

Amoeba Sisters

Video Refreshers April 2015

Description: Each refresher box contains images, major points, and reflection questions that correlate with an Amoeba Sisters video. Please note that these refreshers are brief so they only cover major video points.

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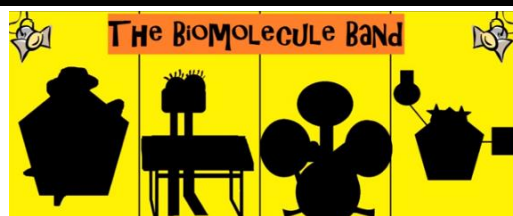
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Video Link: Refreshers are in the order of our Amoeba Sisters video playlist (<http://goo.gl/qTBVOF>).

We have more detailed handouts on <http://www.amoebasisters.com/handouts.html>.

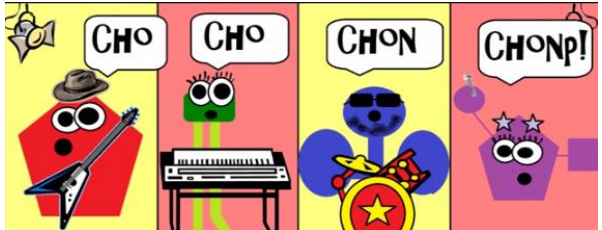


1: Biomolecule Band



MONOMERS

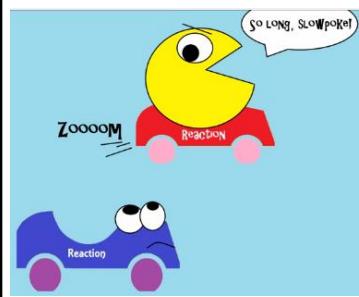
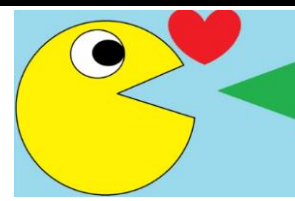
Monosaccharides are the monomers of **carbohydrates**. What are some **functions** of each of these biomolecules?
Fatty acids and **glycerol** are the monomers of **lipids**.
Amino acids are the monomers of **proteins**.
Nucleotides are the monomers of **nucleic acids**.



What does the image above reference to? Keep in mind it's more than just knowing the elements present! How are they arranged? To the Google for biomolecule **structure**. Which one(s) has/have ring structure(s)? Chains?

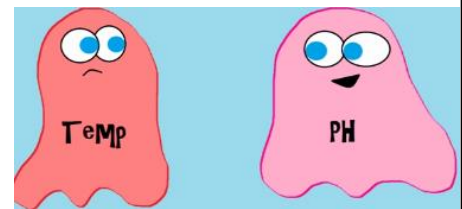
2: Enzymes and Pac-Man

Pac-Man
protein



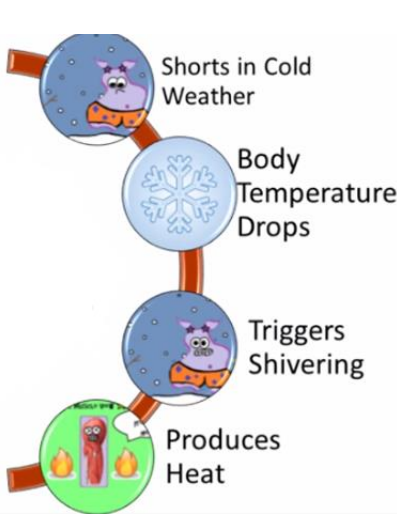
Substrates bind to the **active site** of an enzyme. Which one in the cartoon is the **enzyme**? **Substrate**? Why do we say that enzymes are lock and key **specific**?

Reactions can still occur without the presence of enzymes, but enzymes do have the ability to speed up reactions. Can you give an example of real life enzyme function from the video?



Do all enzymes function at the same temperature and pH? What happens to enzyme function if enzymes are not in their ideal pH or temperature?

3: Homeostasis



What is an example of systems in your body working together to maintain **homeostasis**?

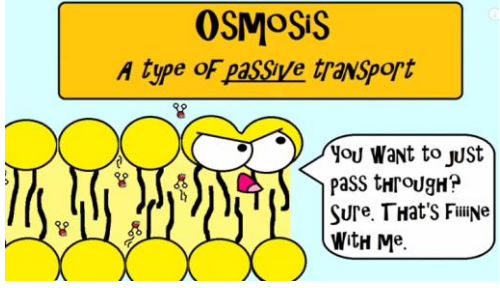


How does a **selectively permeable** cell membrane assist with homeostasis? How is this related to cellular transport?

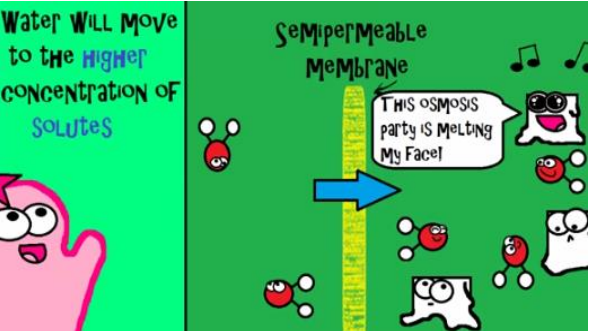


4: Osmosis

Osmosis is the diffusion of water. It is not the only type of **passive transport**. Check out the #AmoebaGIFs page on amoebasisters.com. Which of the following GIFs on the link are also showing passive transport: diffusion, facilitated diffusion, and/or active transport?

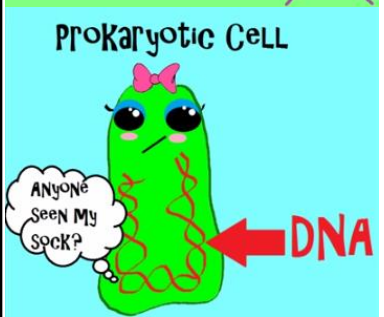


Water moves to areas that are **hypertonic**, which means areas of a **higher solute concentration** (less water concentration).

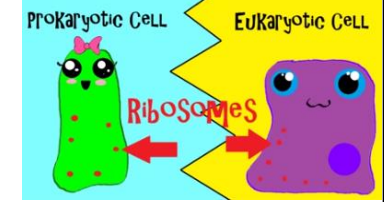
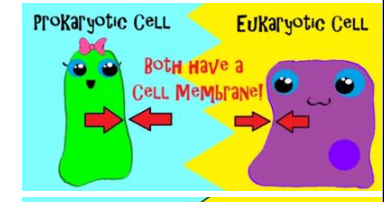
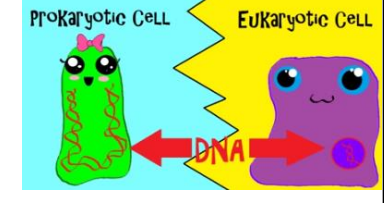


5: Prokaryotes and Eukaryotes

Prokaryotes are **not as complex** as eukaryotes and have some major differences. What do these images reference to?

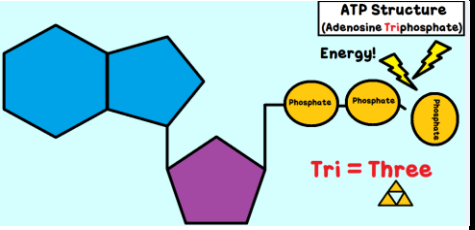


Prokaryotes and eukaryotes are both **cells** and have several things in common- see below!

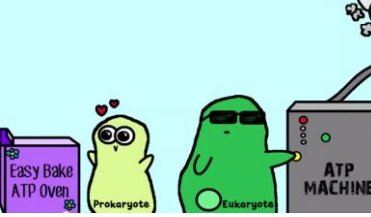


6: Cellular Respiration

The main function of cellular respiration is to produce **ATP**. What is the significance of ATP? How does it release energy?

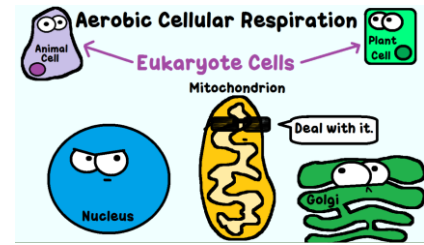


All cells must do some form of cellular respiration- animal cells, plant cells, bacterial cells, etc.

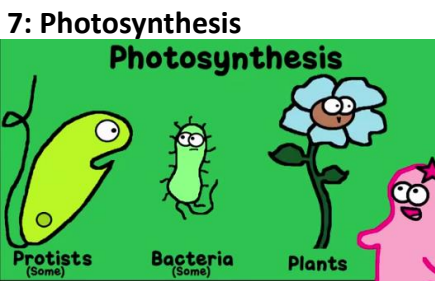


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Which **organelle** in eukaryotes is responsible for the **energy conversion** involved with **aerobic** cellular respiration? Remember that not all cellular respiration is **aerobic**!



7: Photosynthesis



Protists (Some) Bacteria (Some) Plants

In eukaryotes, which **organelle** is involved with the conversion of light energy to chemical energy?

Not all organisms can perform photosynthesis. Here are some organisms above that can perform photosynthesis.

Photosynthesis:

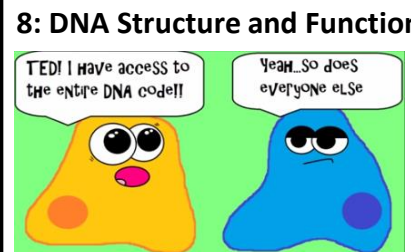
$$6CO_2 + 6H_2O \xrightarrow{\text{LIGHT}} C_6H_{12}O_6 + 6O_2$$

Cellular Respiration:

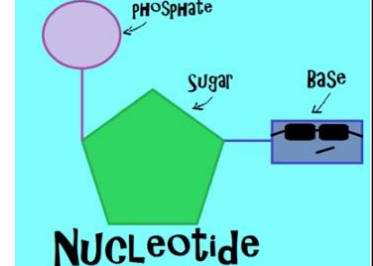
$$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O + \text{ATP ENERGY}$$

Reactants in photosynthesis are **products** in cellular respiration. **Products** in photosynthesis are **reactants** in cellular respiration. Plants can perform both photosynthesis and cellular respiration. Lucky plants!

8: DNA Structure and Function



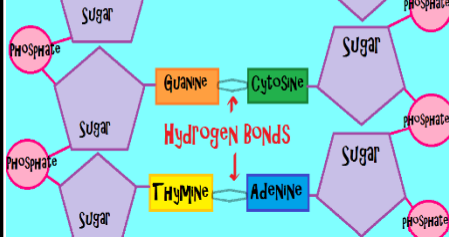
TEDI I have access to the entire DNA code!! Yeah...So does everyone else



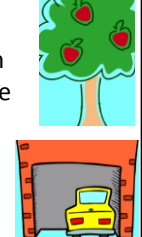
Nucleotide

Your full DNA code is present in all of your body cells, but the portion of DNA used depends on the cell type. Which **organelle** holds DNA in eukaryote cells?

DNA is a **nucleic acid** (type of biomolecule) made up of **nucleotides**. Which part of the nucleotide (above) makes up the sequence that codes for your traits?

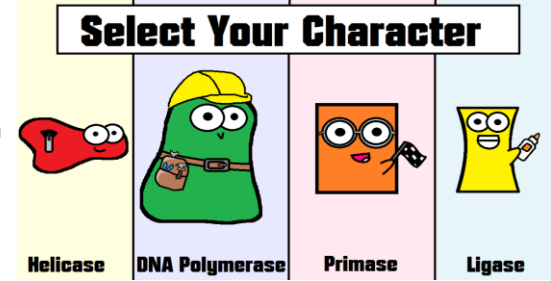


Nucleotides fit together as shown on left and DNA is double stranded. What are the images to the right supposed to remind you of?



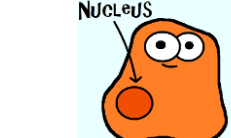
9: DNA Replication

What does it mean to **replicate** DNA? Explain how these enzymes (on right) work together to replicate DNA.



Helicase DNA Polymerase Primase Ligase

Eukaryote Cells

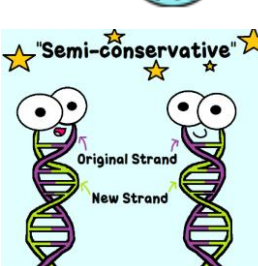


Nucleus

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Cells must replicate their DNA when making new cells as each new cell needs a copy of the genetic material. In eukaryotes, DNA replication occurs in the **nucleus** during **interphase**. Prokaryotes do not have a nucleus.

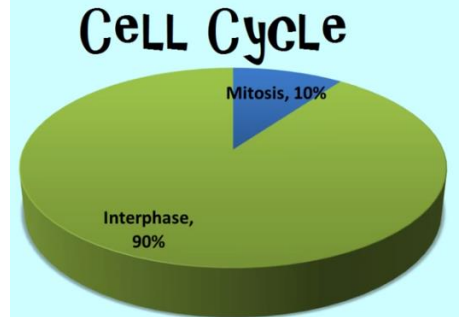
"Semi-conservative"



Original Strand New Strand

What do we mean when we say DNA replication is **semi-conservative**? What do you end up with after DNA replication?

10: Cell Cycle and Cancer

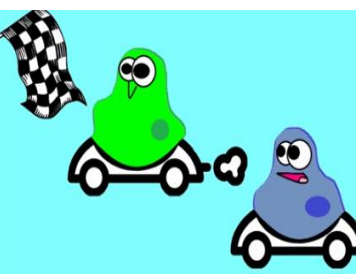


Interphase **Mitosis**

The cell cycle has several **checkpoints**. These checkpoints are critical to ensure that only correctly functioning cells can continue through the cycle. How does this involve cell self-destruction (**apoptosis**)?

At any given time, a cell is in either **interphase** or **mitosis**. Interphase takes up much more time. The cell grows and replicates DNA in interphase. Mitosis (M phase) is when the cell actually divides.

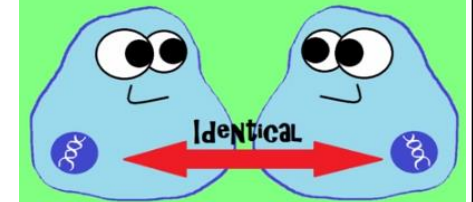
If the cell cycle checkpoints are bypassed and cells have **uncontrolled growth** (meaning uncontrolled cellular divisions--mitosis), this can lead to **cancer**.



11: Mitosis

Mitosis makes **identical** cells. Mitosis has a "t" in it so think "t" for "two"---it results in **two** identical cells, unlike meiosis. In human body cells undergoing mitosis, the starting cell has 46 **chromosomes** and the ending cell has 46 chromosomes. Why is it important that the resulting cells are identical?

Mitosis is done **by body cells**, not sex cells (gametes).




Identical

Mitosis is important for organism **growth** and **repair**! When a cell divides in mitosis, it has different phases. Describe the PMAT phases.

Mitosis Clues!

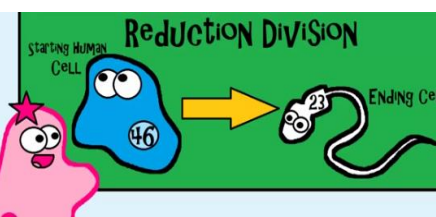
P
M - (M For "Middle")
A - (A For "AWay")
T - (T For "two")



Sorry man, I can't let you in.

12: Meiosis

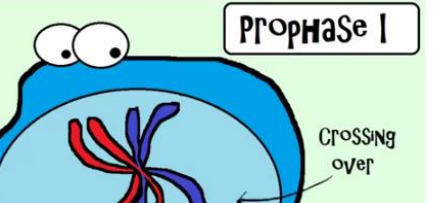
Meiosis makes **non-identical** cells. Meiosis results in 4 sex cells (**gametes**).



Starting Human Cell (46) Ending Cell (23)

Reduction Division

What is the significance of **crossing over**, which occurs in meiosis?



ProPhase I

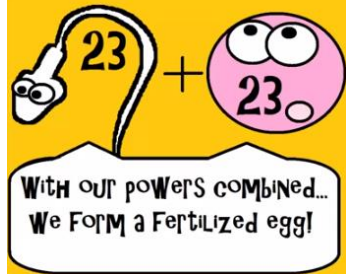
Crossing over

Egg cell

Gametes

Sperm Cell

In humans, gametes have 23 chromosomes. What is the significance of gametes only having half the number of chromosomes as a body cell?



23 + 23

With our powers combined... We Form a Fertilized egg!

13: Monohybrid Crosses (Mendelian Inheritance)

Dominant Allele
I SHALL MAKE THIS PIG HAIRY!

Homozygous DOMINANT

Homozygous Recessive

Heterozygous

An **allele** is a form of a gene. Each parent contributes an allele for a gene in their **gametes**. The combination of the alleles make up the organism's **genotype**. The genotype determines whether a trait will show or not. If a **dominant** allele is present, that is the trait that will show. **Recessive** traits will only show if a dominant allele is not present. (*Mendelian inheritance*)

A **phenotype** is a physical appearance of an organism. This shows a 3:1 phenotype ratio.

Phenotypes

3:1 Ratio

Predict the outcome of offspring from two heterozygous guinea pigs (using trait in video).

14: Dihybrid Crosses (Mendelian Inheritance)

Step 2

HS Hs hS hs

hs hs hs hs

	HS	Hs	hS	hs
hs				
hs				
hs				
hs				

Note: This is based on a video to be released in late April 2015---most recent on this refresher. Once you can solve a monohybrid cross, you can solve dihybrids! This will involve 2 pairs of alleles (instead of 1 pair). 16 boxes in your Punnett square instead of 4 boxes.

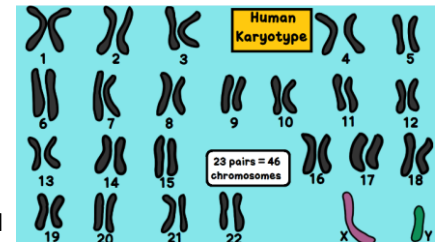
In this example, the HhSs cat could give these gamete combinations: HS, Hs, hS, and hs. Put those around the top of the Punnett square. The second hhs cat could give these gamete combinations: hs, hs, hs, and hs. Put that around the other side of the Punnett square. Then cross.

Predict the offspring of two heterozygous parent pea plants (RrYy x RrYy) by creating a dihybrid square. In peas, assume the Y allele codes for yellow and y codes for green. The R allele codes for round and the r allele codes for wrinkled.

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15: Sex-Linked Traits

Sex-linked traits are traits that are only carried on the **sex chromosomes** (X and Y). Alleles for sex-linked traits are written as coefficients on the sex chromosomes as shown below, and they are typically on the X chromosomes unless otherwise informed.



Homozygous DOMINANT

Homozygous Recessive

Heterozygous

X^hY

XHY

Using the hemophilia example from the video (sex-linked, recessive)—**predict** the outcome of children from a woman who has the disorder with a man who does not.

16: Multiple Alleles

Multiple allele genetic problems can be modeled using blood types, as there are multiple alleles to code for blood type A, B, AB, or O. Blood types are identified based on the **antigens** that are present on red blood cell surfaces.

ANTIGENS

Phenotype (the appearance of an organism based on its genotype)	Genotype (genetic makeup of an organism)
Type A	I ^A I ^A I ^A i

Phenotype	Genotype
Type O	ii

Phenotype	Genotype
Type B	I ^B I ^B I ^B i
Type AB	I ^A I ^B

Blood type genotypes are written as coefficients on the letter "I" (stands for immunoglobulin). **Predict** the outcome of offspring from one parent who has type AB blood and another parent who has type O blood.

17: RNA vs. DNA

DNA and RNA are both **nucleic acids**, but they contain different **sugars** (deoxyribose for DNA and ribose for RNA). DNA is **double** stranded and RNA is **single** stranded. Both contain some of the same bases A, G, and C---but which bases are different?

Deoxyribose Nucleic Acid (DNA)

Ribonucleic Acid (RNA)

There are three major RNA types, which are important to know for protein synthesis. Which of these types starts in the nucleus?

Messenger RNA "mRNA"

Transfer RNA "tRNA"

I carry amino acids!

Ribosomal RNA "rRNA"

Who wants to be in the nucleus with a bunch of suits?

18: Protein Synthesis

DNA Codes For **Protein**

DNA can code for **protein**, and it is this protein that can influence or make up your traits. That is why the process of protein synthesis, which means to make protein, is so important to understand!

Transcription

Translation

Amino Acid

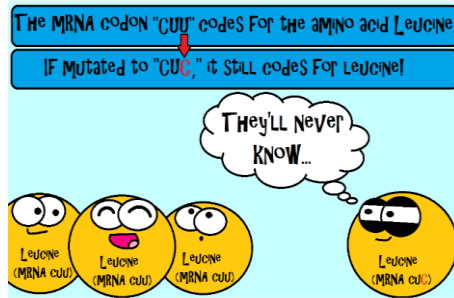
Contact Made. Detaching amino acid.

Describe how **transcription** produces mRNA in the **nucleus**, which is then used to make **protein** during **translation** in the **cytoplasm**.

19: Mutations

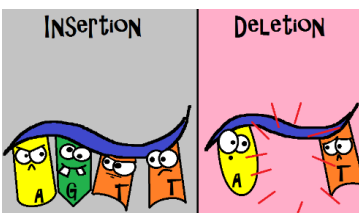
Mutations are **random** changes that can occur in **nucleic acids** from external or internal factors. They can be harmful, helpful (rare), or neutral in their effect-- such as the comic on right. If a mutation occurs in a **gamete** (sex cell), it can be passed to offspring that develop from it.

The mRNA codon "CUU" codes for the amino acid Leucine. IF Mutated to "CUG," it still codes for Leucine!



Substitution

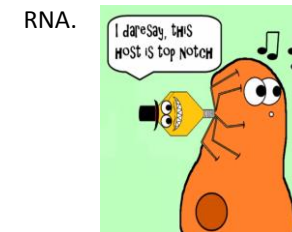
Substitutions, insertions, and deletions are **gene mutations**. Since bases are read in 3's (**codons**), **insertions** and **deletions** are especially dangerous as they can result in a **frameshift**. Describe a frameshift.



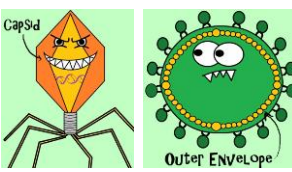
Chromosomal mutations involve the **chromosomes**, which are made of DNA and protein. These can result in deletions, duplications, translocations, and insertions.

20: Viruses

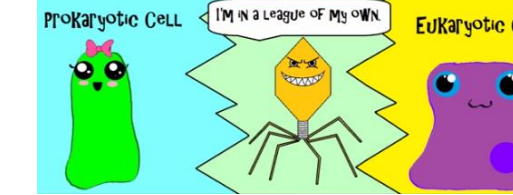
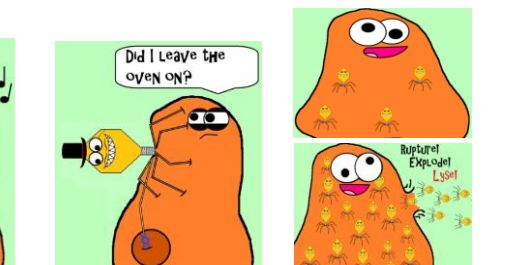
Viruses are not alive. They are not cells. They require a **host** to replicate. However, they do have genetic material in the form of DNA or RNA.



Explain the steps in the **lytic cycle** (type of viral reproduction) above. How would the **lysogenic cycle** be different?

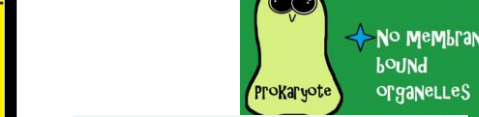


Viruses need to be able to attach to **specific** host cells to reproduce. Viruses have different structures that assist this. They may have a **capsid** and/or **envelope** around their genetic material.

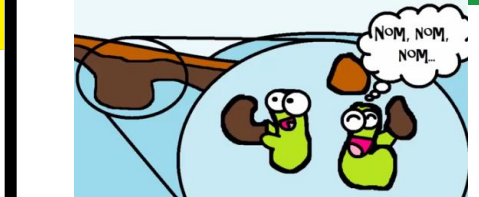



21: Bacteria

★ **NO NUCLEUS**
★ **NO MEMBRANE-BOUND ORGANELLES**

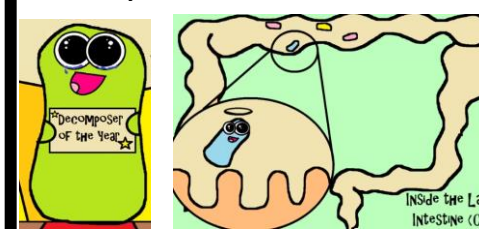
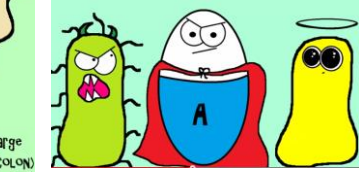


Bacteria are **prokaryotes**. They have a cell membrane and DNA, but they are much less complex than eukaryotes.

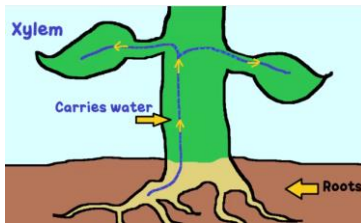
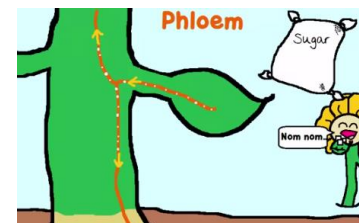


Bacteria, like viruses, **can cause disease**. Antibiotics specifically target prokaryote cells, so they target bacteria. However, many antibiotics are broad spectrum which means that they will also target "good" bacteria that live in the human body. What effect can this have on an organism?

Bacteria often get an unfair reputation. Describe how these microorganisms can **positively maintain the health of organisms and ecosystems**.

22: Plant Structure and Adaptations

Vascular plants have **vascular tissue**. Vascular tissue – made up of the **xylem** and **phloem**- is responsible for transporting water and sugars. How can this transport system support other plant systems, such as the plant's reproductive system?

Stomata (singular: **stoma**) must open or close based on environmental conditions. Stomata need to be opened to allow gases in, but the plant can lose water by doing so. How might this relate to the transport of water in a plant?



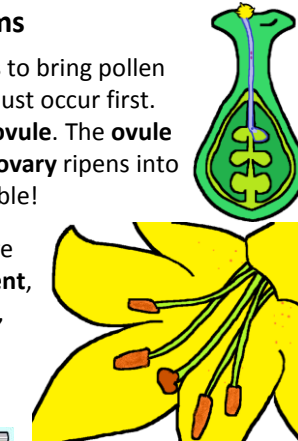
Plants often have structural **adaptations** (example: broad leaves or needles).

23: Plant Reproduction in Angiosperms

Many angiosperms rely heavily on **pollinators** to bring pollen to the **stigma**. This is called **pollination** and must occur first. **Fertilization** is when the pollen fertilizes the **ovule**. The **ovule** will develop into a **seed**. In angiosperms, the **ovary** ripens into a **fruit**. A fruit is not always sweet or even edible!

Can you identify the following reproductive structures in angiosperms? **Anther, filament, stamen, stigma, style, ovary, ovule, petal, pollen grain**. All are found on one of the diagrams on the right.

Some angiosperms produce edible, sweet fruit. This fruit may be eaten by organisms so that the seeds can be spread. How would developing fruit work with the transport system of a plant (think: xylem and phloem)?

Seed dispersal is critical because it reduces competition with the parent plant. There are a variety of different methods (ex: wind, water, animals) of seed dispersal.

24: Human Body Systems

It is critical to not only know the functions of body systems, but to realize that body systems do not work in isolation. They work together.



Example 1: The circulatory and respiratory system work closely together. The respiratory system involves the exchange of gases and the circulatory system transports these gases throughout the body. *How could the circulatory system work with the immune system to defend the body against pathogens?*

Example 2: The muscular system works with the digestive system. Muscular contractions are necessary in helping food travel through many portions of the digestive system. *Which system would be involved with secreting hormones involved in digestion?*