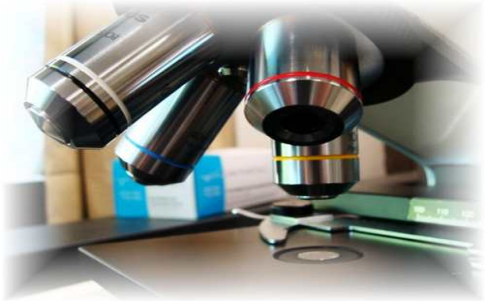

About Science Prof Online PowerPoint Resources

• Science Prof Online (SPO) is a free science education website that provides fully-developed Virtual Science Classrooms, science-related PowerPoints, articles and images. The site is designed to be a helpful resource for students, educators, and anyone interested in learning about science.

• The SPO Virtual Classrooms offer many educational resources, including practice test questions, review questions, lecture PowerPoints, video tutorials, sample assignments and course syllabi. New materials are continually being developed, so check back frequently, or follow us on Facebook (Science Prof Online) or Twitter (ScienceProfSPO) for updates.

• Many SPO PowerPoints are available in a variety of formats, such as fully editable PowerPoint files, as well as uneditable versions in smaller file sizes, such as PowerPoint Shows and Portable Document Format (.pdf), for ease of printing.

• Images used on this resource, and on the SPO website are, wherever possible, credited and linked to their source. Any words underlined and appearing in blue are links that can be clicked on for more information. PowerPoints must be viewed in *slide show mode* to use the hyperlinks directly.

• Several helpful links to fun and interactive learning tools are included throughout the PPT and on the Smart Links slide, near the end of each presentation. You must be in *slide show mode* to utilize hyperlinks and animations.

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Image: Compound microscope objectives, T. Port

Introduction to Biology

VIDEO:
Introduction to Biology

Image: Hawaiian Ginger, T. Port

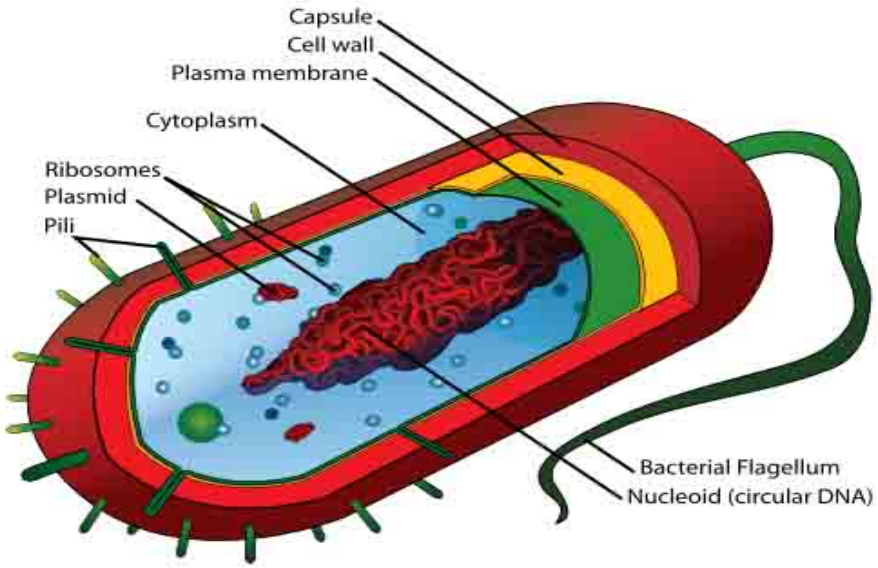
What is biology?

The study of LIVING THINGS

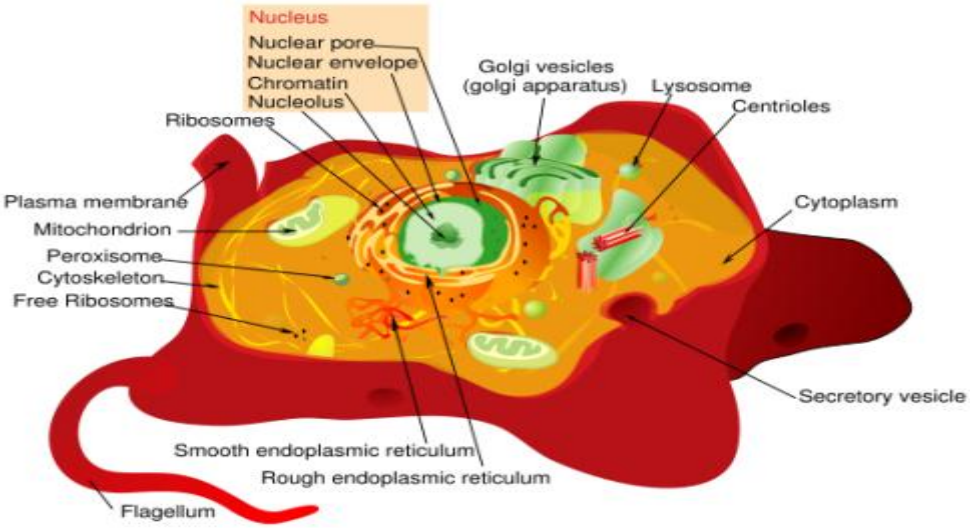
Where can living things be found?

Image: Earth, Wiki

CELLS Are the Building Blocks of Life!



Prokaryotic Cell



Eukaryotic Cell

- All living things are made of one or more cells.
- Cells only come from other cells.
- Cells are really small.
- How small are they?

Images: Prokaryotic cell diagram & Eukaryotic cell diagram, M. Ruiz

How do you define *living*?

Some characteristics of life …

- Organization
- Acquire and transform materials & energy
- Homeostasis
- Respond to stimuli
- Grow, develop & reproduce
- Adapt and evolve (change)

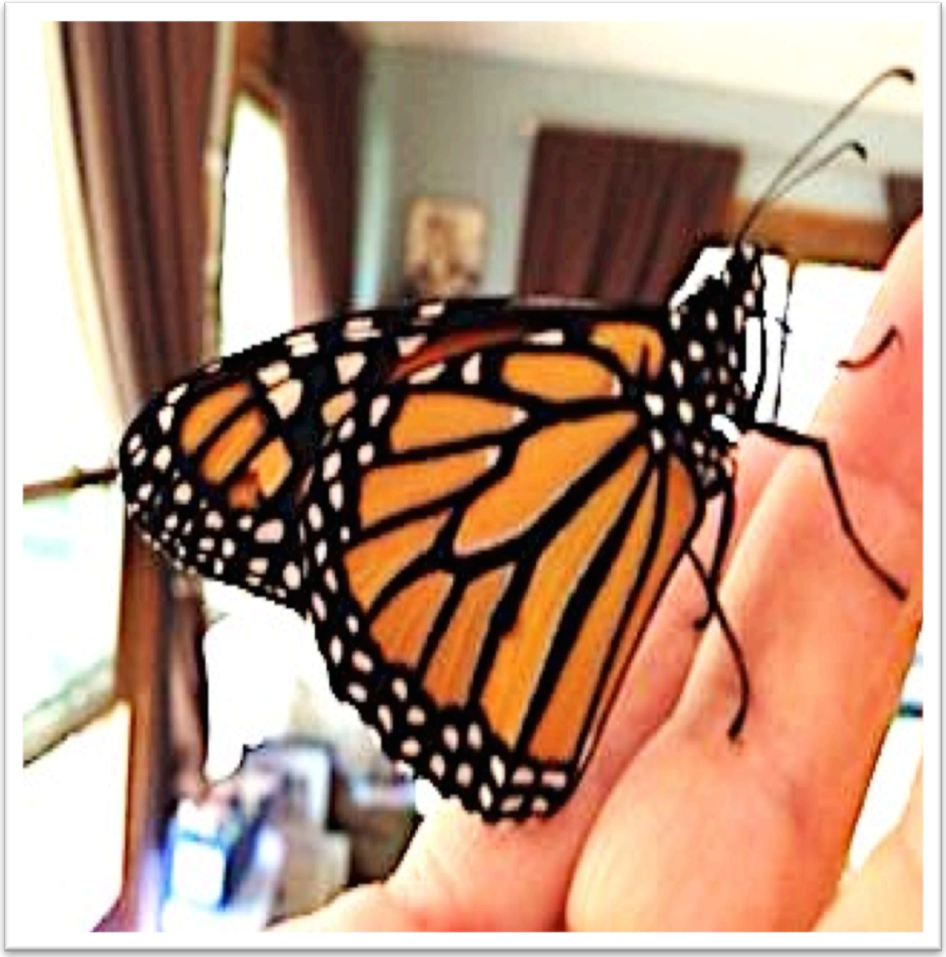


Image: Newly emerged Monarch Butterfly, T. Port

Cellular Organisms *vs* Acellular Particles

1. Cellular life:

   Prokaryotes

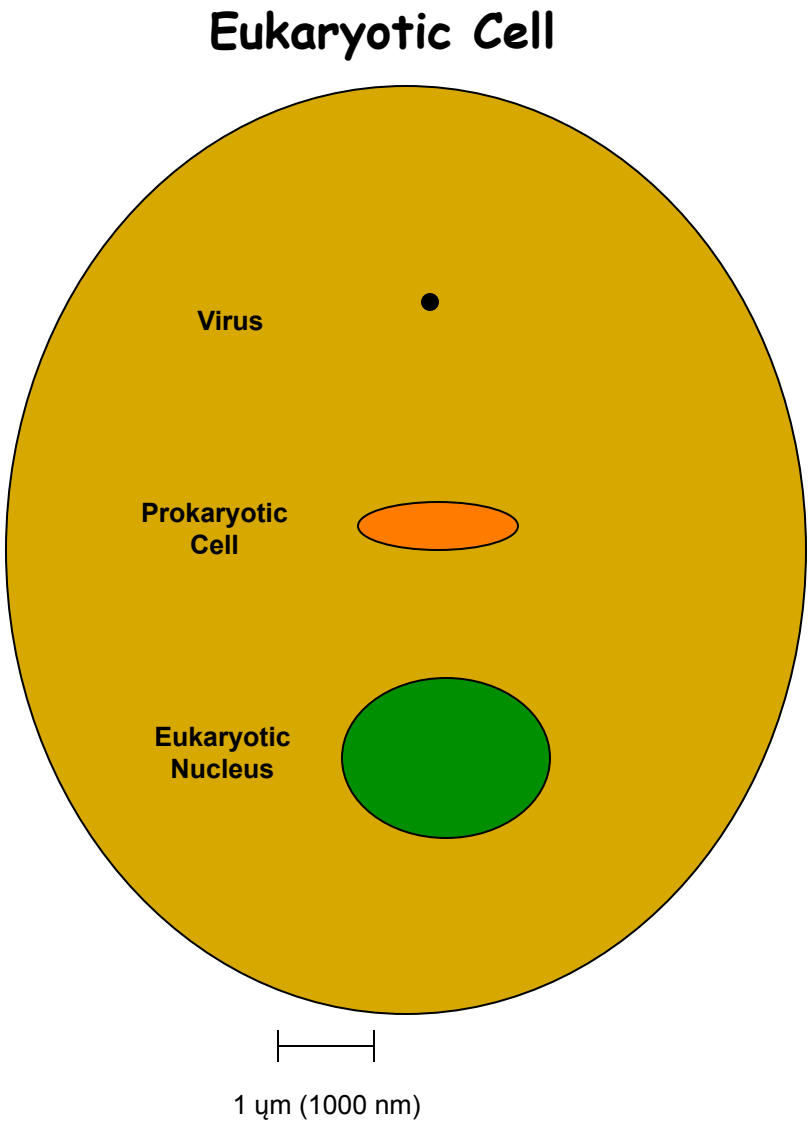
   Example: Bacteria

   Eukaryotes

   Example: Most other cellular life.

2. Acellular infectious particles:

   Viruses

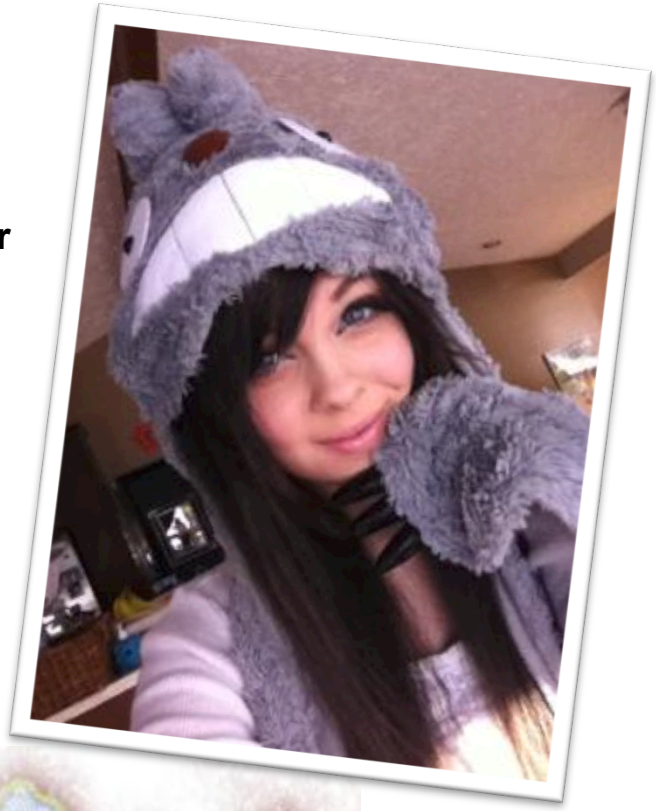


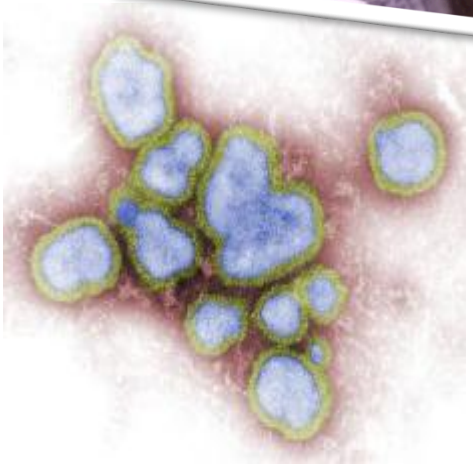
Are Viruses Alive?

- Viruses
  - are not made of cells
  - cannot reproduce on their own
  - do not grow or undergo division
  - do not transform energy (metabolism)
  - lack machinery for protein synthesis

Multicellular Organism:

Kayla





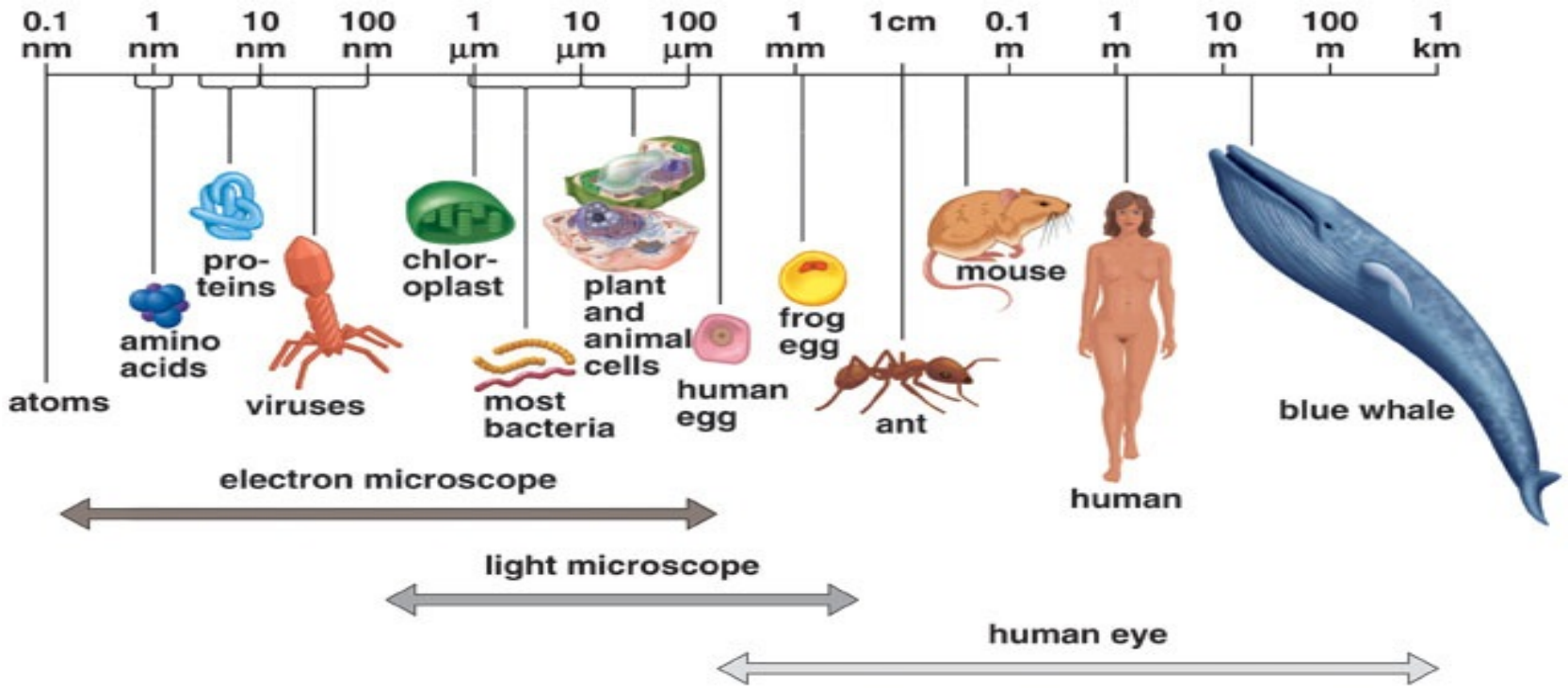
Acellular Infectious Agent:

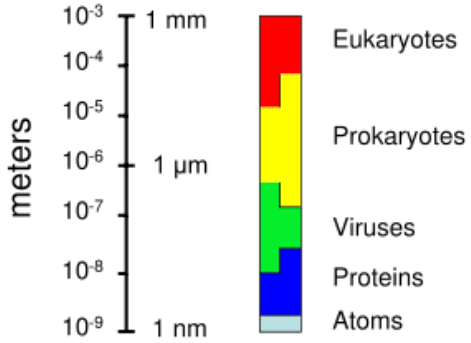
H1N1 Influenza Virus

Later this semester we will examine this question in more detail, through the fantastic Radiolab podcast episode "Shrink."

Images: Eukaryotic living organism named Kayla, T. Port; H1N1 Influenza Virus, Public Health Image Library (PHIL) #11702

Sizing Things Up (and Down)





1 m = 100 cm = 1,000mm = 1,000,000 µm = 1,000,000,000nm

1mm = 1000 µm = 1000000nm

1 µm = 1000nm

Click link for an interactive

"Size of Microscopic Things"

animation on Cells Alive.

Prokaryotes…The "studio apartment" of cells.

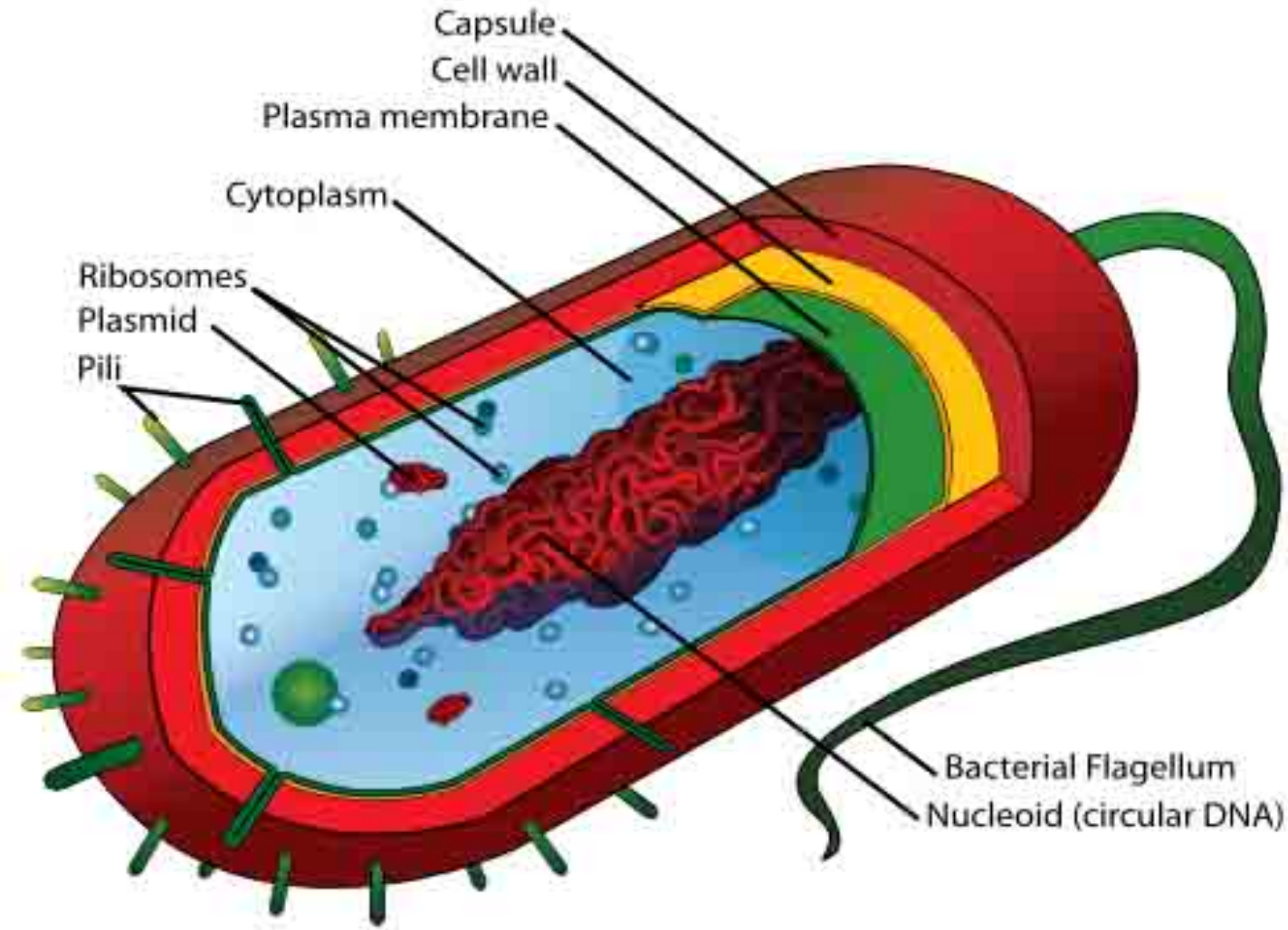
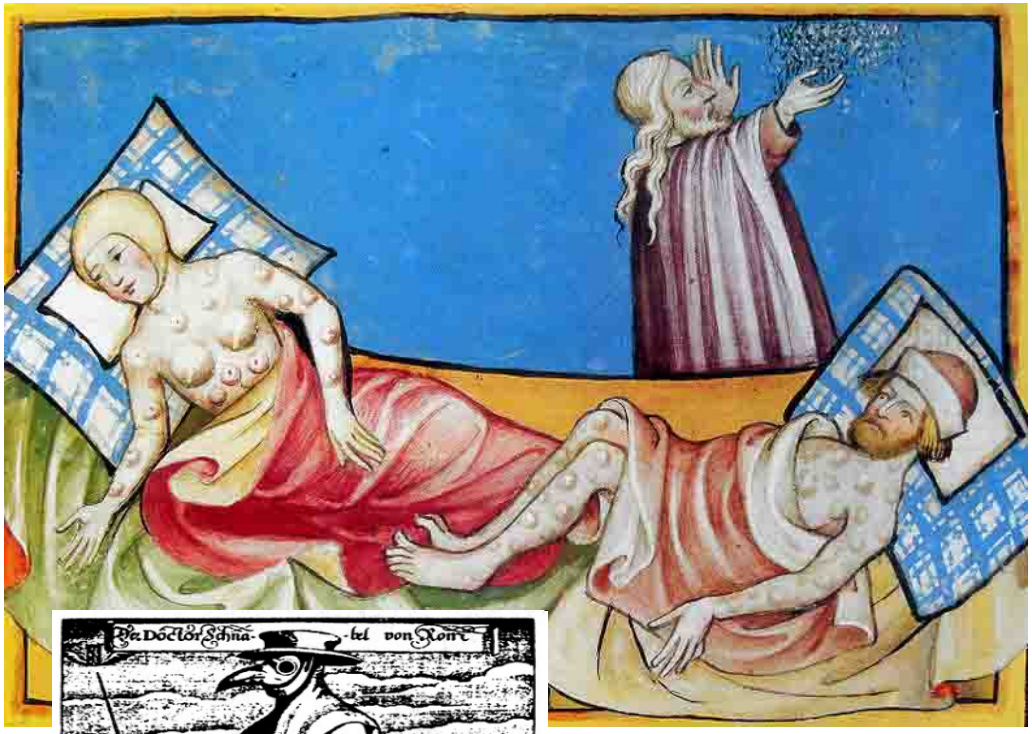


Image: Prokaryotic cell diagram, M. Ruiz,

Prokaryotes can be our foes…



Doctor beak from Roman engraving, 1656 Physician attire for protection from the Bubonic plague (a.k.a Black death).

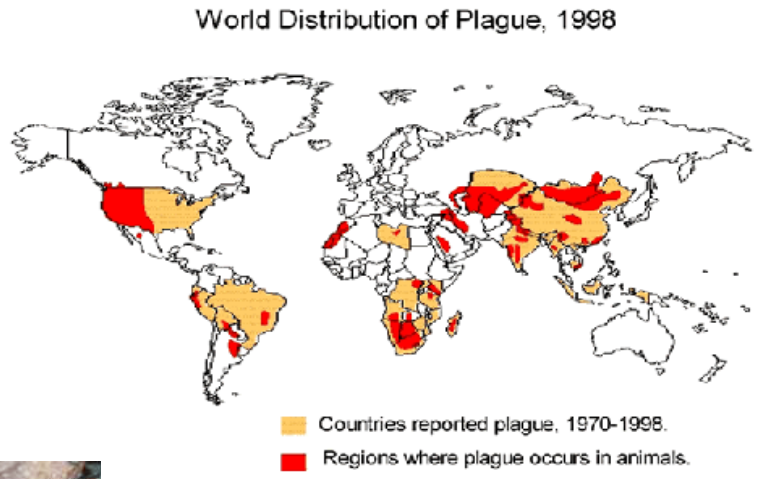
Bubonic Plague

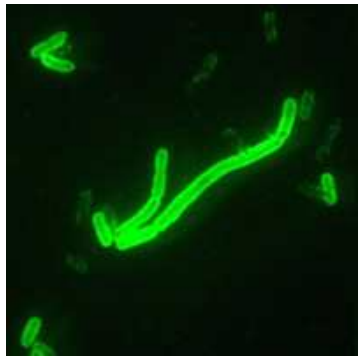
- a.k.a. Black Plague & Black Death
- Caused by bacteria *Yersenia pestis.*
- Several pandemics of plague have occurred throughout history.
- 50 million deaths between years 1346 – 50.
- Nearly 1/2 of Europe perished in this plague
- **WATCH THIS !**
  "Bring out your dead!" plague scene from Monty Python & Holy Grail.

Images: *Yersenia pestis*, CDC; Black Death illustration, Toggenburg Bible (1411); Black Plague Physician Attire, History of Medicine, Paul Furst

Ecology of *Yersenia pestis*

Bubonic Plague

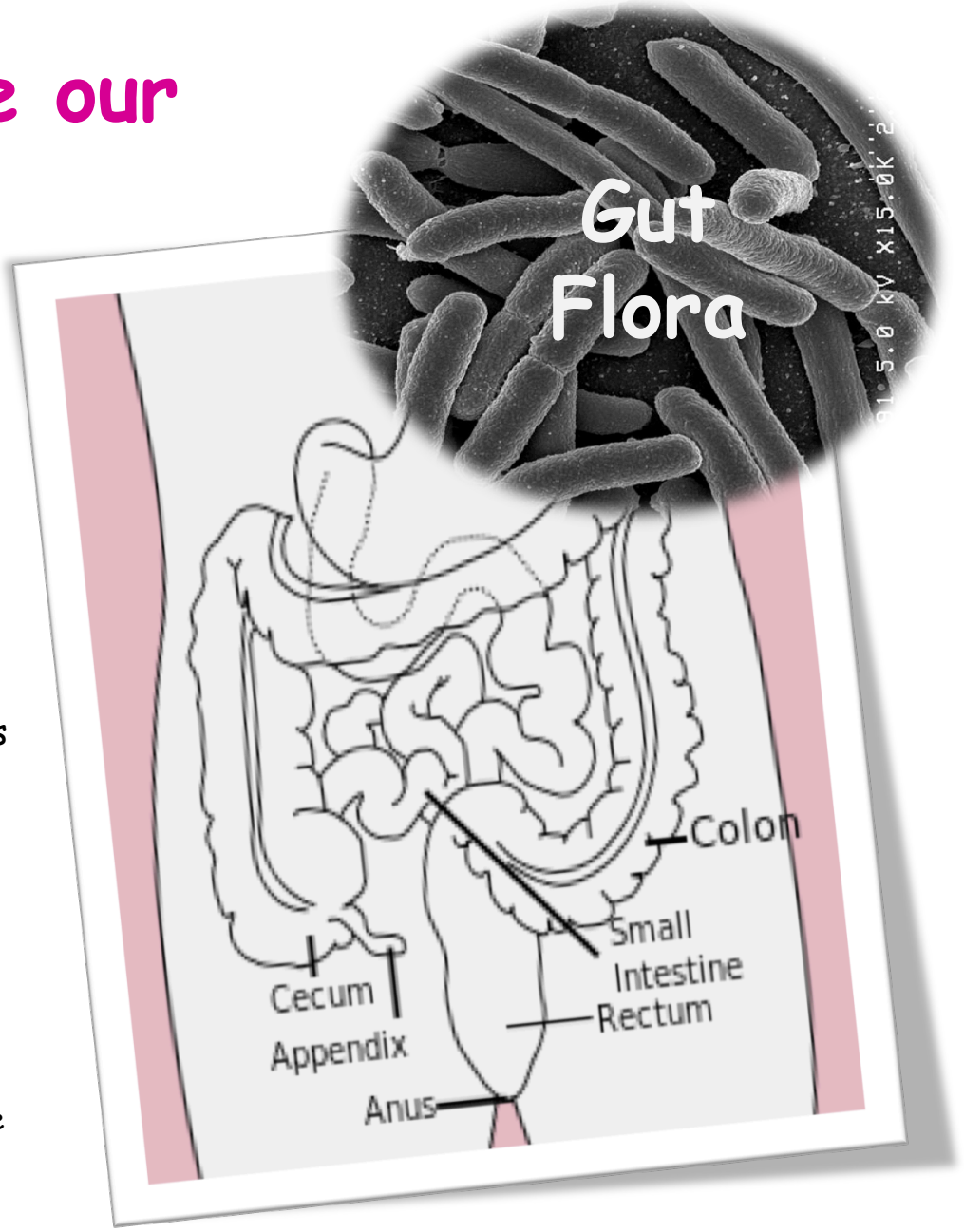




Images: Worldwide distribution of plague 1998, CDC; Waste in open market, frabood; Brown rat, National Park Service; Scanning electron micrograph of flea, CDC; *Yersenia pestis*, CDC

Prokaryotes can be our friends…

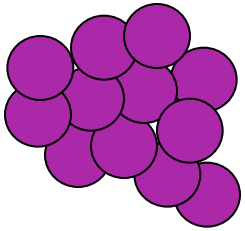
- Human body has ~ 100 trillion microbes in intestines (10x more than the total number of human cells in the body).
- Bacteria that live on and in us without usually causing harm are called **normal flora**.
- Bacteria = ~ 60% of the dry mass of poo.
- Relationship between gut flora and humans **mutualistic** … win/win.
- Gut microbes perform many useful functions:
  - preventing growth of harmful, pathogenic bacteria
  - producing vitamins for host (such as biotin and vitamin K)
  - producing hormones to direct host to store fats
  - keeping our immune system on its toes



Images: *E. coli*, Rocky Mountain Laboratories, NIAID, NIH; Human Gastrointestinal Tract, Wiki

Prokaryotes

Staphylococcus



Coccus-shaped bacteria, which divides in a way that results in grape-like clusters.

- ***Staphylococcus aureus*** (golden staph), most common cause of staph infections.
- Approximately 20–30% of general population "Staph carriers."
- *S. aureus* can cause illnesses ranging from minor skin infections to life-threatening diseases, such as meningitis, toxic shock syndrome (TSS) & septicemia.
- **MRSA** = Methicillin-resistant *Staphylococcus aureus*
- One of the four most common causes of **nosocomial infections**, often causing postsurgical wound infections.
- ***S. epidermidis*** is normal flora which inhabits the skin of healthy humans.

Bacterial "cousins"… one friend, one foe…

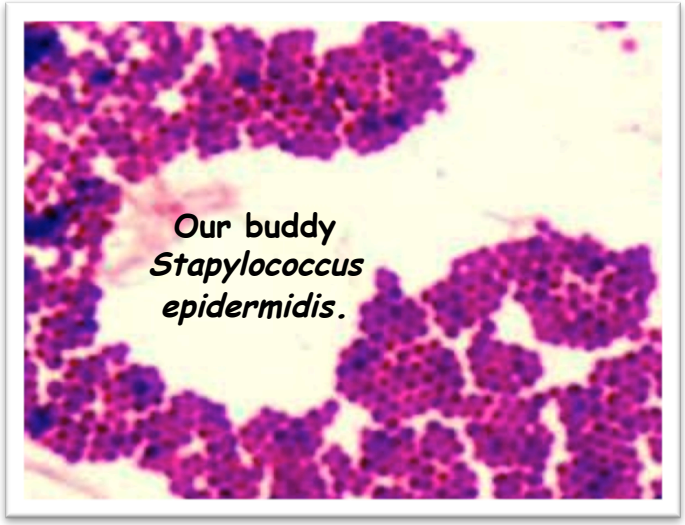


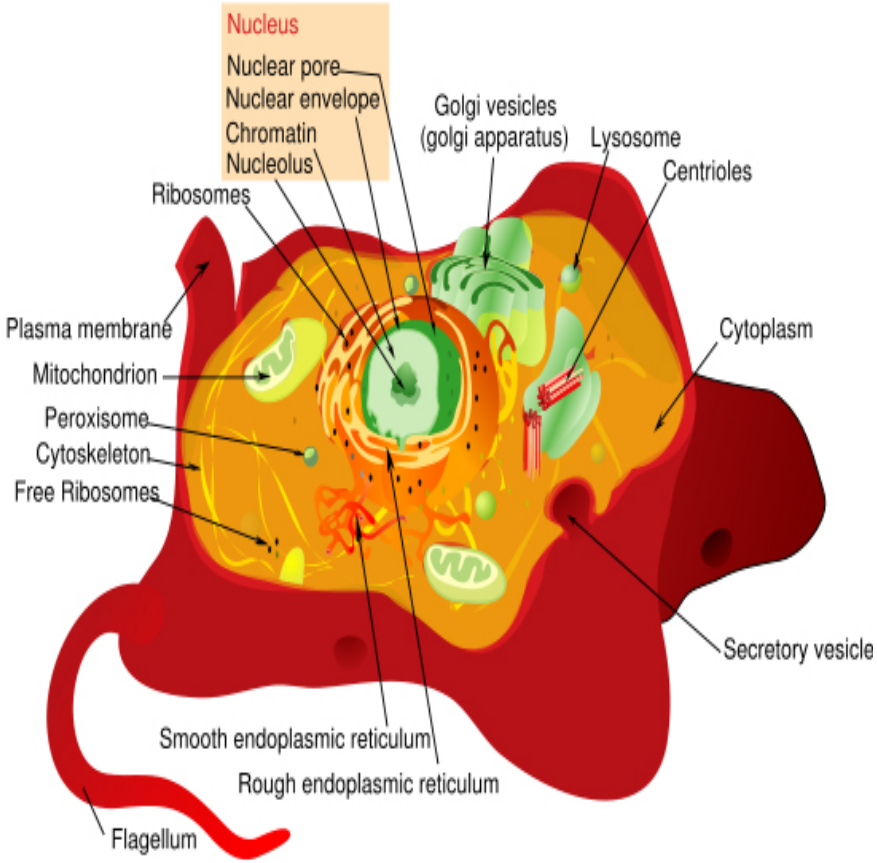
Image: Mannitol salt plates, T. Port; *S. aureus,* Janice Haney Carr , PHIL #10046; Gram stain *Staph,* T. Port

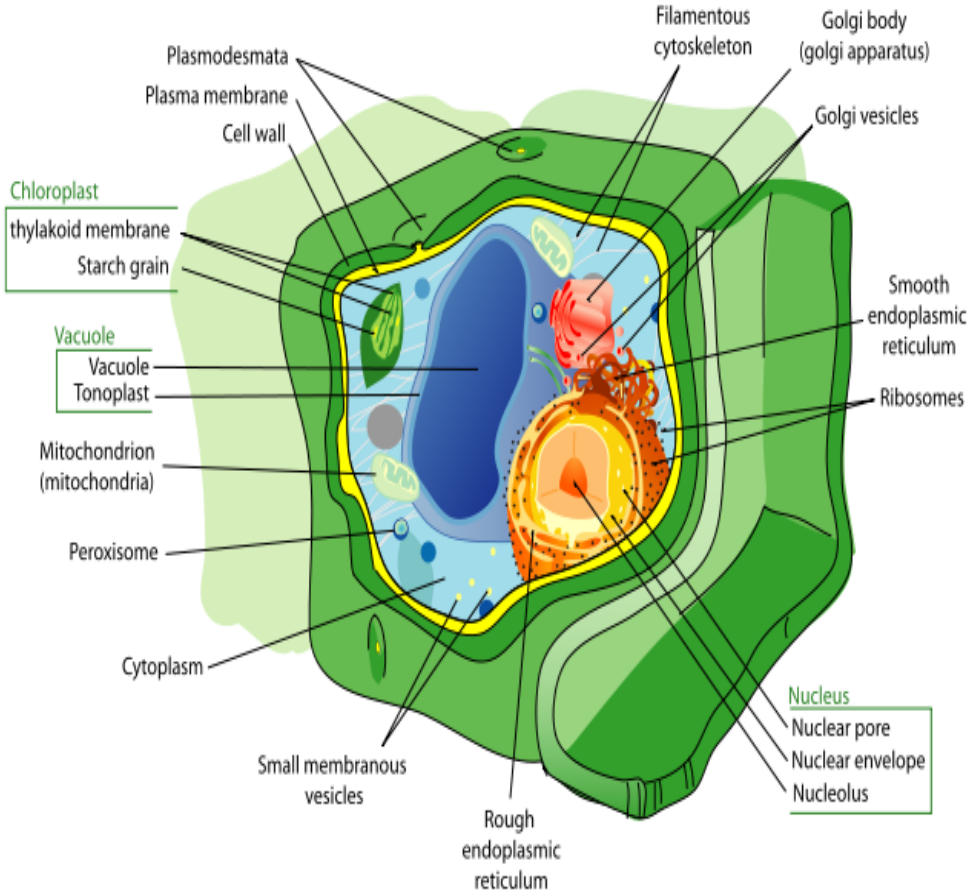
Prokaryotes

Bacteria
are
EVERYWHERE!

Images: Various types of bacterial growth media inoculated with different types of samples, T. Port

Eukaryotes…The "mansion" of cells.





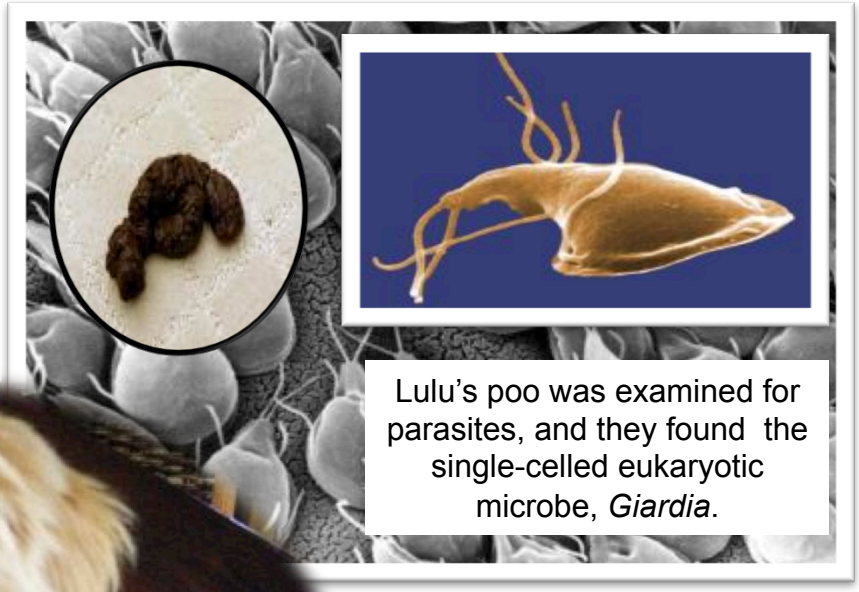
Images: Animal cell & Plant cell, M. Ruiz

From the Virtual Biology Classroom on ScienceProfOnline.com

Eukaryotes…

are also everywhere.

(Some are macroscopic. Some are microscopic.)



Lulu's poo was examined for parasites, and they found the single-celled eukaryotic microbe, *Giardia*.

She likes to eat acorns, when playing outside.

Her sock monkey is cotton, a plant product..

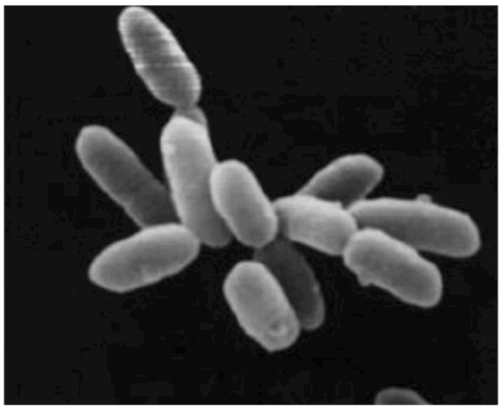
Lulu, the puppy, is a multicellular eukaryotic organism.

Her favorite treat is a bully stick, made from bull penises.

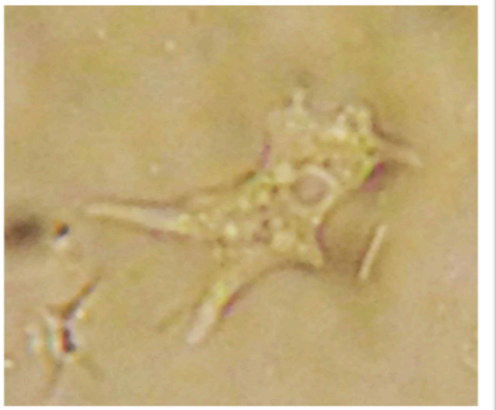
Images: Giardia, Public Health Image Library, (PHIL) #11649; #11632 & #3394; Dog poo & Lulu with sock monkey, T. Port; Oak leaves and acorns, Wiki, Pizzle sticks, Wiki.

The Major Classifications of Living Things

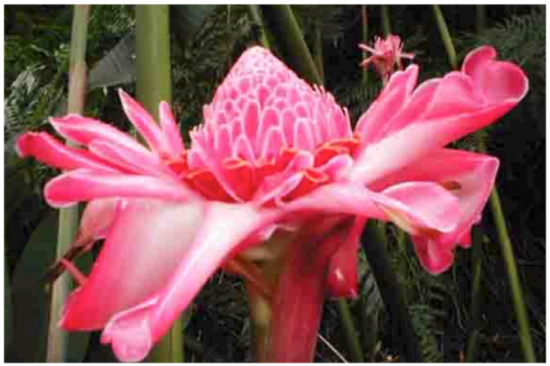
Bacteria



Archaea

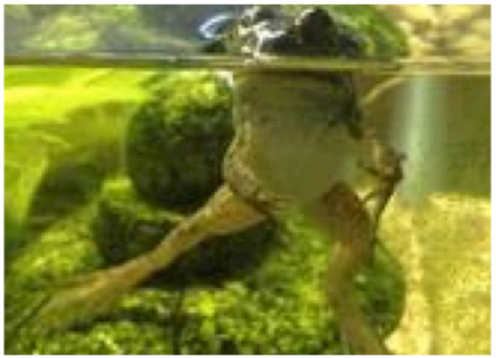


Protozoa



Plants

Fungi

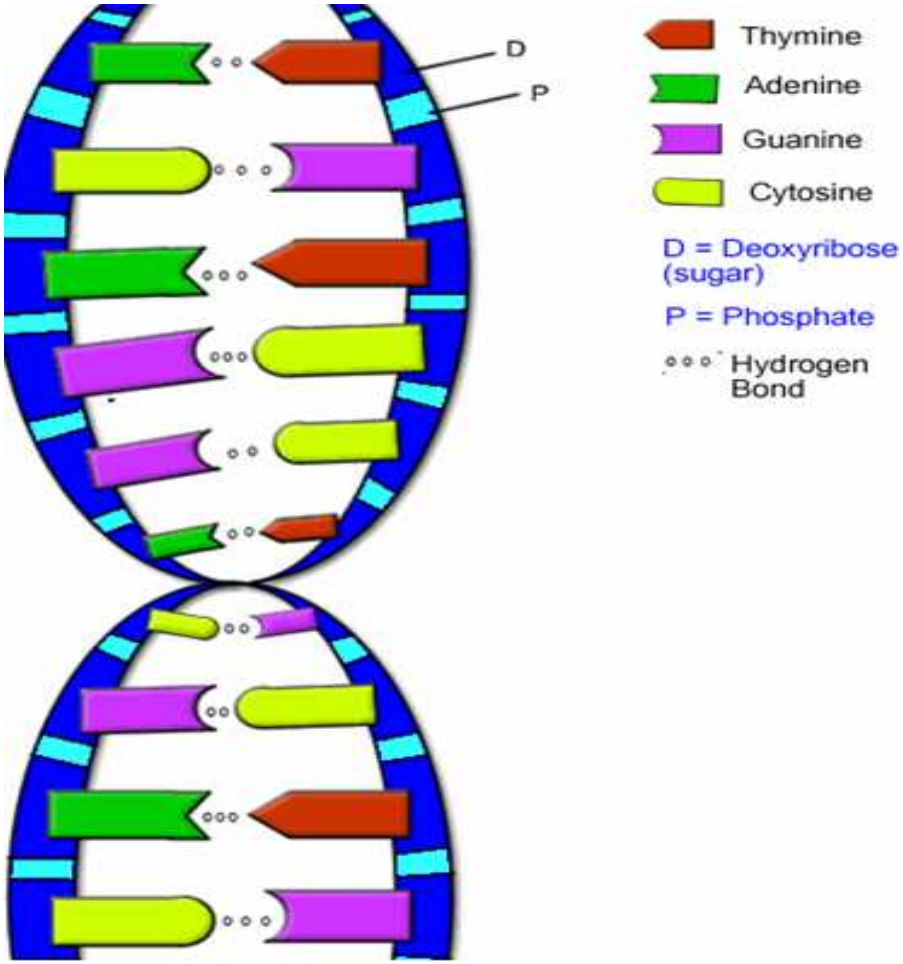


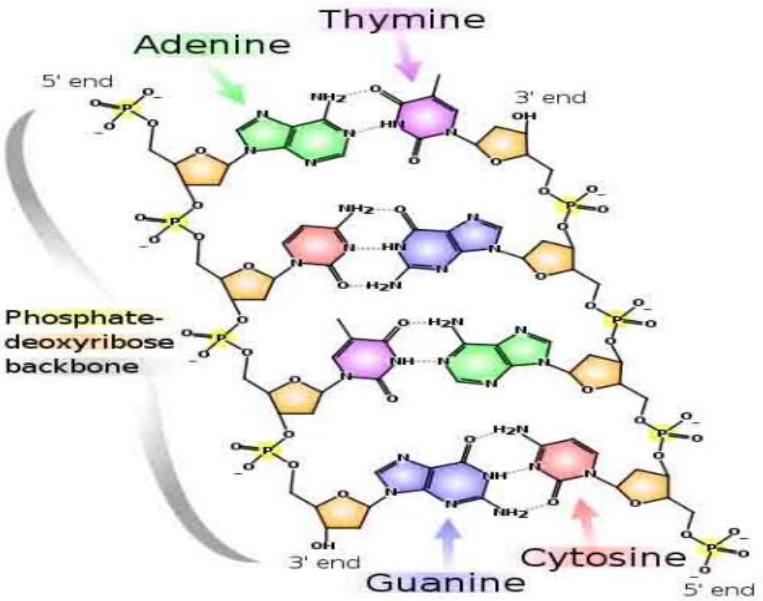
Animals

Image: *S. aureus*, Janice Haney Carr , PHIL #10046; Archaea, Wiki; Amoebae, Hawaiian Ginger, Mushroom and Bullfrog by T. Port

All biological cells have their instruction manual written in DNA

(deoxyribonucleic acid).



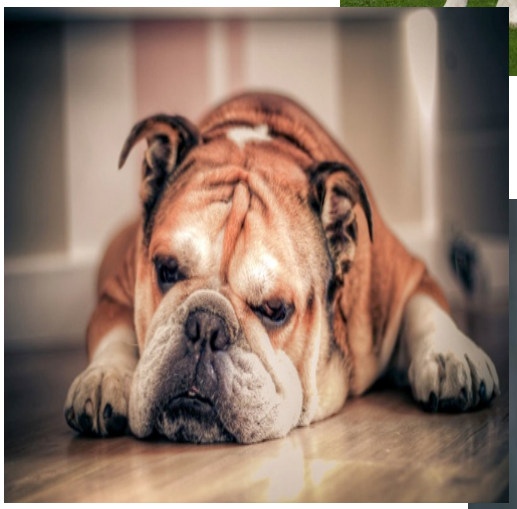


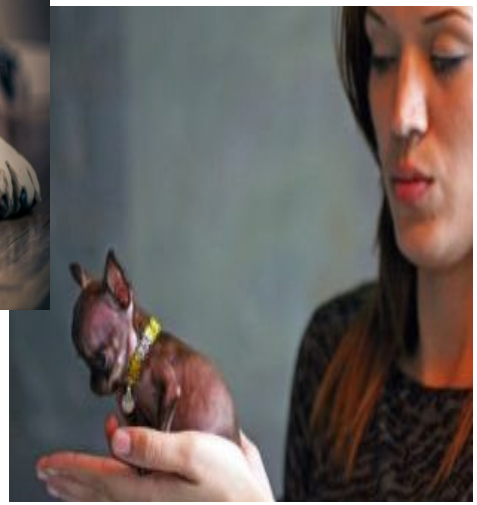
From the Virtual Microbiology Classroom on ScienceProfOnline.com

Images: Model of DNA Molecule, Field Museum, Chicago, T. Port; DNA Detail Diagram: Madprime; DNA & RNA Diagrams, BiologyCorner

Organisms, Cells & Viruses **Evolve and Change** Naturally and Artificially

Canis lupus - Gray Wolf





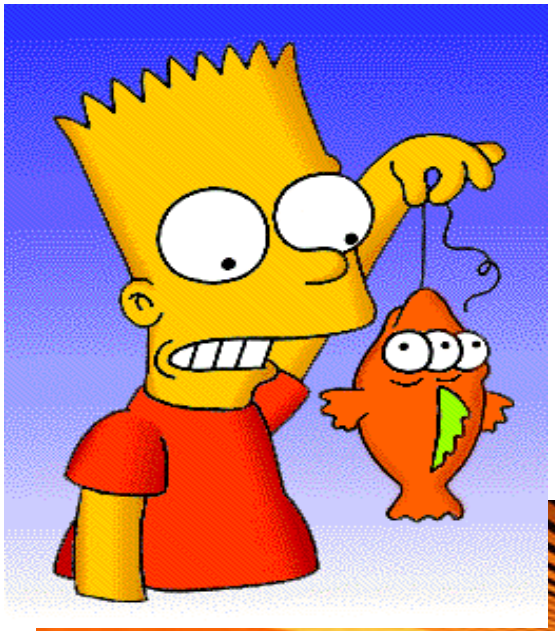
Canis lupus familiaris – Domestic dog

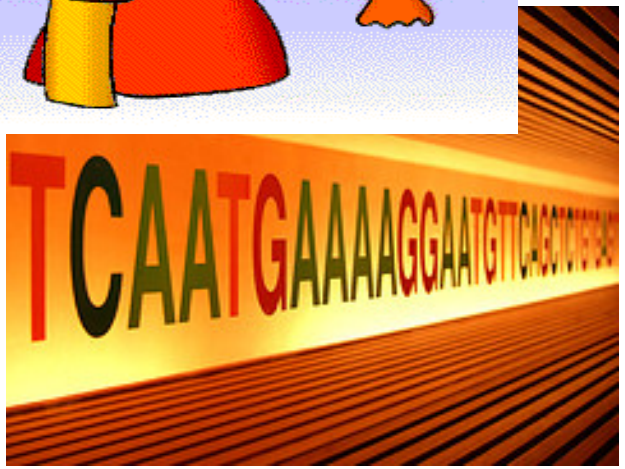
Images: Gray wolf, Wiki; Great Dane; English Bulldog, Milly, the worlds smallest Chihuahua

How Does Change Happen?

Mutations of Genes

- A mutation is a change (mistake) in the DNA sequence; rare.
- Almost always bad news, but…
- Rarely leads to a protein having a novel property that improves ability of organism and its descendants to survive and reproduce.





Images: Blinky & Bart, Matt Groening

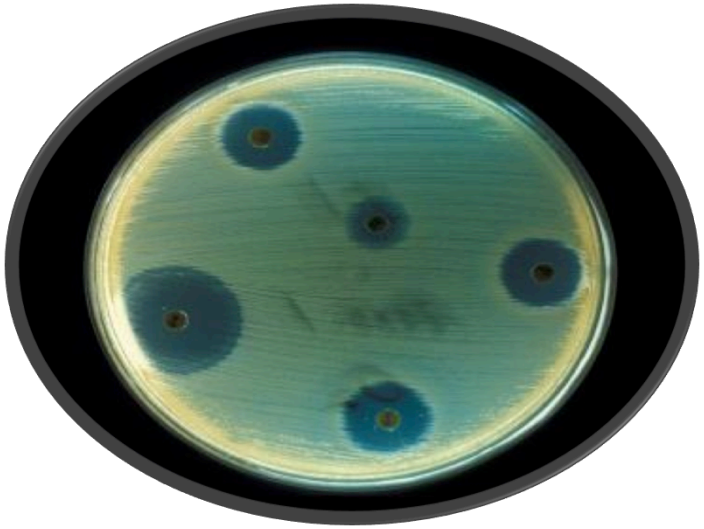
Mutations and Bacterial Change

- Antibiotic Resistance = **When a microorganism is able to survive exposure to an antibiotic.**

- Genetic mutation in bacteria can produce resistance to antimicrobial drugs (example: beta-lactamase).

- If a bacterium carries several resistance genes, it is called multidrug resistant (MDR) or, informally, a superbug or super bacterium.

- Any use of antibiotics can increase selective pressure in a population of bacteria to allow the resistant bacteria to thrive and the susceptible bacteria to die off.



REVIEW!
Antibiotic Resistance Animation
from Sumanas

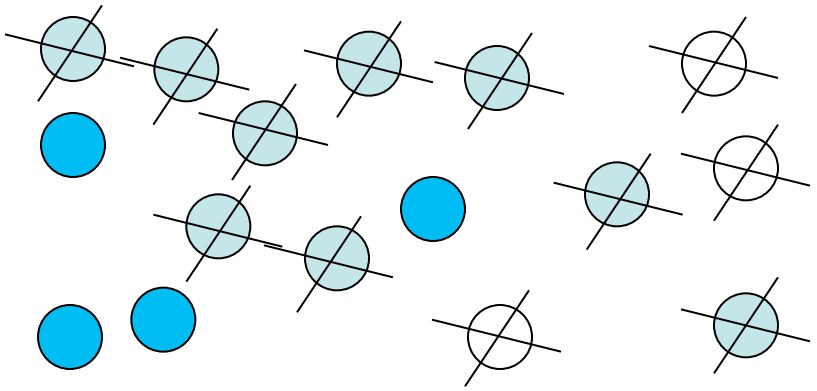


Image: *Staphylococcus aureus* on antibiotic test plate, PHIL #2641

Why should we care about biology?

- Human health care and treatment of diseases, such as plague & smallpox

(Smallpox is a deadly viral disease that was ERADICATED through widespread vaccination. We will talk about smallpox during our next class meeting when we discuss scientific method)

- Care and treatment of our natural resources and other organisms on earth

Images: Child with Smallpox, James Hicks, CDC; Monarch Butterfly laying eggs on Common Milkweed.

Some Areas of Biological Study

- **Botany:** Study of plants
- **Zoology:** Study of animals
- **Anatomy:** Structures of organisms
- **Physiology**: Functions within organisms
- **Ecology:** Study of how organism in an ecosystem interact with each other and their environment.
- **Microbiology**: Study of organisms too small to see with the naked eye

Confused?

Smart Links

Here are some links to fun resources that can help introduce you to biology:

- "Science Is Real" music video by They Might Be Giants.
- Science Prof Online: Free science education resource with virtual classrooms, biology PowerPoint lectures, laboratory exercises, practice test and review questions, science photos, videos and more.
- Discovery Education: Free science resources for students.
- Cells Alive! Website with many helpful biology animations and activities.
- "Put It To The Test" music video by They Might Be Giants.
- The Biology Project: Has tutorials and problem sets for learning biochemistry, cell, developmental, molecular, and human biology, Mendelian genetics and immunology.
- "She Blinded Me With Science" music video Thomas Dolby.

(You must be in PPT slideshow view to click on links.)