

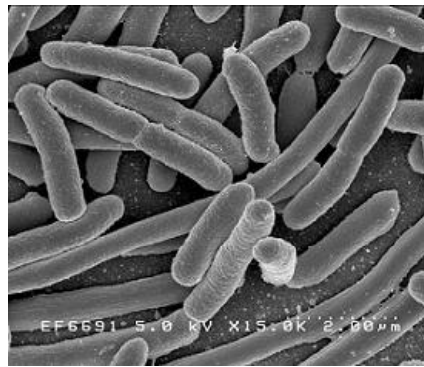
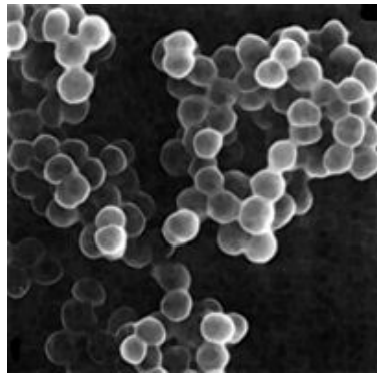
# Antibiotic Resistant Bacteria: Natural Selection at Work



# Bacteria are everywhere

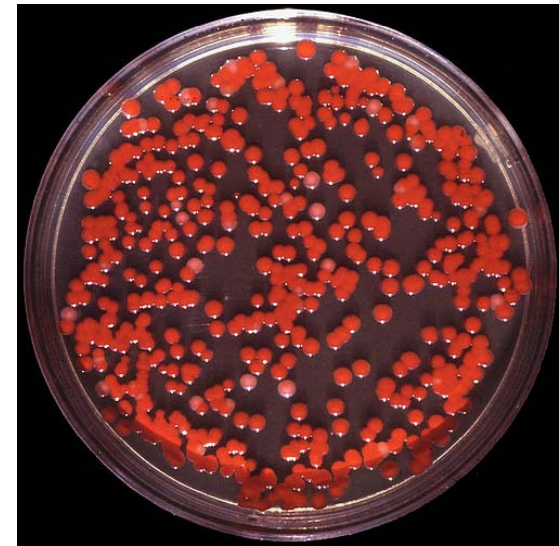
- Bacteria are single-celled organisms that grow in populations called colonies.
- Many different kinds of bacteria can grow together in similar environments.
- Demo showing growth of bacteria from various sources

Pictures taken with an electron microscope



# *Serratia marcescens*

- Rod shaped motile bacterium
- Naturally grow a red color by production of a reddish-orange pigment called prodigiosin
- Grow in damp places such as bathrooms, soil, biofilms of teeth, digestive tract
- As a human pathogen, can be associated with urinary tract and wound infections



# What are antibiotics?

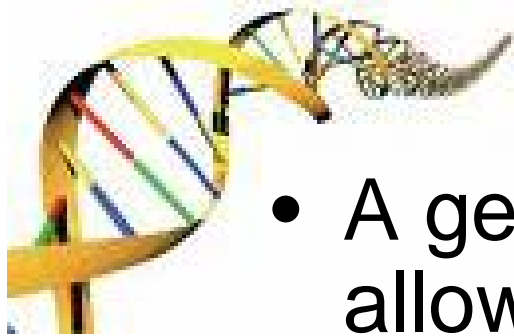


- Powerful medicines that treat *bacterial* infections
- They work by either killing bacteria or preventing growth and reproduction of bacteria

# Antibiotic Resistance Lab

- You will be investigating the presence of antibiotic resistance within a population of *Serratia* bacteria.

# How do bacteria become resistant?



- A gene encodes a protein that allows them to avoid the harmful effects of the antibiotic
- Genes for resistance can emerge in a bacterial population spontaneously (genetic mutation), they can obtain them from other bacteria (sharing DNA), or scientists can put genes into bacteria.

# Natural Antibiotic Resistance

- Mutations allowing for bacteria to grow in the presence of antibiotics already exists in the bacterial population.
- Not all bacterial cells within a population are identical
- Like a population of humans, they all contain slight differences in their DNA

Why do you think this may be a good idea for the bacteria?

-survival of the fittest



# Can the misuse of antibiotics result in resistant bacteria?

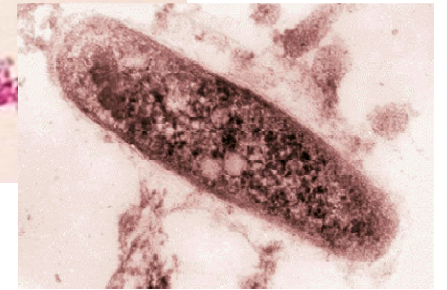
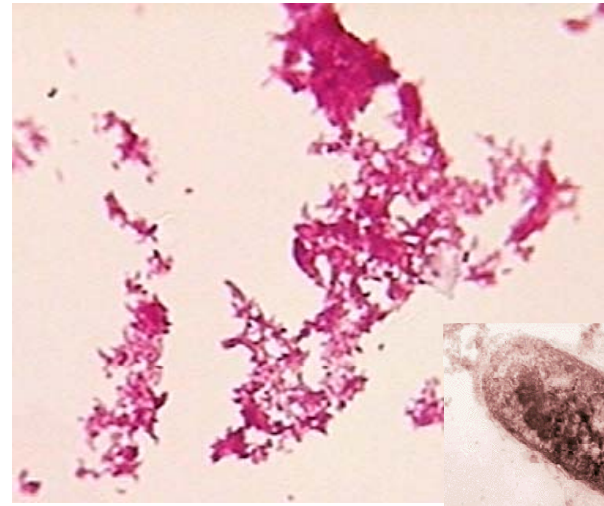
- Antibiotics are prescribed by doctors to fight bacterial infections.
- Antibiotics do not treat viral infections!
- How do doctors know what to prescribe?
  - throat, urine cultures
- Why is it important to finish your prescription?
- Why shouldn't you use unfinished prescriptions from other people?





# Tuberculosis

- TB mainly affects your lungs (pulmonary tuberculosis), and coughing is often the only indication of infection initially.
- In the United States, cases of tuberculosis began declining steadily in the 1940s and 1950s mainly because of antibiotic therapy and improved public health programs.
- TB is a re-emerging bacterial lung infection
- World Health Organization indicates that rates of tuberculosis resistant to multiple drugs (MDR-TB) are now at their highest level ever. (Reuters Health. Feb 28, 2008. "Drug resistant tuberculosis reaches new high")



Mycobacterium tuberculosis



TB lung infection

# TB activity- antibiotic resistance simulation and spread of disease

- See the emergence and spread of Ab resistant bacteria

# What are some potential problems for selection of antibiotic resistant bacteria?

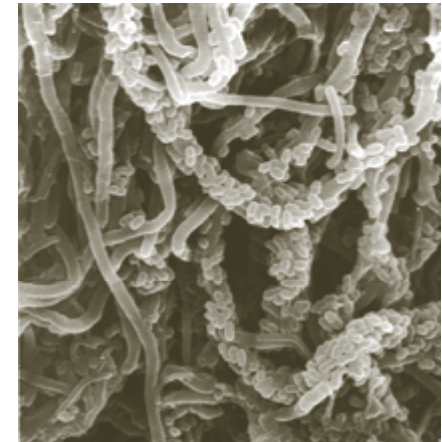
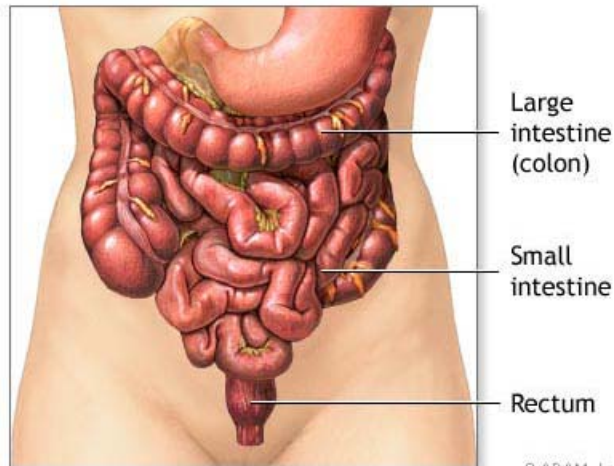
- MRSA  
<http://well.blogs.nytimes.com/2008/01/23/resistant-bacteria-meets-reality-television/>
- Explain why hospitals fear reaccuring Staph infections.



MRSA lesion on knee

# Good bacteria?

- Our bodies provide a home for many kinds of bacteria
  - In our gut
  - In our mouth
  - On our skin



Bacteria in the mouth



Pimple caused by bacteria

# How can we prevent bacterial growth?

- We try to prevent the growth of some bacteria on our bodies and in our homes.
- What are some common products you use on a regular basis for cleaning?
  - Soaps (hand soap, face wash)
  - Toothpaste/mouthwash
  - Dish soap
  - Laundry detergent
  - Mops and sponges
- Most if not all contain a chemical called Triclosan used to prevent bacterial growth.



# Other products containing Triclosan

- Deodorant
- Cosmetics
- Shave cream
- First aid sprays and creams
- Paints
- Floor and wall coverings
- Furniture
- Children's toys and kitchen gadgets



# Are we stimulating the evolution of resistant bacteria with the use of antibacterial products?

- Long term exposure to chemicals allows for the selection of those bacteria that contain genes for resistance to antibacterial chemicals.
- Should antibacterial products be used in such a common way?

[http://www.cdc.gov/ncidod/eid/vol7no3\\_supp/levy.htm](http://www.cdc.gov/ncidod/eid/vol7no3_supp/levy.htm)