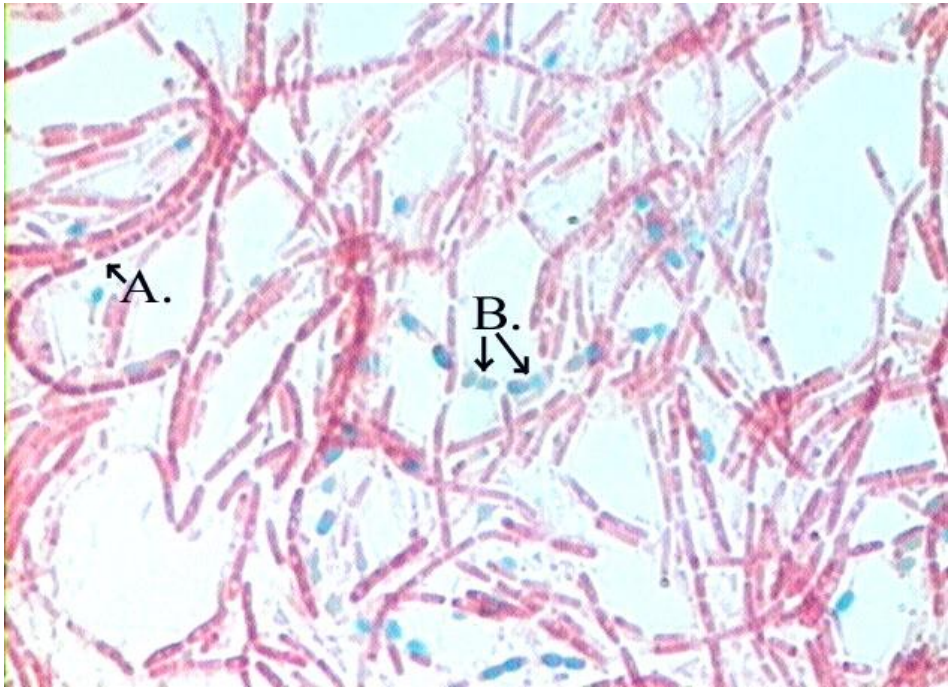
2. Conjugation: swapping genes over a bridge between two bacteria

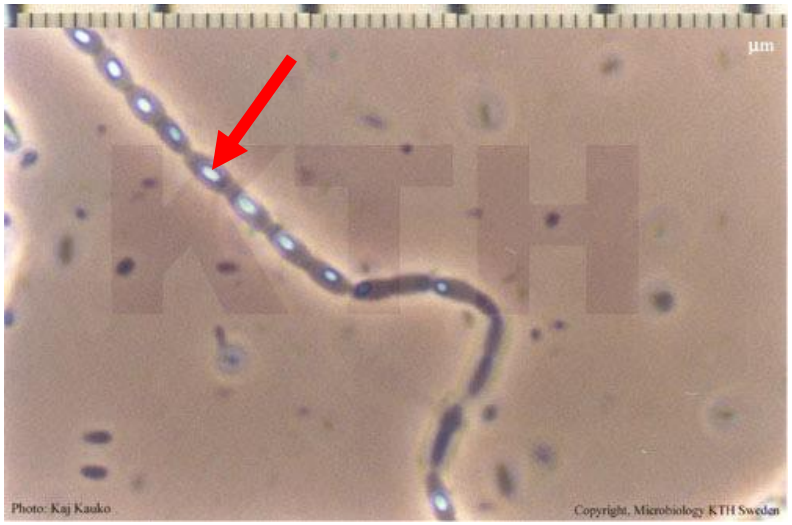




1. Donor cell attaches to a recipient cell with its pilus. The pilus draws the cells together.
2. The cells contact one another.
3. One strand of plasmid DNA transfers to the recipient.
4. The recipient synthesizes a complementary strand to become an F^+ cell; the donor synthesizes a complementary strand, restoring its complete plasmid.

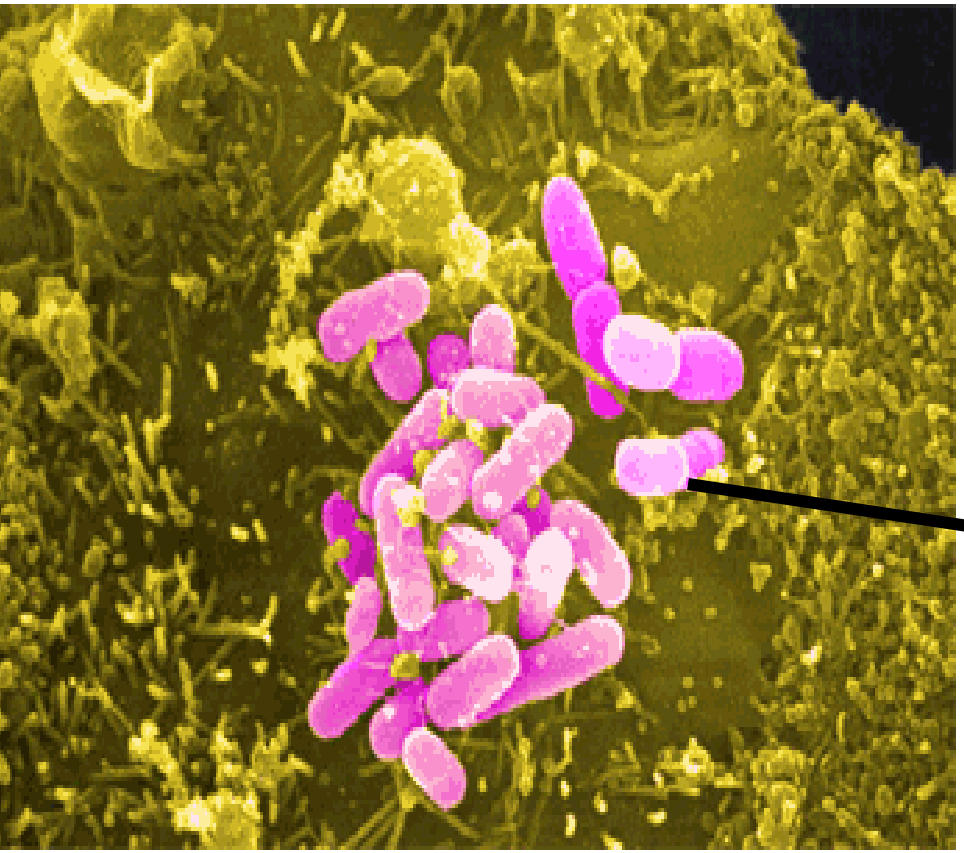
3. Spore Formation- endospores form so that bacteria can remain dormant in harsh conditions and then germinate when conditions become favorable

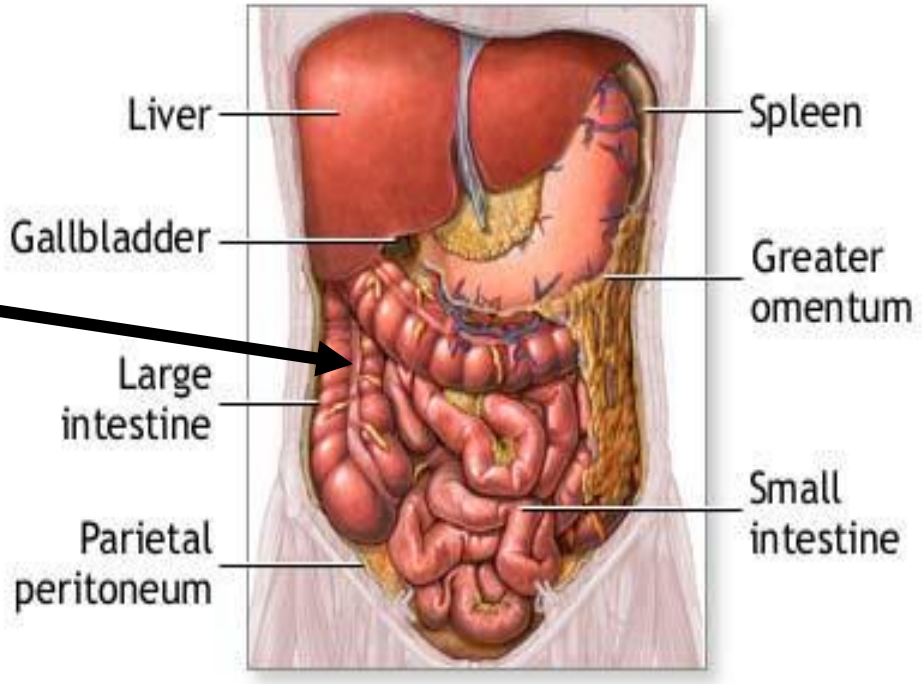




Symbiotic relationships (Mutualism):

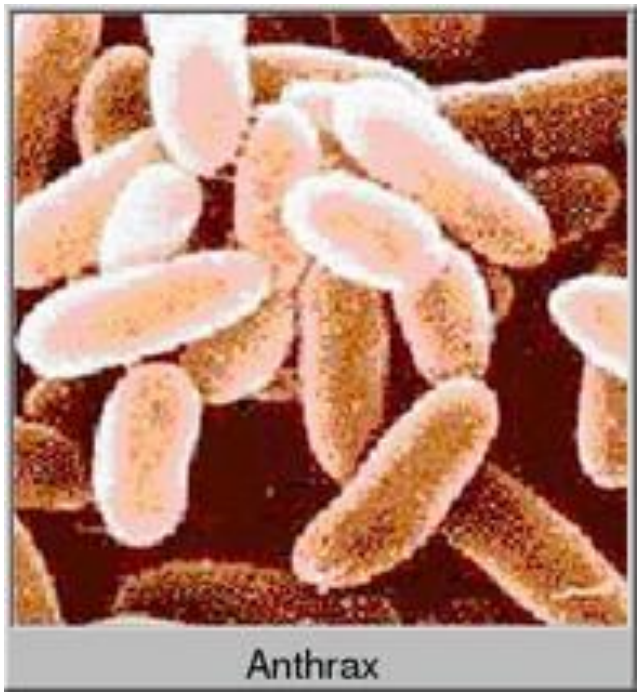
- *E. coli* in the intestines aid in digestion and produce vitamins in exchange for food and a warm home.

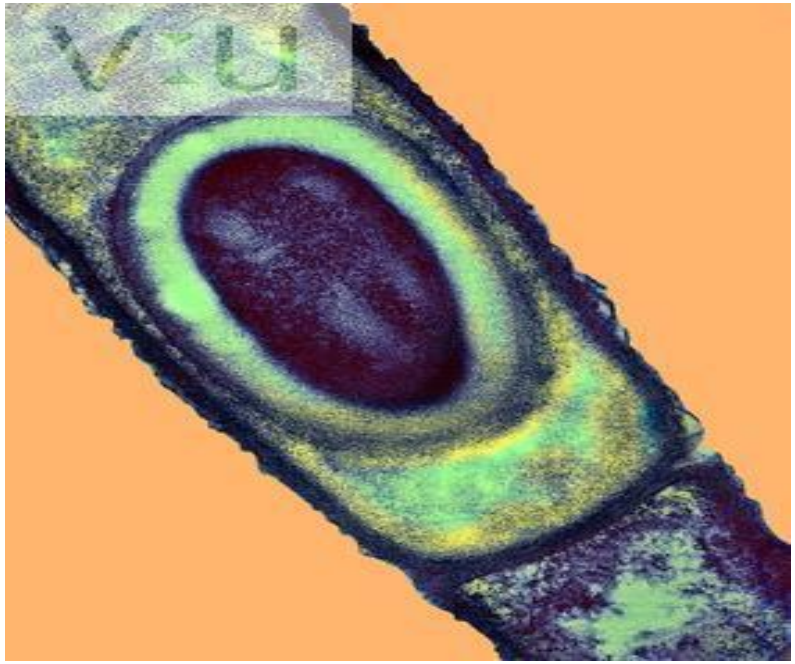




Biowarfare: Anthrax

- *Bacillus anthracis*
  - Commonly known as anthrax
  - Lives in the soil and forms spores
  - Can be fatal





Importance of Bacteria

- Decomposers
- Nitrogen Fixation
- Photosynthesis (oxygen)
- Oil spill clean up
- Digestion aid & vitamin production
- Foods such as cheese and yogurt
- Medicines
- Biowarfare

Careers with Bacteria

- **Microbiologist** - studies and cultures bacteria
- **Epidemiologist** -Study infectious diseases and how they spread.
- **Food Safety Inspector-** check slaughtered animal carcasses for disease or bacteria