

Microbiology

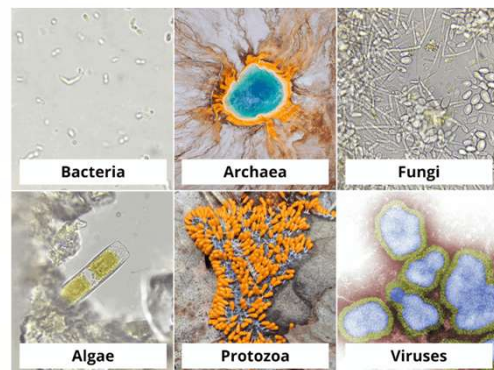


MYSTIC
AQUARIUM

PROTECT OUR
OCEANS

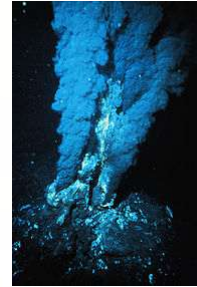
What is microbiology?

- The study of microbes:
 - Bacteria
 - Viruses
 - Fungus
 - Other microscopic organisms
- Microbes can be symbiotic
- Symbiotic relationships might be:
 - parasitic (live at the expense of the host)
 - mutualistic (host and organism both benefit)
 - commensal (organism does not harm host)



Bacteria, fungi and viruses are *everywhere*!!

- Environment:
 - Soil, air, water
 - Ex. Thermal vents-"thermophiles"- hot springs, volcanos, composting
- On and in animals; *and us*!
 - Skin
 - Respiratory tract
 - Mouth, stomach, intestines, and more...



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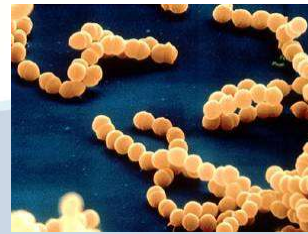
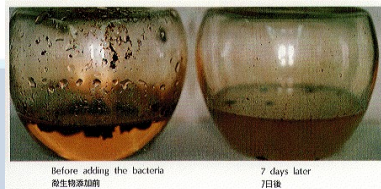
Thermophile: Thiocystis

<http://en.wikipedia.org/wiki/File:Nur04506.jpg>



What are bacteria?

- Microscopic living organisms with many functions including....
 - Helping digestion
 - Protecting against invasion by other microbes
 - Clean up and break down organic debris (including oil!)
 - And many, many more...



<http://www.google.com/url?source=images&ct=ref&q=http://microbewiki.kenyon.edu/index.php>



Bacteria are everywhere!!!!

“Good” bacteria: also called “normal flora”

- Probiotics and vitamin producers in intestines
 - Ex. Lactobacillus
- E. Coli: helps digest food in intestines
- Ruminants- digestion of plant material in the rumen

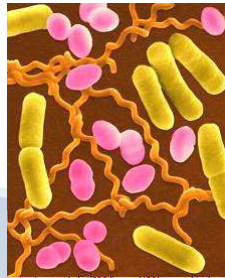


- When “good bacteria” go bad...
- Salmonella in peanut butter or produce
- E. Coli in food (ex. Beef)
- Staphylococcus on skin travels inside body after an injury



Bacterial structures and identification

- Cocci (spheres), bacilli (rods), coccobaccilli, spirochaetes
- Movement by cilia, flagella, lamellepodia ("foot"- like an amoeba)



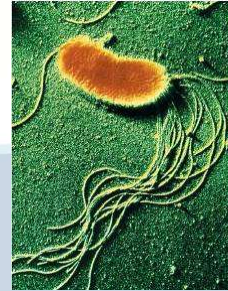
Mixed cocci, rods and spirochaetes



Ciliates- (Didinium)

www.ucmp.berkeley.edu/~ciliata/ciliata8h.html

Bacteria with multiple flagella

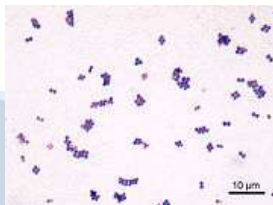


www.scienceclarified.com/As-Bi/Bacteria.html

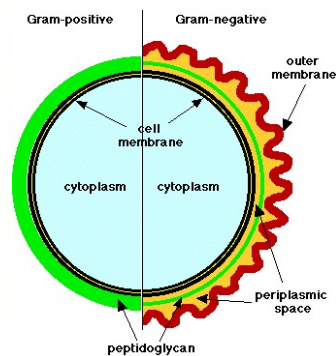
Gram Stain for Identification

- Named for scientist Hans Gram
- One of first and easiest tests to identify bacteria
- Important in determining antibiotic use!!

- Gram positive
- Have thick cell wall with mostly peptidoglycan
- Picks up purple stain well (stains peptidoglycan)



Staphylococcus aureus

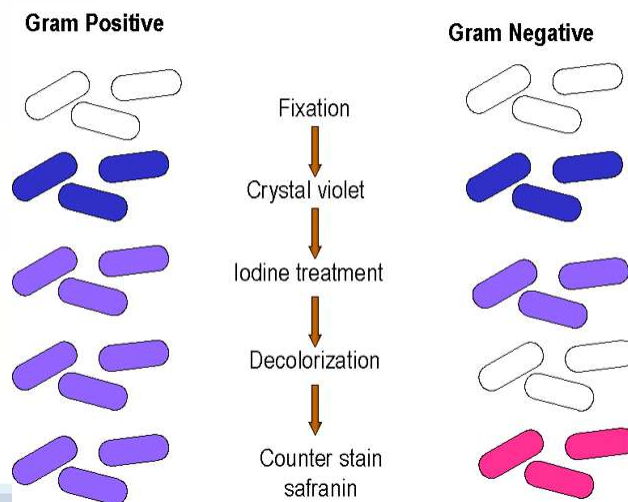


- Gram negative
- Only small percent of cell wall made of peptidoglycan
- Does not pick up stain well (=pink)



Escheria coli

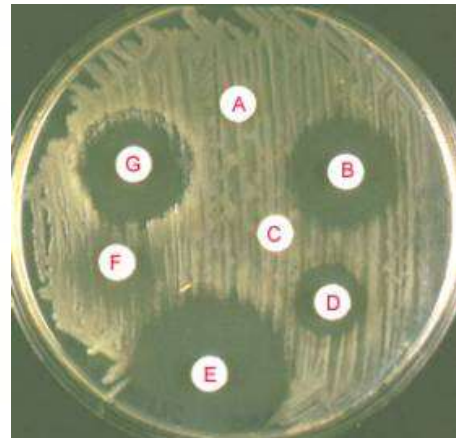
Gram stain procedure



pathmicro.med.sc.edu/fox/culture.htm

Antibiotic Choices

- Different antibiotics attack bacteria in different ways
- Attacks are based on microbe structure and function:
 - Interfere with cell wall building
 - Damage cell membrane function
 - Bind microbe DNA
- Antibiotics are specific against Gram positive, Gram negative, anaerobic bacteria, or broad-spectrum (kills multiple types)
- Sensitivity evaluated by “zones of inhibition” on growth plate



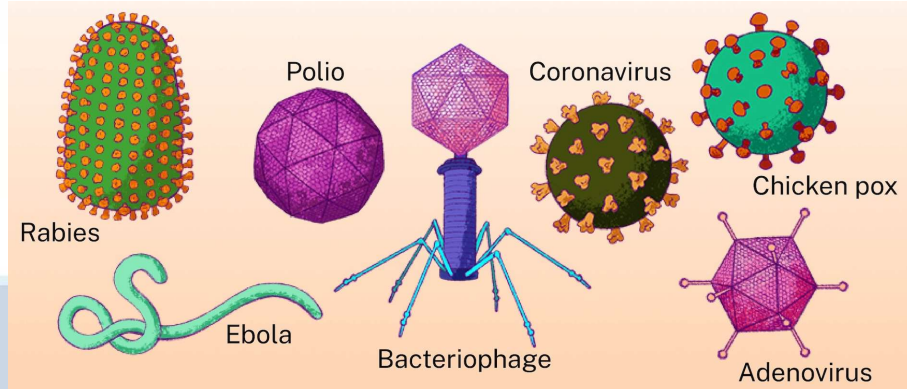
jameslunsford.com/microunknown2_exp_explain2.htm

Example: This bacteria is NOT killed by antibiotics “A” and “C” (they have no inhibition zones)



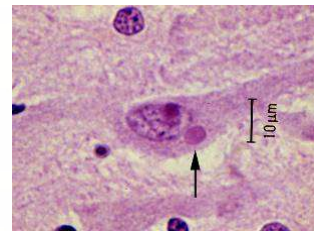
What are viruses?

- Even smaller than bacteria....
- They only replicate in living cells
- Can infect single-cell organisms (like bacteria) as well as higher plants and animals

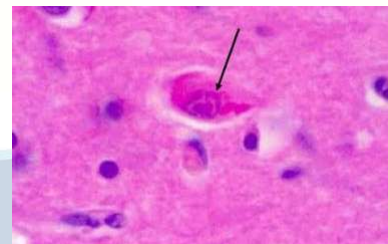


Demonstration of Viruses

- Individual virus particles too small to see on slide preparations
- Can sometimes see “inclusion bodies” within cytoplasm or nucleus of cells
 - Viral production factories



Classic rabies inclusion body in brain cell



Measels inclusion bodies

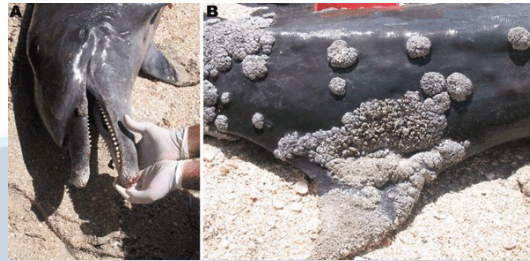
Fungi

- Single celled or branched organisms including yeasts, molds and mushrooms
- Plant-like but have no stems, roots or chlorophyll
- Diseases include: athletes foot, ringworm, aspergillosis and many, many more



Ringworm

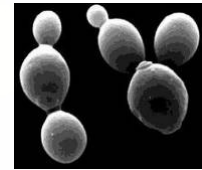
Dolphin lobomycosis: *Lacazia loboi*



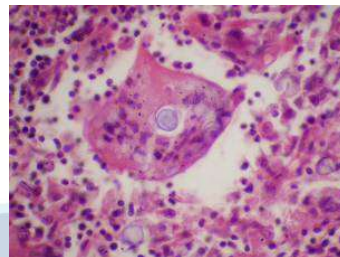
www.cdc.gov/eid/content/15/8/1301-F2.htm

Fungi Presentation

- Yeast are single celled and oval shaped
- Hyphae are long thread-like filaments
- May take up some stains
- Can also be grown in culture- usually on special media plates, but may be difficult



Budding yeast

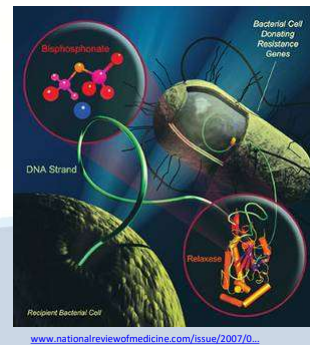
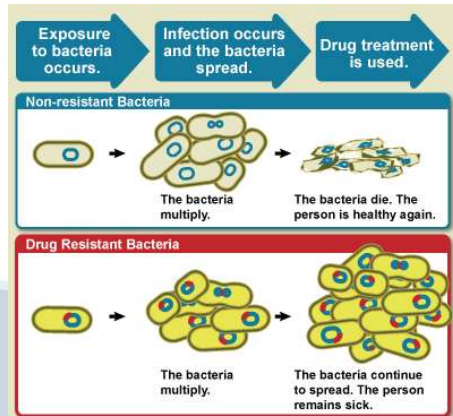


Cryptococcus in lung

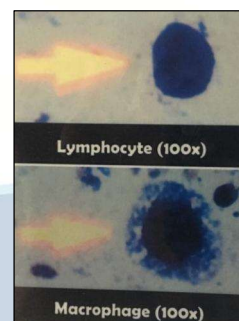
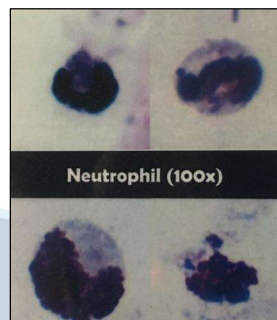
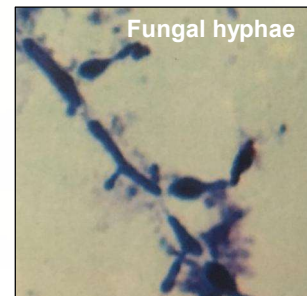
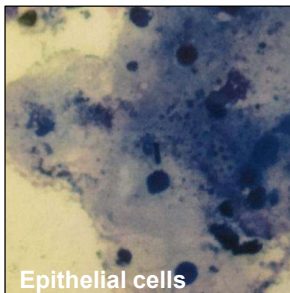


Antimicrobial Resistance

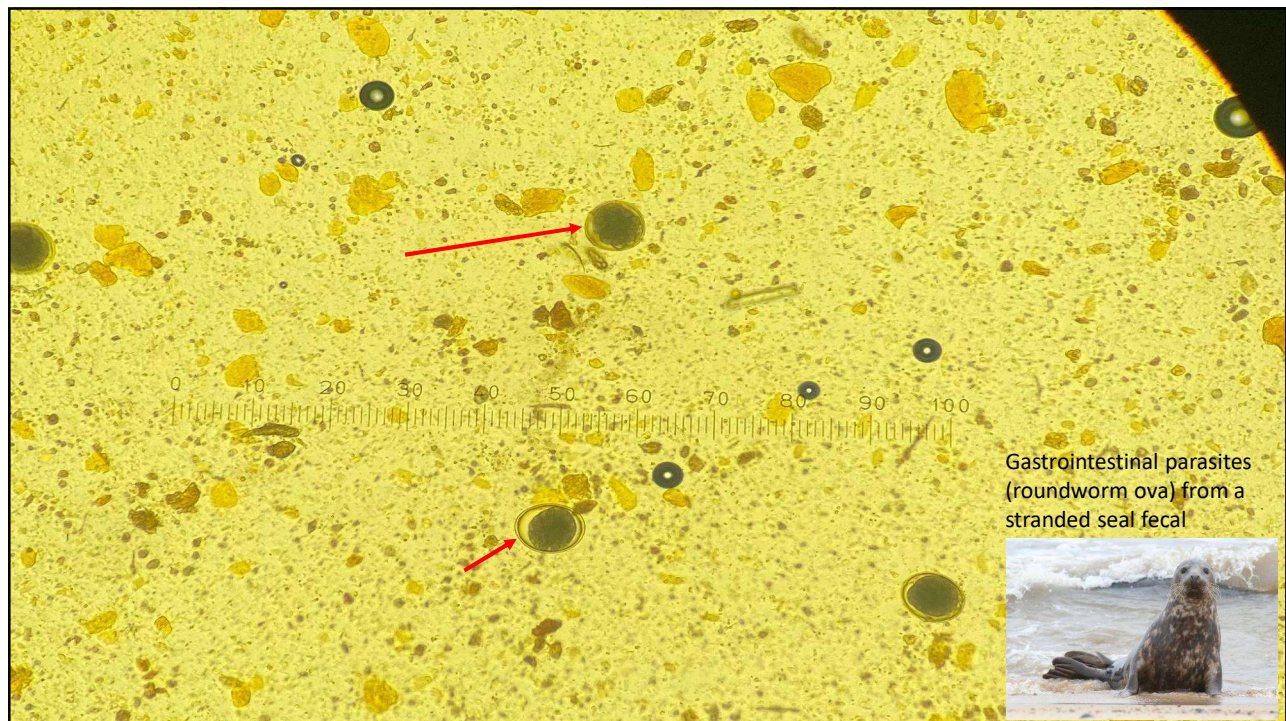
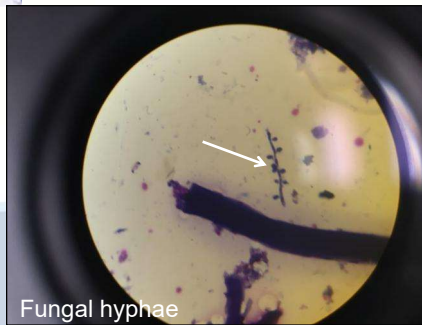
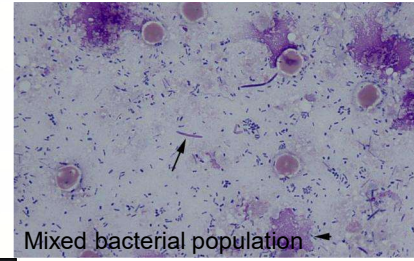
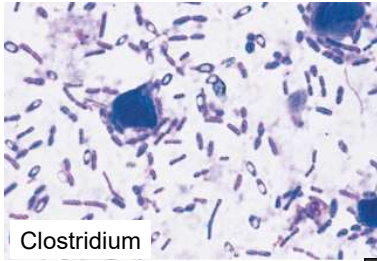
- Many microbes have now developed resistance to antimicrobials
- Improper use (giving antibiotics for a viral infection, not finishing a proper course of antibiotics) and over-use in particular have contributed to this



Gastric fluid cytology

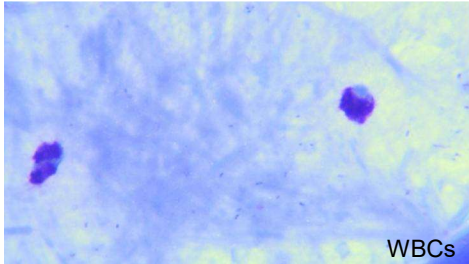


Fecal cytology

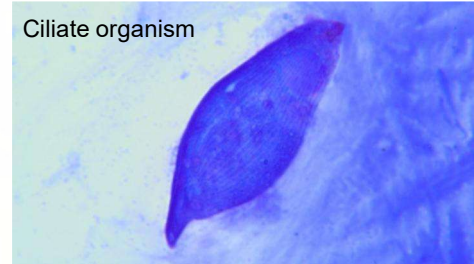




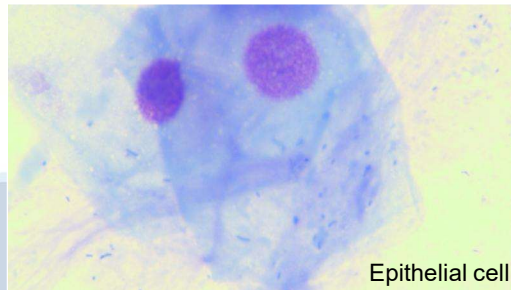
Chuff blow hole cytology



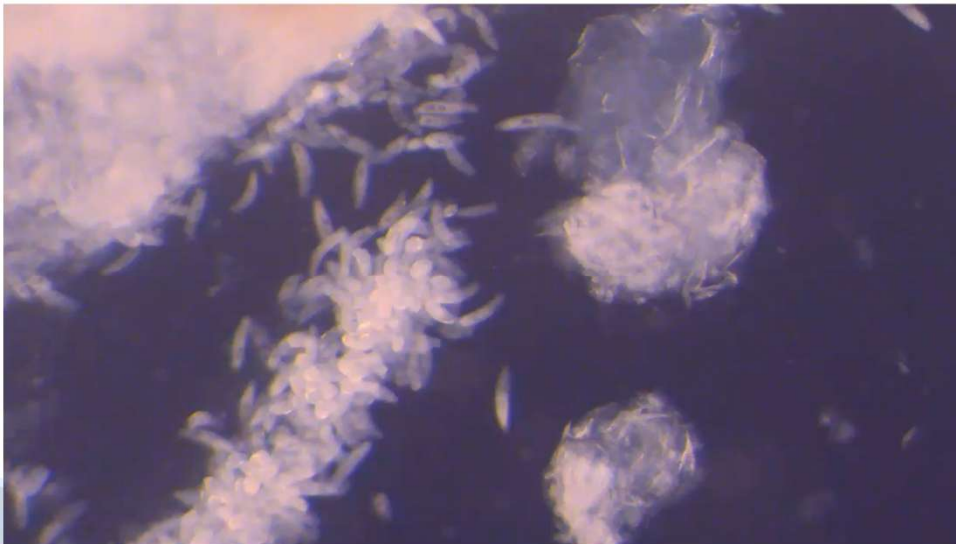
WBCs



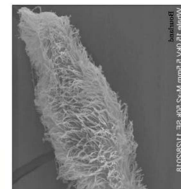
Ciliate organism



Epithelial cell



Ciliates isolated from beluga blow sample



Ciliate (~100uM)
Kyaroikeus sp.

