



# Amoeba Sisters

## Main Idea Video Refreshers

### Description:

These refreshers are designed to focus on main biological concepts covered in all of our biology videos (as of April 2016) by asking main idea questions, displaying comics from our videos/GIFs, and using some mnemonic devices. They are brief so they only address major concepts.

### How do I use this?

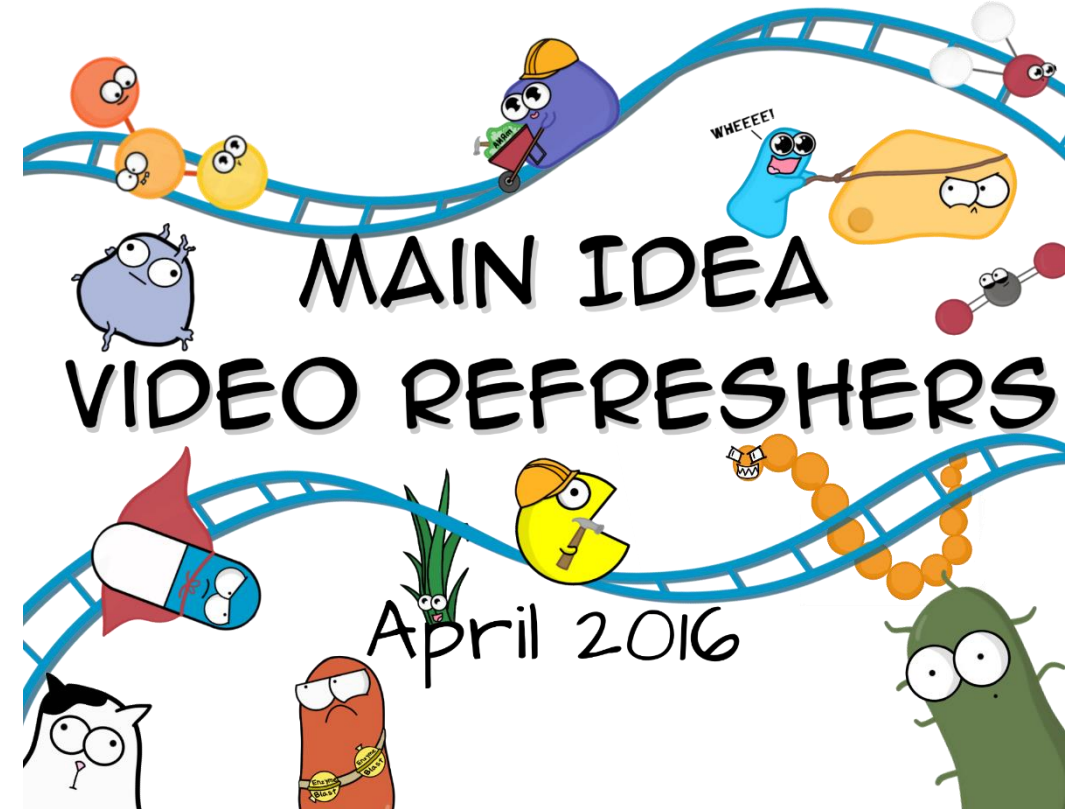
Each **box** has a **number** on it that corresponds to the video number in our official Amoeba Sisters Video Playlist: [goo.gl/u79sjZ](http://goo.gl/u79sjZ)

If you are finding the main idea questions to be challenging, the number will help you identify which video to watch in the Amoeba Sisters' playlist.

### Terms of Use:

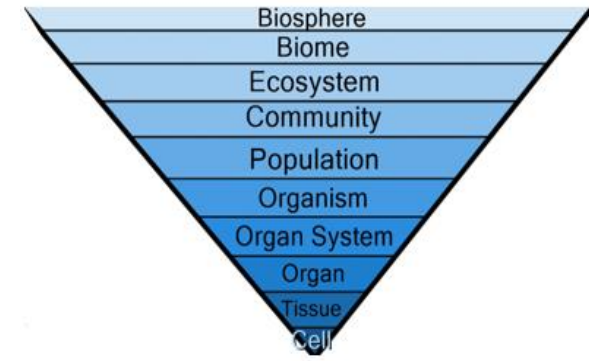
We hope you will find this useful! As with all of our public website material, it may be reproduced and/or uploaded on websites *for educational purposes only*. They can be printed front and back in black and white; however, they are best viewed electronically in color.

*Use for any financial gain is prohibited.*



Copyright © 2016 Amoeba Sisters  
View more handouts on:  
[www.amoebasisters.com/handouts](http://www.amoebasisters.com/handouts)

**1** Describe each of the **biological levels of organization**. Analyze these levels by relating them to each other as well as the whole system. Can you give an example of each?

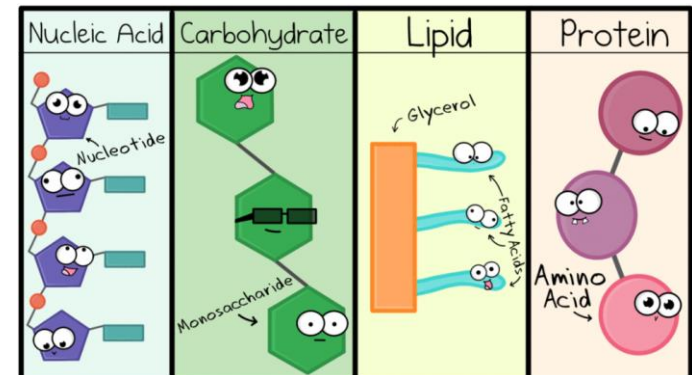


What are **biotic** and **abiotic** factors? Which levels in the above graphic take abiotic factors into account?

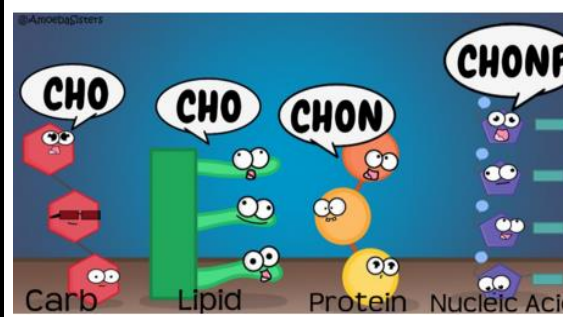


Brianna Rapini & Sarina Peterson  
#AmoebaSisters

**2** **Monosaccharides** are the **monomers** (building blocks) of carbohydrates. Can you name other building blocks (monomers) for the biomolecules?



Amoeba Sisters #AmoebaGIFs



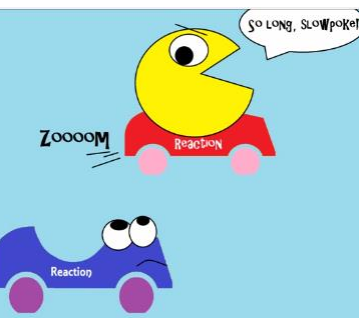
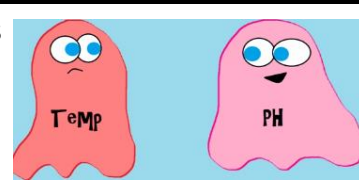
What does the graphic on the left reference? How are biomolecules arranged **structurally**?

Name 2 **examples** + **functions** of each biomolecule.

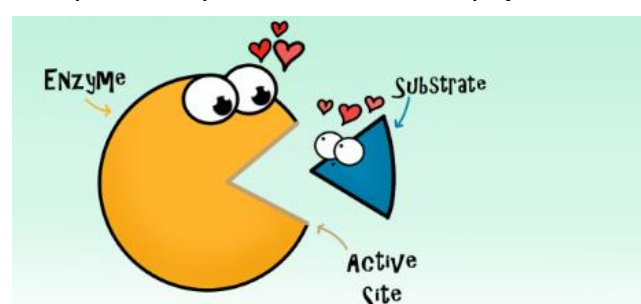


**3** **Pac-Man** → **Protein**

**Enzymes** are **proteins**, which means they are composed of amino acids. Enzymes have an **ideal** temperature and pH. They can be **denatured** by extreme temperatures and pH.

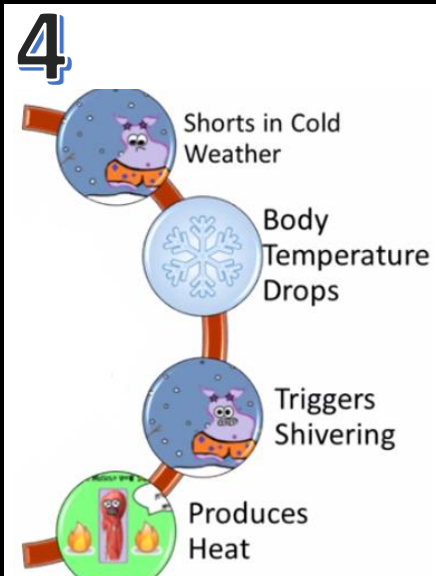


**Substrates** bind to the **active site** of an enzyme. Why do we say that enzymes are lock and key **specific**?



Amoeba Sisters #AmoebaGIFs

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 an enzyme role from the video?

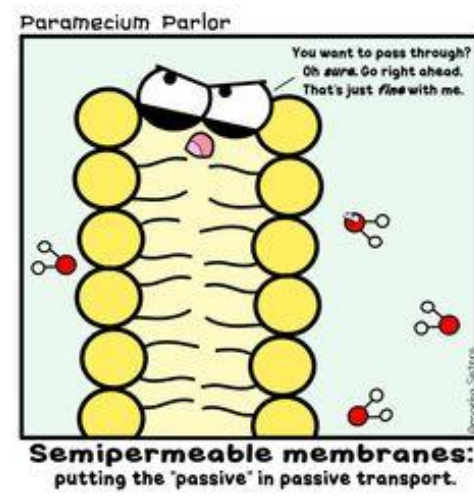
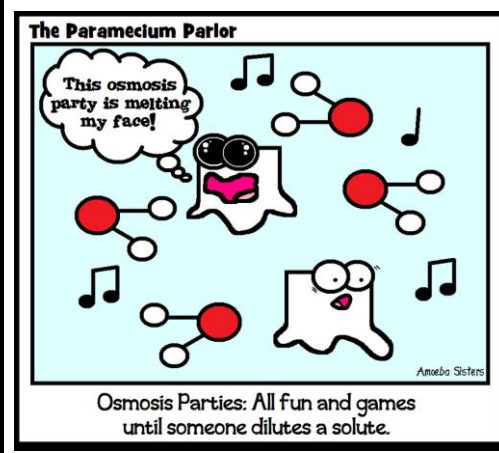


What is an example of systems in your body working together to maintain **homeostasis**?

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



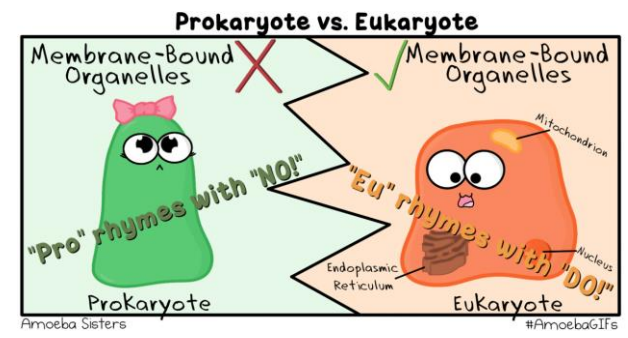
**5** Osmosis is the **passive** movement of water. Remember that water moves to areas of **higher solute concentration (hypertonic areas)**, which therefore tend to be areas of lower water concentration. View the real life examples in the video.



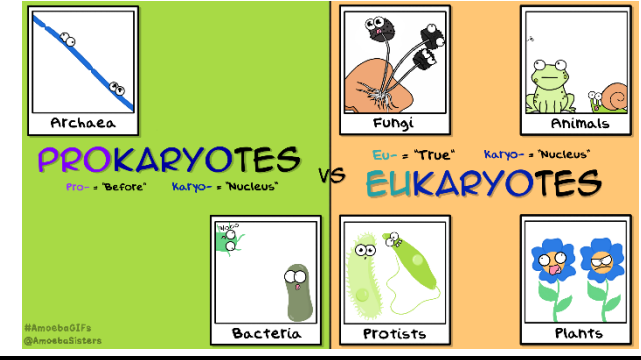
Check out the #AmoebaGIFs page on [amoebasisters.com](http://amoebasisters.com). Which of the following GIFs are also showing **passive transport**: diffusion, facilitated diffusion, and/or active transport?

**6** Both **prokaryotes** and **eukaryotes** contain a **cell membrane, genetic material, and ribosomes**.

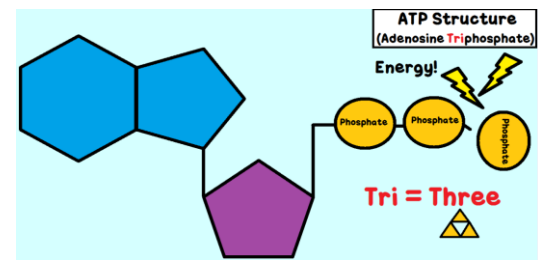
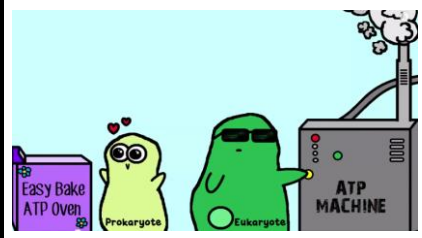
Prokaryotes are not as complex as eukaryotes. What does it mean to say that prokaryotes do *not* have **membrane bound organelles**? What are some examples of membrane bound organelles?



Which types of cells can be identified as prokaryotes? Eukaryotes? What types of cells do you have in your body?



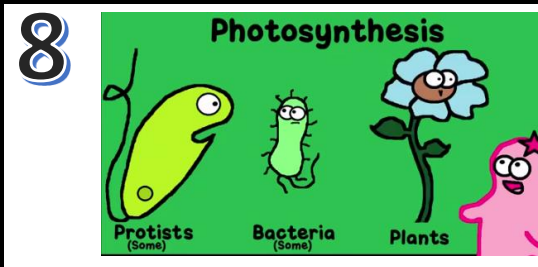
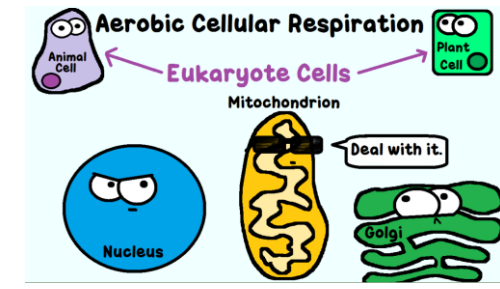
**7** The main function of cellular respiration is to produce **ATP**. What is the significance of ATP? How does it release energy?



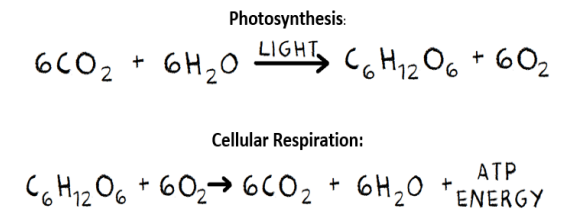
**All cells** must do some form of cellular respiration- animal cells, plant cells, bacterial cells, etc.

Which **organelle** in eukaryotes is responsible for the **energy conversion** involved with **aerobic** cellular respiration?

Remember that not all cellular respiration is **aerobic**! How is **anaerobic** respiration different? Which type is **fermentation**?

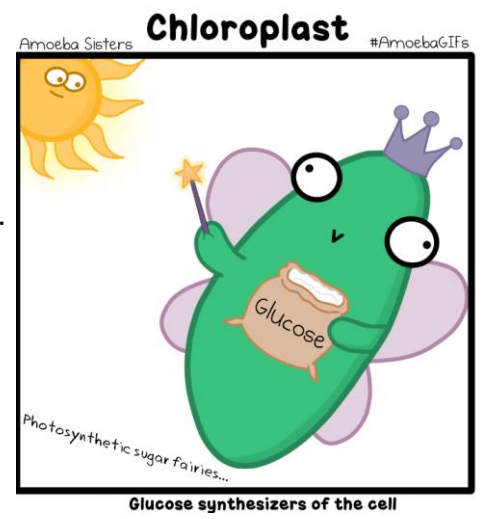


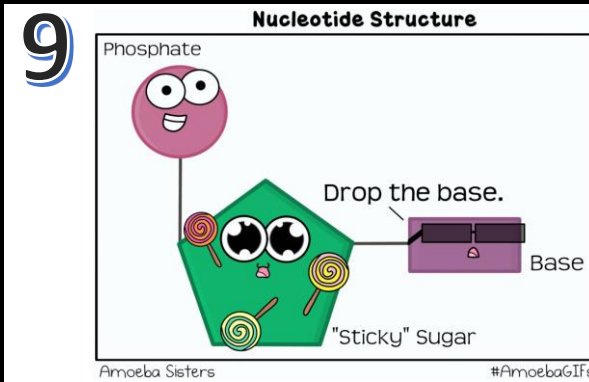
Not all organisms can perform photosynthesis. Here are some organisms above that can perform photosynthesis.



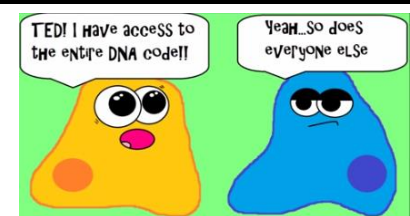
**Reactants** in photosynthesis are **products** in cellular respiration. **Products** in photosynthesis are **reactants** in cellular respiration. Since all cells must do some form of cellular respiration, plants perform *both* photosynthesis and cellular respiration. Lucky plants!

Eukaryotes have the **organelle** (on right) which converts light energy to chemical energy.

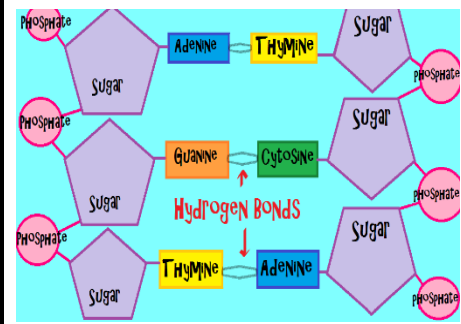




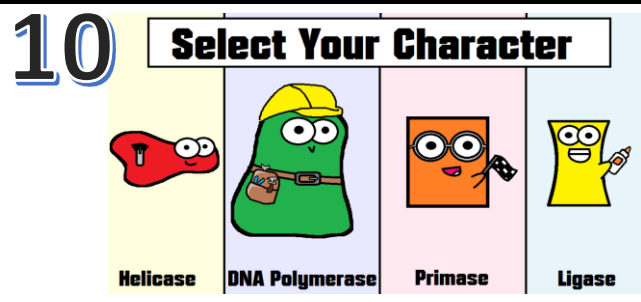
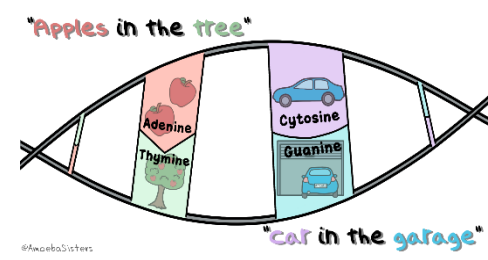
DNA is a **nucleic acid** (type of biomolecule) made up of **nucleotides**. Which part of the nucleotide (left) makes up the sequence that codes for your traits?



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?



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



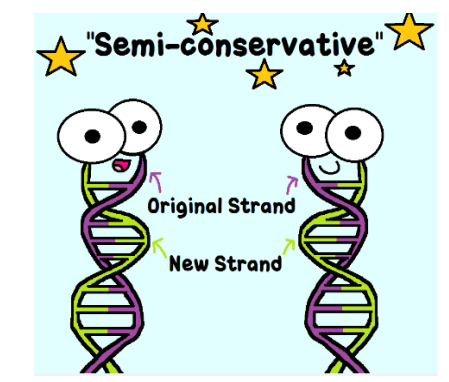
Cells must replicate their DNA when making new cells as each new cell needs a copy of the genetic material. In eukaryotes, DNA replication occurs in the **nucleus** during **interphase**. Prokaryotes do *not* have a nucleus.

Eukaryote Cells

Nucleus

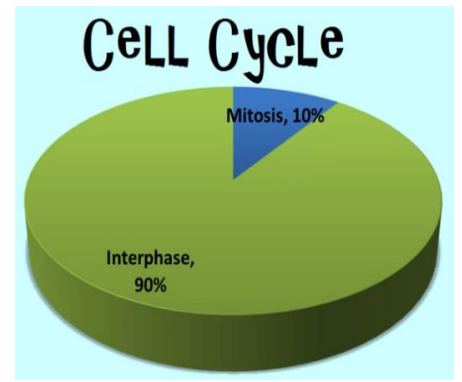
What does it mean to **replicate** DNA? Explain how these enzymes (above) work together to replicate DNA.

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



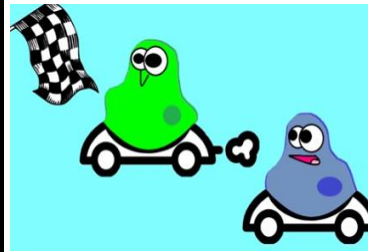
### 11

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.



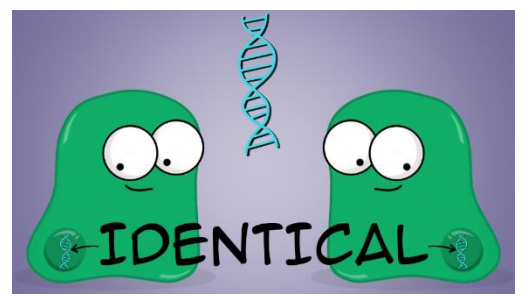
The cell cycle has several **checkpoints**. These checkpoints are critical to ensure that only correctly functioning cells can continue through the cycle. How does this involve cell self-destruction (**apoptosis**)?

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

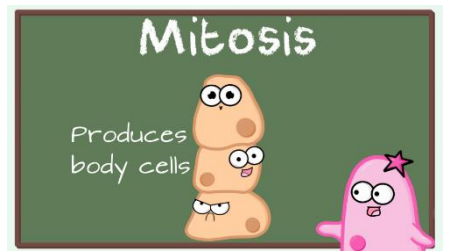
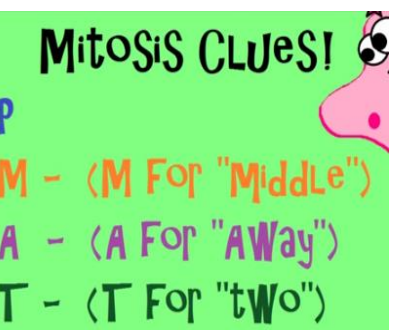


### 12

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?

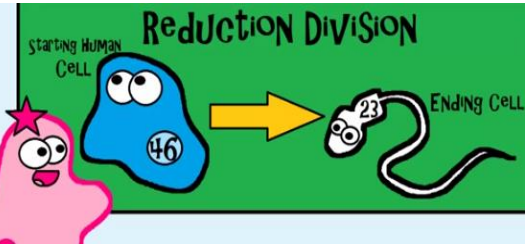


Mitosis is important for organism **growth** and **repair**! When a cell divides in mitosis, it has different phases. Describe the PMAT phases.

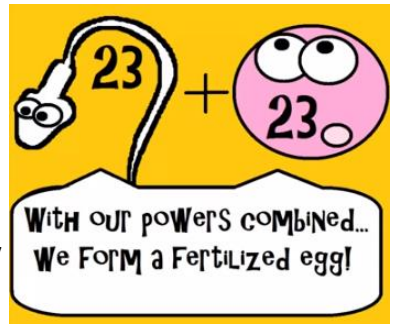


Mitosis produces **body cells** (somatic) and *not* sperm or egg cells (gametes).

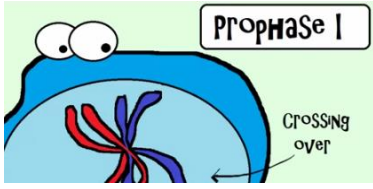
# 13



In humans, **gametes** (sperm and egg cells) have 23 chromosomes. What is the significance of gametes only having half the number of chromosomes as a body cell?



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

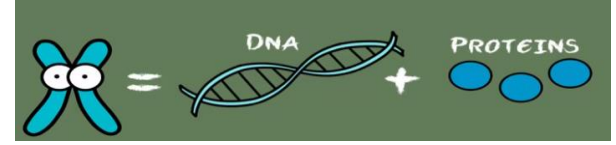


What is the significance of **crossing over**, which occurs in meiosis?

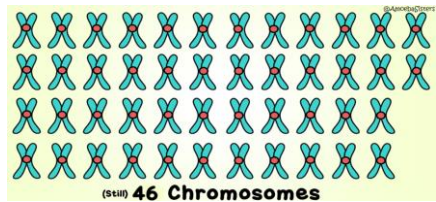
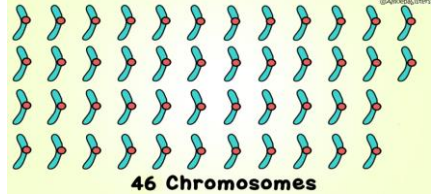
Like mitosis, interphase only occurs once before the process starts. Unlike mitosis, the **PMAT stages happen twice**. How is Meiosis 1 different from Meiosis 2?



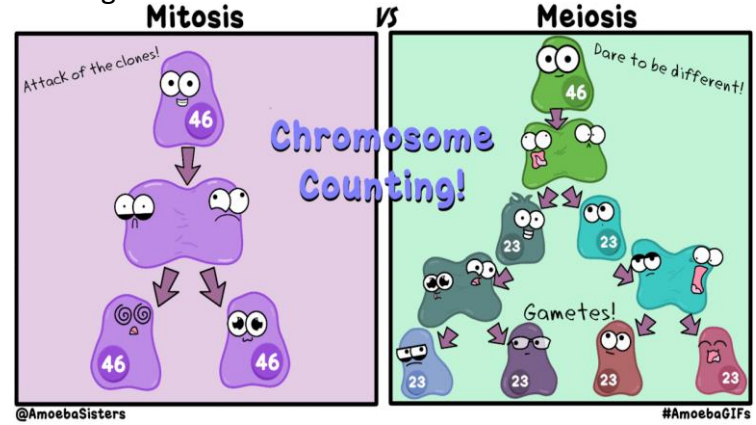
# 14



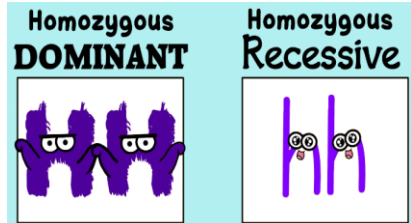
In **interphase**, chromosomes duplicate. When a cell with 46 chromosomes duplicates, why do we still count 46 chromosomes? Do **chromatid** numbers change?



How do **chromosome** and **chromatid** numbers change in mitosis vs. meiosis? In humans, how many chromosomes are in cells resulting in **mitosis** vs. **meiosis**?

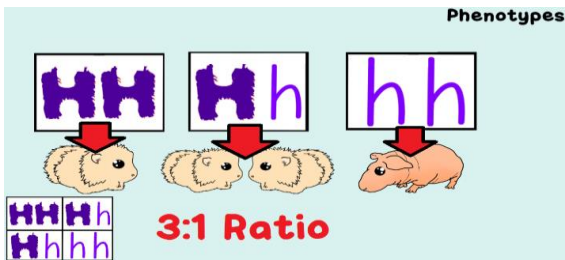


# 15



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 (right) shows a 3:1 phenotype ratio.



**Predict** the genotype and phenotype ratios of offspring from two heterozygous guinea pigs (using trait in video).

# 16



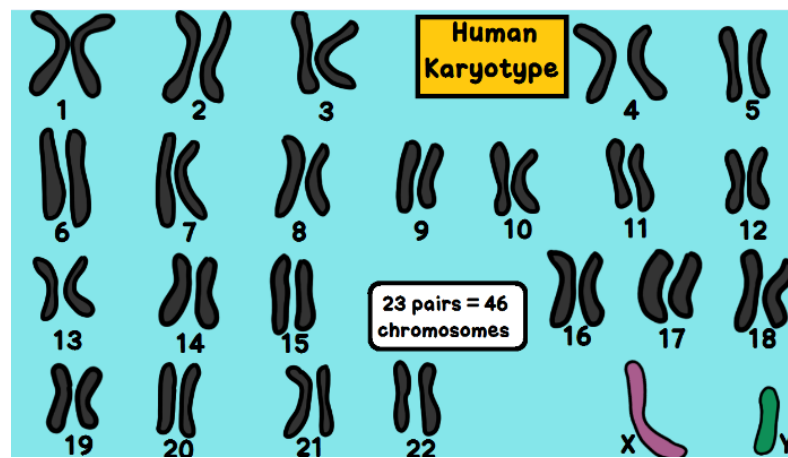
If you can do a **monohybrid cross** from the previous box, you can do a **dihybrid cross** like this example (left)! The **HhSs** cat could give these **gamete combinations**: HS, Hs, hS, and hs. Put those around the top of the Punnett square. The second **hhss** cat could give these **gamete combinations**: 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.

Having problems with figuring out the gamete combinations that go on the top and side of the square? Check out the FOIL method in the video.

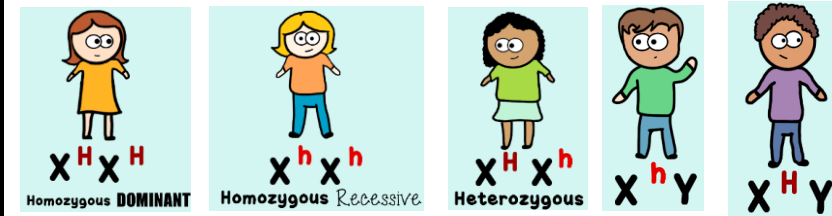
# 17

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.



Human Karyotype

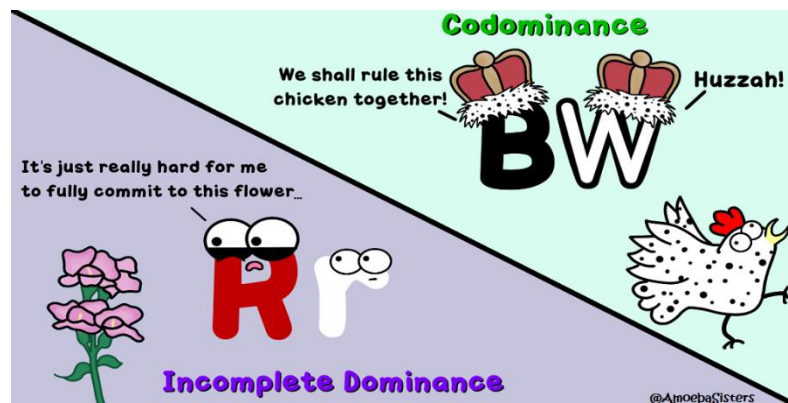
23 pairs = 46 chromosomes



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.

# 19

**Incomplete dominance** and **codominance** are excellent examples of non-Mendelian traits. Why? How is incomplete dominance different from codominance?



In the snapdragon example from the video, a red flower crossed with a white flower would result in what flower **phenotype**? **Genotype**? In the chicken example, a black chicken crossed with a white chicken would result in what chicken **phenotype**? **Genotype**? Explain.

## Epistasis

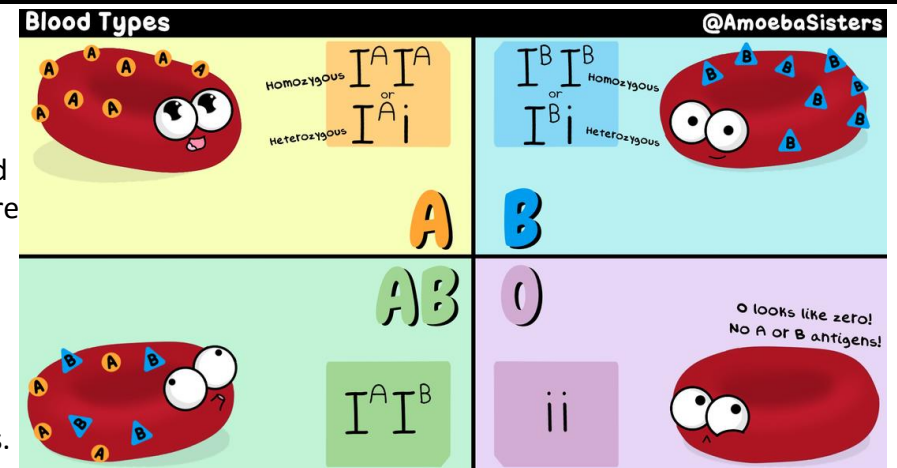
When one gene depends on another gene for it to be expressed



Explain how the term **epistasis** (above) can impact a trait.

# 18

**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.

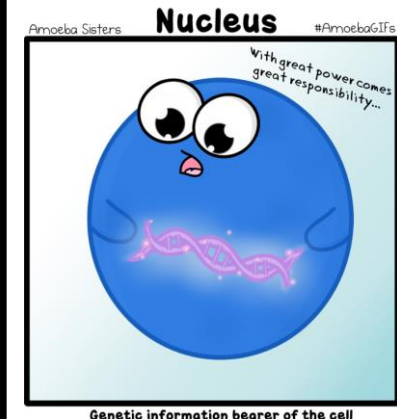
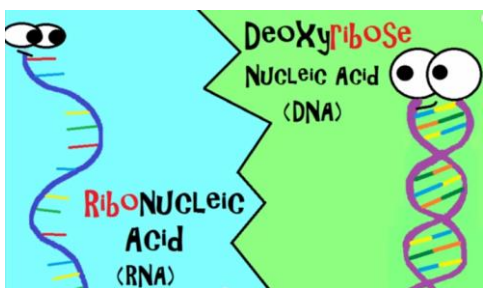


Brianna Rapini & Sarina Peterson

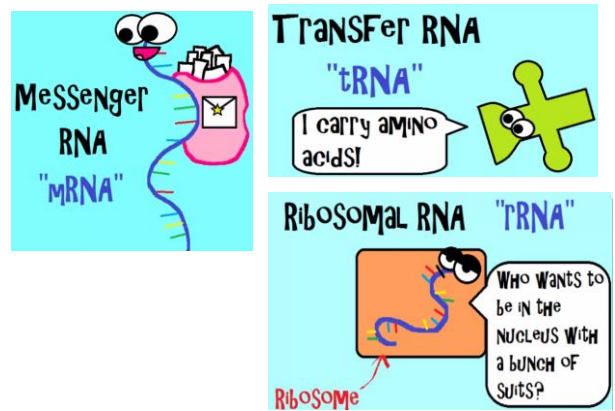
Blood type genotypes are written as coefficients on the letter "I" (stands for immunoglobulin) as shown in the chart above. **Predict** the outcome of offspring from one parent who has type AB blood and another parent who has type O blood.

# 20

**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?*



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

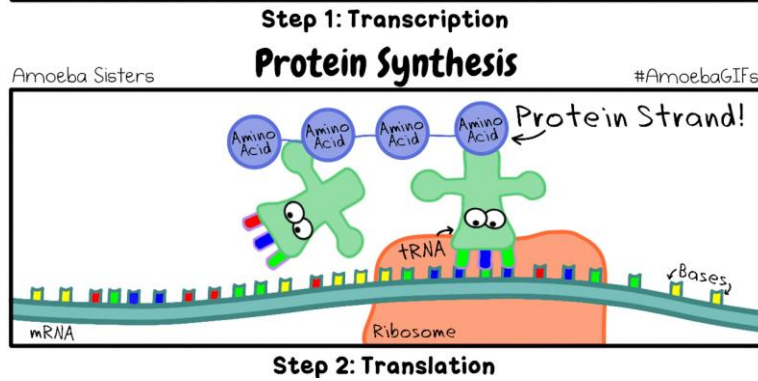
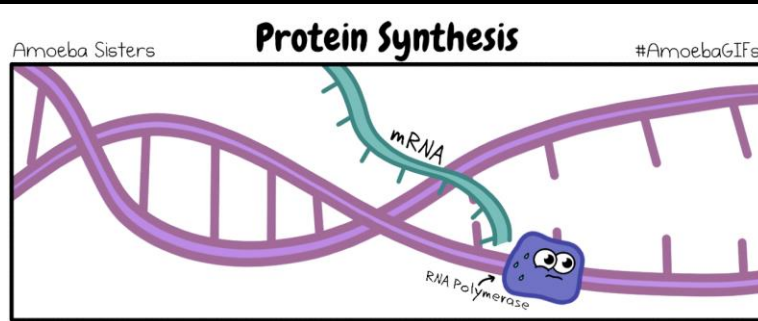


# 21

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!



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



# 23

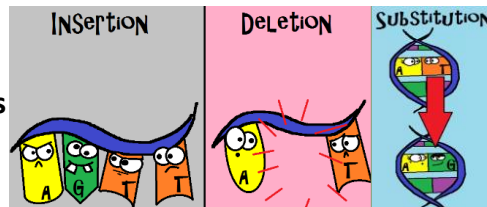
**Mutations** are **random** changes that can occur in **nucleic acids** from external or internal factors. They can be harmful, helpful (rare), or neutral in their effect---such as the comic on right. If a mutation occurs in a **gamete** (sex cell), it can be passed to offspring that develop from it.

Brianna Rapini & Sarina Peterson



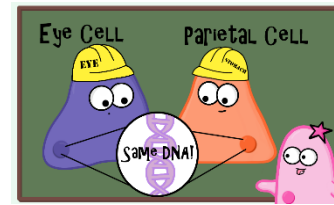
**Chromosomal mutations** involve the **chromosomes**, which are made of DNA and protein. These can result in deletions, duplications, translocations, and insertions. Can you describe each of those mutations?

**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.

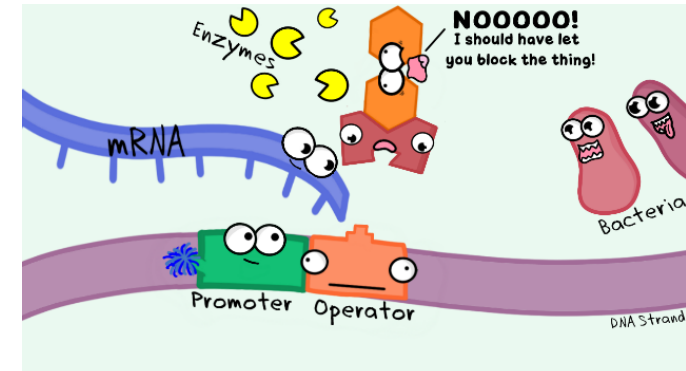
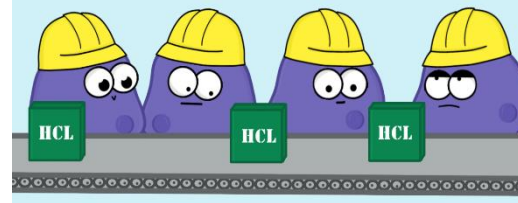


# 22

While your body cells contain the full DNA code, they use portions of it based on the cell's function. This is because **gene expression** is a **regulated** process. The comics (below left) shows that eye cells have the same DNA as parietal cells, but the DNA code for producing HCL is not activated in the eye cells. (thankfully!)



## EYE CELL DEPARTMENT

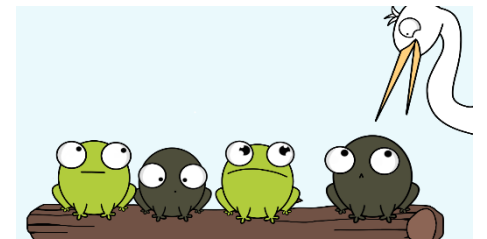
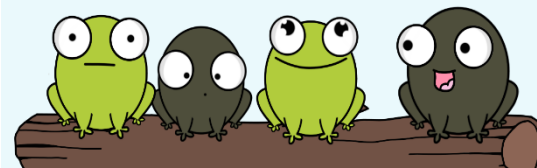


**Operons** are used to regulate genes, and they often involve enzymes. They are mostly commonly found in bacteria with a few eukaryote exceptions. Describe what occurs in the operon using the graphic above.

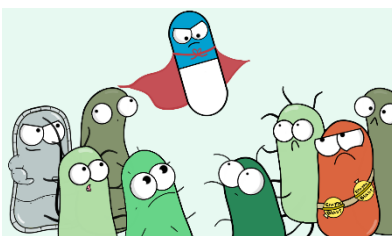
# 24

## Same Species of Frog

- ♥ Can breed with each other
- 🧬 Can pass down DNA to offspring
- ★ Have variety of traits



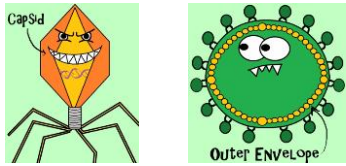
**Natural selection** is a mechanism of **evolution**. Explain how natural selection could take place over a long period of time, assuming that in this habitat, the darker frogs blend in well with their environment and the light frogs are instead easily seen.



**Antibiotic resistance in bacteria** is a health concern and can show natural selection in action. Explain how this occurs in terms of natural selection?

**25** **Viruses** are *not* cells. They require a **host** to replicate. However, they do have genetic material in the form of DNA or RNA. Most scientists consider viruses to be non-living.

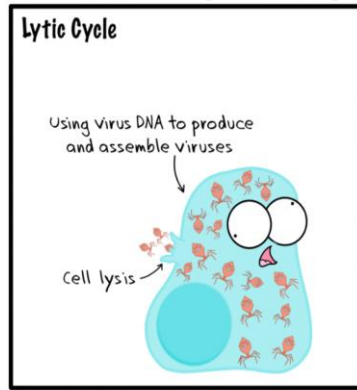
Viruses need to be able to attach to **specific** host cells to reproduce. Viruses have different structures that assist this. They may have a **capsid** and/or **envelope** around their genetic material (shown below).



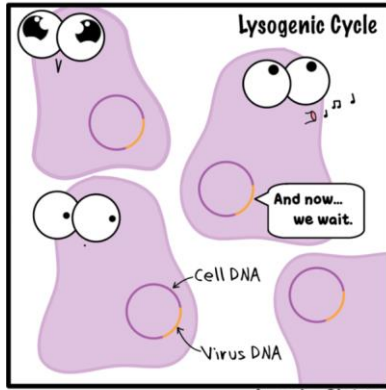
Brianna Rapini & Sarina Peterson



When it comes to viral replication, how is the **lytic cycle** (below left) different from the **lysogenic cycle** (below right)? Describe the events that occur during these cycles.



#AmoebaGIFs



Amoeba Sisters



View the graphic on the left. This is a naming system known as **binomial nomenclature**. What advantages do **scientific names** have over common names? Which word is the **genus**? The **species**?

**Dichotomous Key:**

- 1A. Cell(s) is/are prokaryotic...go to 2.
- 1B. Cell(s) is/are eukaryotic...go to 3.
- 2A. Cell wall(s) contain(s) peptidoglycan ...it's *Escherichia coli*.
- 2B. Cell wall(s) do(es) not contain peptidoglycan ...it's *Methanopyrus kandleri*.
- 3A. Autotrophic...it's *Chlorophytum comosum*.
- 3B. Heterotrophic...go to 4.
- 4A. Organism is multicellular ...it's *Agaricus bisporus*.
- 4B. Organism is unicellular....it's *Amoeba proteus*.

A **dichotomous key** is a system that allows you to identify organisms based on a series of statements that are organized in pairs. Use the dichotomous key on the right to identify the scientific name for the amoeba (on left).



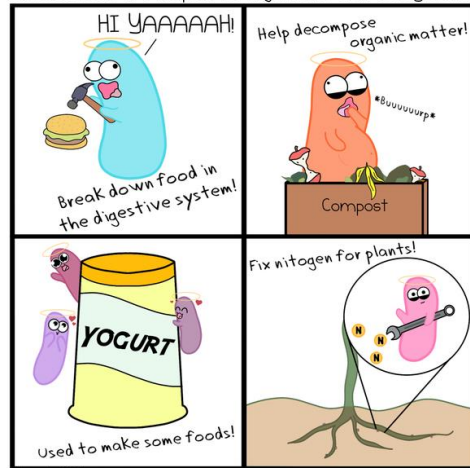
**27** Bacteria are **prokaryotes**. They have a cell membrane and DNA, but they are much less complex than eukaryotes.



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

**Misunderstood Bacteria**

Bacteria that are helpful to organisms and ecosystems!

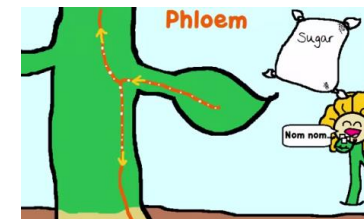
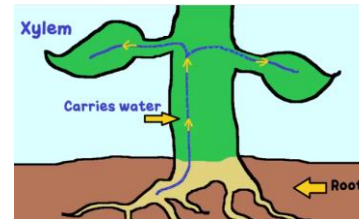


@AmoebaSisters

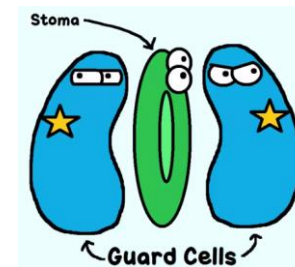
Bacteria, like viruses, **can cause disease**. **Antibiotics** specifically target **bacteria**, which are a type of **prokaryote cells**. Antibiotics are *not* effective on eukaryote cells nor viruses.

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?

**28** 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?

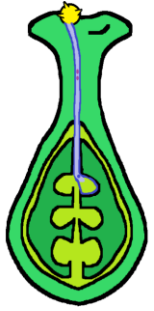


Plants often have structural **adaptations**. Consider broad leaves or pine needles. How can these structural adaptations be useful to the plant?



# 29

Angiosperms are flowering plants. 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 in this box.



To reproduce, 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**.

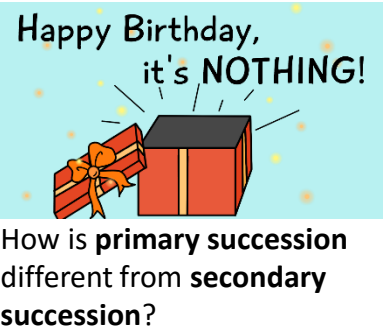


All angiosperms produce **fruit**. Some angiosperms produce edible, sweet fruit. This fruit may be eaten by organisms, which helps seed dispersal. How would developing fruit work with the **transport system** of a plant (think: xylem and phloem)?

**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.

# 31

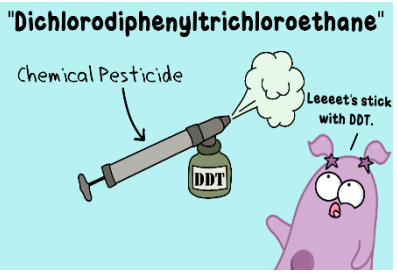
What is **ecological succession**? Describe the **sequence** of events, including the first types of organisms to arrive. How do the events change **species diversity**?



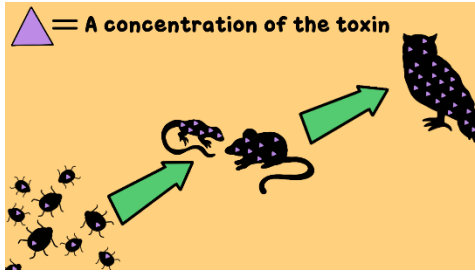
**Succession:** Hurry, my child! Take the scepter and succeed the throne!  
**Ecological Succession:** Process over time of organisms in an ecological community

How is **primary succession** different from **secondary succession**?

# 32



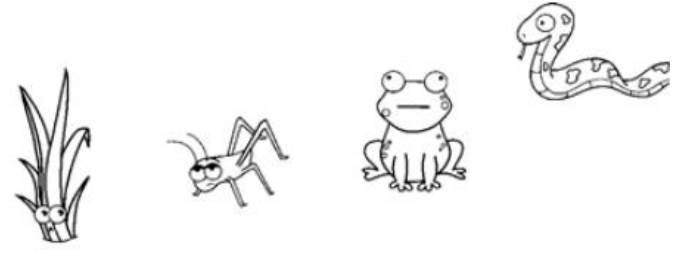
Describe what occurs during **biomagnification** using the graphic on the right.



How does **DDT** impact **ecosystem stability**? Use both graphics to explain.

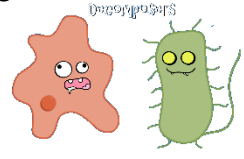
# 30

A **food chain** can model how energy travels through trophic levels. For the organisms on the right, how could you draw in arrows to create a food chain? Circle the **autotroph**. Color the **producer(s)** green and **consumer(s)** yellow. Label the **primary, secondary, and tertiary consumer**.



Explain how you could place the organisms in an energy pyramid. If the grass in this above example had 10,000 Kcal of energy, approximately how much would you expect of that energy to be stored in **trophic level 4**?

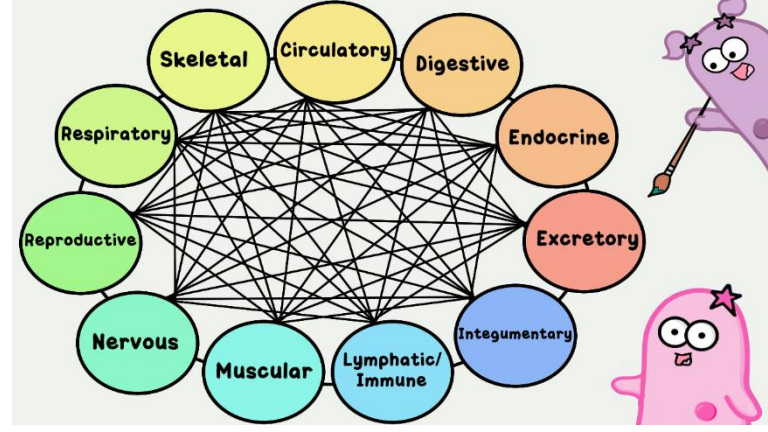
What is the difference between a **food web** and a **food chain**? Which one has more **biodiversity**? What are examples of **decomposers**? What is their role?



\_\_\_\_\_ Kcal  
Brianna Rapini & Sarina Peterson

# 33

It is critical to not only know the **functions of body systems** on the right, 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?*