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Review Resources

Videos:

- Bozeman Science** <http://www.bozemanscience.com/biology-main-page/>
(Covers all of these topics in 5-10 minute videos. Taught by a high school teacher, he uses good visuals to help and goes nice and slow. I would watch these ones first.)
- Crash Course Biology** <https://www.youtube.com/playlist?list=PL3EED4C1D684D3ADF>
(Covers all of these topics in 10-15 minute videos in a fun and engaging way, but also goes into a lot more detail than we need.)
- Khan Academy** <https://www.khanacademy.org/science/biology>
(Covers all these topics in 10-20 minute videos with some good visual representations. Most of them also go into more detail than we need.)

Articles:

- <http://www.shmoop.com/biology/>
These are well written, detailed articles. I would definitely use these first.
- <http://www.biology-online.org/>
Click on "tutorials" on the top of the page for helpful articles . Pretty dry and text-based, but has some good information.
- <http://www.sparknotes.com/biology/>
Again some general articles

Other Web pages

- State Assessment Page—for the content and assessment information**
<http://www.k12.wa.us/Science/Assessments.aspx>
- Vision Learning- visuals and learning resources for Science**
<http://www.visionlearning.com/en/library>
- About Biology— ask questions find answers**
<http://biology.about.com/>
- The Biology Project University of Arizona**
<http://www.biology.arizona.edu/default.html>
- A Different Online Biology Book through classzone for the McDougal Littell *Biology 2010* textbook**
http://www.classzone.com/cz/find_state.htm
- Understanding Evolution**
http://evolution.berkeley.edu/evolibrary/article/evo_01

Your Thoughts and NOTES

What will the Biology EOC be like?

The Biology EOC is mainly a scenario based test that covers the Biology State Science Standards. About half of the biology EOC is based on the content within this review booklet. The other half is centered around systems, inquiry, and application.

Systems - Predictability and Feedback

- Feedback is a process in which the output of a system provides information used to regulate the operation of the system. Positive feedback increases the disturbance to a system. Negative feedback reduces the disturbance to a system.
- Systems thinking can be especially useful in analyzing complex situations.
- To be useful, a system needs to be specified as clearly as possible.
- In complex systems, entirely new and unpredictable properties may emerge. Consequently, modeling a complex system in sufficient detail to make reliable predictions may not be possible.
- Systems can be changing or in equilibrium.

Inquiry - Conducting Analyses and Thinking Logically

- Basically, the scientific method. In short: ask a question, design an experiment, draw conclusions, ask more questions, create a model, communicate clearly, be honest, know reliability and validity, and think critically.

Application - Science Technology and Society

- In short: know that science, technology, and society are intertwined. Understand criteria and constraints. Science is used to solve problems. Perfect solutions do not exist. Math helps science be better. All people need to be able to use science to make society better.

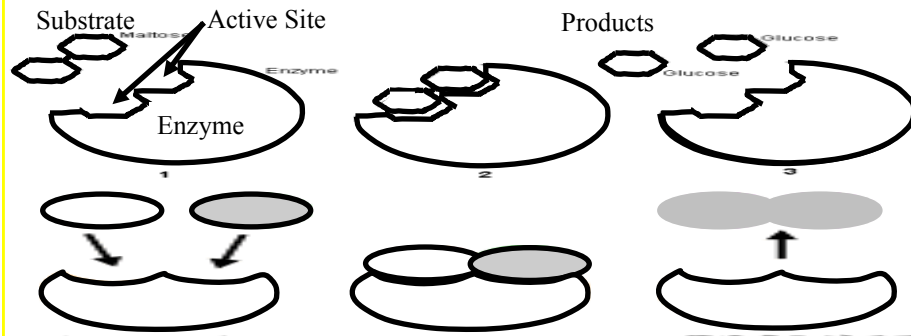
Proteins

Proteins are made of subunits called **amino acids**. **Remember, DNA codes for what proteins will be made.** **Proteins** are used to build cells and do much of the work inside organisms (muscles, tissues, hormones, hair). They also act as **enzymes** helping to control metabolic reactions in organisms.

Enzymes are protein molecules that act as **catalysts (they speed up reactions)**. Enzymes help larger molecules break down into smaller molecules. Other enzymes put smaller molecules together to make larger ones. So, enzymes help break down and build molecules. Enzymes help regulate the speed of reactions that transfer chemical energy from food molecules to special molecules that store energy (carbohydrates, lipids, and ATP).

Enzymes work like a lock and key. The shape of the enzyme's active site determines what molecules it can react.

Color the enzyme purple, the substrate yellow. Also color the active site red.



Changes in the environment can cause changes in the amount and or activity of proteins (e.g. enzymes) produced by a gene. Excess heat, a change in pH from neutral to acid or basic, etc. change the shape of enzymes and their active sites so the enzyme is unable to work or work as well.

List two functions of proteins: Build cells
Do much work inside oell and organism

What is the subunit of proteins: Amino acids

What codes for Proteins: a gene

What are Enzymes used for: to regulate the speed of reactions (they speed ip reactions)

What different factors will change (denature) an enzyme making it unable to work? Excess heat, change in ph, etc

7. Look at the table of amino acid sequences. Based on the data, which two organisms could you infer are most closely related?

- A. The guinea pig and the squirrel
- B.** The guinea pig and the rabbit
- C. The rat and the field mouse
- D. The rat and the squirrel

Species	Sequence of Amino Acids in the Same Part of the Cytochrome C Molecule
Guinea Pig	Lys-Glu-His-Iso
Rat	Arg-Lys-His-Lys
Squirrel	Arg-Glu-His-Lys
Rabbit	Lys-Glu-His-Iso
Field Mouse	Arg-Lys-His-Arg

8. Which of the following describes natural selection the best?

- A. The idea that the organisms that can change their DNA survive and reproduce the most
- B.** The idea that the most fit for an environment survives and reproduces the most
- C. The idea that the biggest and strongest survive and reproduce the most
- D. The idea that the smallest species are killed by the biggest species

9. There was a large population of fish living in a mountain lake when a major landslide occurred and split the lake in two. A **million years later** humans reconnected the lakes in order to build a larger lake for a mountain resort. What would you predict scientist observing the two populations of fish being reunited would observe?

- A.** The populations surviving in different conditions would evolve into two different species of fish
- B. The populations of fish would recognize each other as same species, breed and reproduce
- C. The two populations would still be the same species

10. A new insecticide (ant killer) is used in an area. Ten years later, the insecticide didn't work on most of the ants. What is the most likely explanation for the insecticide not killing the ants anymore?

- A. Over time, using the insecticide caused more and more ants to die.
- B.** Over time, some ants had random mutations that were selected for by the environment.
- C. Over time, using the insecticide made the ants chose to change so it could not kill them.
- D. Over time, using insecticide destroyed the insects' predators, but did not harm the insects.

There is a population of moth's that are white with black speckles and within this population there are a few moths that have black wings. They spend most of their time on aspen tree silver, black and white trunks.

11. If, an environmental change caused the trunks to begin to darken and become black, what might we observe in this population of moths over the next ten thousand years? **Moth that had the black trait would reproduce more and there would be more black moths in the population.**

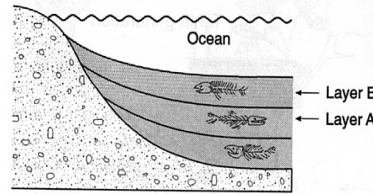
Adaptations, Natural Selection, & Evolution Practice Questions

1. Over the last 4.6 billion years that the earth has been around, there have been numerous extinctions. After each extinction event the fossil record shows that the earth started to become populated with different organisms. What allowed these new organisms to be so successful?

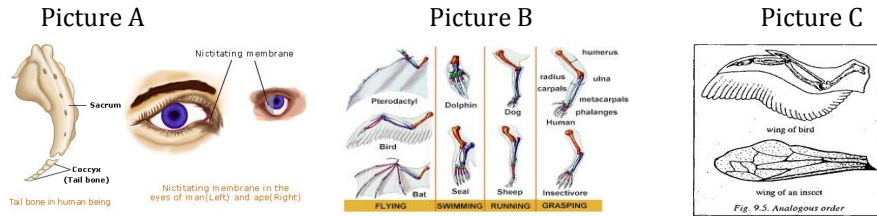
- A. They had the ability to fill the extinct species' niche (place in the environment)
- B. There was a decreased rate of reproduction in the new organisms population
- C. They had limited food resources so organisms populations increased rapidly
- D. There were more predators hunting the new organisms for food

2. The diagram below shows undisturbed sedimentary strata (layers) at the bottom of an ocean. The fossils found in layer A resemble the fossils found in layers B and C. This similarity suggests that

- A. the fossils in layer B must be more complex than those in layer A
- B. the fossils in layers B and C may have evolved from earlier forms of life
- C. the fossils in layer A would not be expected to have similar DNA to those in layer B
- D. the fossil in layer A went extinct millions of years ago and are not related to fossils in layer C



Use the following pictures to answer questions



4. What could we infer about the vertebrates from picture B?

- A. Their vestigial structures lead us to infer they have distant common ancestors
- B. Their homologous structures lead us to infer they have recent common ancestor
- C. Their analogous structures lead us to infer they have a recent common ancestor
- D. Their similar structures lead us to infer they would all have very different genes

5. The number and location of bones of many fossil vertebrates are similar to those in living vertebrates. Based on scientific understanding of organisms and how they get their traits, what inference would scientists make?

- A. The data provides evidence for inheritance through a distant common ancestor.
- B. The data provided evidence that the vertebrates inherited acquired traits.
- C. The data provides evidence that the vertebrates struggle for existence.
- D. The needs of the organisms made the structures similar.

6. Scientist's observing a beetle population noticed that in the next several generations of beetles some had black spots on their backs. What would bring about this change?

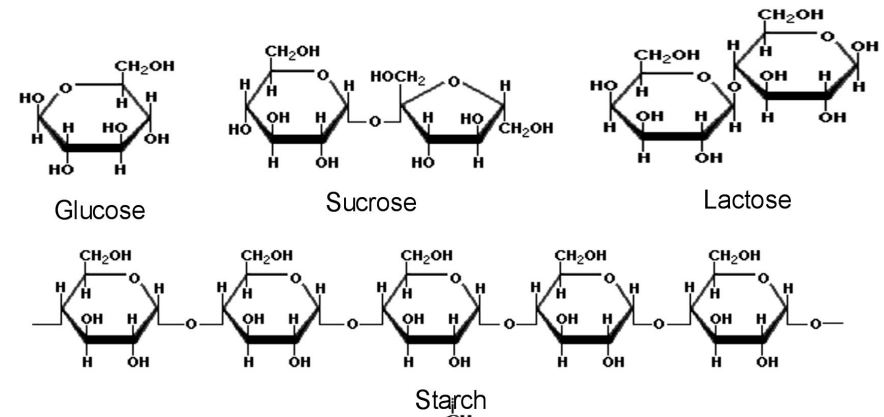
- A. Natural selection
- B. Competition
- C. Predation
- D. Mutation

Carbohydrates

Carbohydrates are used by the body for energy storage and structural support. They make up cell walls of plants (cellulose) and exoskeletons of insects and crustaceans. Carbohydrates like sugar and starch store energy for organisms.

Carbohydrates are made of smaller subunits called simple sugars. Simple sugars include glucose and fructose. These simple sugars make up larger more complex carbohydrates: starch, cellulose, chitin, and glycogen.

Glucose is the carbohydrate made in photosynthesis. It's chemical formula is $C_6H_{12}O_6$. This is used as short term energy in the organism. Starch is a complex carbohydrate made up of many subunits of glucose. Complex carbohydrates can store more energy than simple carbohydrates.



Name the two functions of carbohydrates: **Energy storage and structural support for the body**

What is the subunit of larger carbohydrates: **single sugars**

What process makes glucose in plants: **photosynthesis**

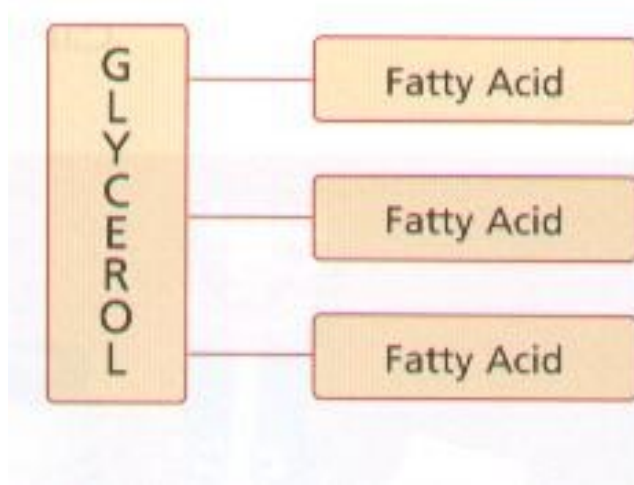
How are simple carbohydrates different from complex carbohydrates?
Simple sugars are made up of 1 single molecule (unit) and they provide short-term energy storage.
Complex carbohydrates are made up of many sugar subunits, and store more energy and are considered long term energy sources.

Which type of carbohydrate stores more energy? Simple or **Complex**

What molecule would build or break apart carbohydrates: **Enzymes**

Lipids

Lipids are large molecules made up of fatty acids and glycerol. They are used for making cell membranes, waxy coverings on plant leaves, hormones, steroids, oils and fats. Phospholipids make up the cell membrane which regulates what goes in and out of a cell. Hormones and steroids help send chemical signals through out the organism. Fats are used for long term energy storage for the organism.



Name the three functions of Lipids:

- **Making cell membranes**
- **Making waxy coverings on plant leaves**
- **Making hormones, steroids, oils, and fats**

What are the subunits of Lipids: **Fatty acids & glycerol**

What structure in a cell is made up of lipids: **Cell Membrane**

What molecule would build or break apart lipids: **Enzymes**

What are some examples of lipids: **Hormones and steroids**

Because natural selection can produce amazing adaptations, it's tempting to think of it as an all-powerful force, urging organisms on, constantly pushing them in the direction of progress — but this is not what natural selection is like at all.

First, natural selection is not all-powerful; it does not produce perfection. If your genes are "good enough," you'll get some offspring into the next generation — you don't have to be perfect. This should be pretty clear just by looking at the populations around us: people may have genes for genetic diseases, plants may not have the genes to survive a drought, a predator may not be quite fast enough to catch her prey every time she is hungry. No population or organism is perfectly adapted.

Second, it's more accurate to think of natural selection as a process rather than as a guiding hand. Natural selection is the simple result of variation, differential reproduction, and heredity — it is mindless and mechanistic. It has no goals; it's not striving to produce "progress" or a balanced ecosystem.

This is why "need," "try," and "want" are not very accurate words when it comes to explaining evolution. The population or individual does not "want" or "try" to evolve, and natural selection cannot try to supply what an organism "needs." Natural selection just selects among whatever variations exist in the population. The result is evolution.

How are mutations passed down to offspring? **From parents DNA in the egg and sperm during fertilization**

What are some types of changes mutations can make to the DNA? _____
A nucleotide can be deleted, there can be an insertion of an extra nucleotide causing the DNA to code for a different protein or change in the protein made

How can a mutation be harmful? **Yes**

How can a mutation have no effect at all on a protein? **Yes**

How can a mutation be helpful? **Yes**

A certain species of lizard is normally green and lives in a damp green place. The environment change, the water dries up, and the place ends up more brown. How could a mutation that makes the lizard brown instead of green help it survive and reproduce?

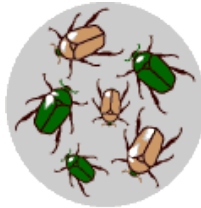
If the lizard is brown it will help it to be camouflaged, so hard to see in it's environment which helps it to live longer and have more chances to reproduce more offspring.

How would the lizard become brown in the first place? **A random mutation in the egg or sperm of one of the parents. Or, it inherited the alleles that code for brown skin from it parents.**

To find out how natural selection works, imagine a population of beetles:

There is variation in traits.

For example, some beetles are green and some are brown.



There is differential reproduction.

Since the environment can't support unlimited population growth, not all individuals get to reproduce to their full potential. In this example, green beetles tend to get eaten by birds and survive to reproduce less often than brown beetles do.



There is heredity.

The surviving brown beetles have brown baby beetles because this trait has a genetic basis.



End result:



The more advantageous trait, brown coloration, which allows the beetle to have more offspring, becomes more common in the population. If this process continues, eventually, all individuals in the population will be brown.



If you have variation, differential reproduction, and heredity, you will have evolution by natural selection as an outcome. It is as simple as that.

Biologists use the word fitness to describe how good a particular genotype is at leaving offspring in the next generation relative to how good other genotypes are at it. So if brown beetles consistently leave more offspring than green beetles because of their color, you'd say that the brown beetles had a higher fitness.

The brown beetles have a greater fitness relative to the green beetles.

		
Number that survive compared to total	95 %	33 %

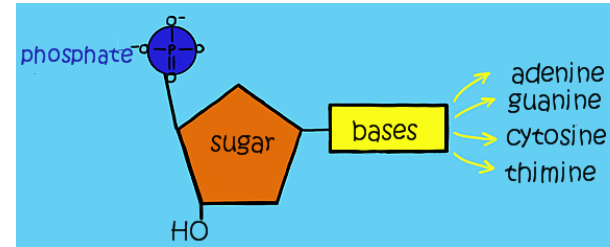
Of course, fitness is a relative thing. A genotype's fitness depends on the environment in which the organism lives. The fittest genotype during an ice age, for example, is probably not the fittest genotype once the ice age is over.

Fitness is a handy concept because it lumps everything that matters to natural selection (survival, mate-finding, reproduction) into one idea. The fittest individual is not necessarily the strongest, fastest, or biggest. A genotype's fitness includes its ability to survive, find a mate, produce offspring — and ultimately leave its genes in the next generation.

Nucleic Acids

Nucleic acids (DNA and RNA) carry the genetic information in a cell. The subunits that make up nucleic acids are called nucleotides. The nucleotide is made up of a phosphate, sugar, and a nitrogen base.

DNA or deoxyribonucleic acid contains all the instructions for making every protein needed by a living thing and is located in the nucleus. RNA or ribonucleic acid help transfer the genetic information from the nucleus to the ribosomes so that proteins can be made.



Name the two functions of nucleic acids:

- _____ *** Carry the genetic information in a cell**
- _____ ***Contain cell instructions for making all proteins needed**
- _____ ***Help transfer the genetic information from the nucleus to the ribosomes**

What is the subunit of nucleic acids: **Nucleotides**

What molecule would build or break apart nucleic acids: **Enzymes**

What are some examples of nucleic acids:

- * DNA (deoxyribonucleic acid)**
- *RNA (ribonucleic acid)**

Elements & Macromolecules in Organisms

For each of the questions, match the best option with the given example:

Write the name of the **macromolecule (biomolecule)** next to the **subunit**.

protein lipid nucleic acid carbohydrate

Fatty acids and glycerol	Lipid
Simple sugar	Carbohydrate
Nucleotide	Nucleic acid
Amino acid	Protein

Write the name of the **macromolecule (biomolecule)** next each **example**.

protein lipid nucleic acid carbohydrate

DNA	Nucleic acid
Enzyme	Protein
Fatty acid	Lipid
Complex sugar	Carbohydrate

Write the name of the **example** next to the monomer **subunit**.

starch RNA enzyme phospholipid

Fatty acids and phosphate	Phospholipid
Simple sugar	Starch
Nucleotide	RNA
Amino acid	Enzyme

Write the name of the **macromolecule (biomolecule)** next each **example**.

protein lipid carbohydrate nucleic acid

Cell membrane	Lipid
Enzyme	Protein
RNA	Nucleic acid
Cell Wall	Carbohydrate

Adaptations, Natural Selection and Evolution

Adaptations are any behavioral or physical characteristics organism is born with that help it to survive long enough to reproduce in its environment. In animals, these characteristics fall into three main categories: body parts, body coverings, and behaviors. Any or all of these types of adaptations play a critical role in the survival of an animal.

Again, adaptations can be either physical or behavioral. A *physical adaptation* is the structure of a body part that helps an organism survive. This could be wings to fly, a thick coat to stay warm or a thin coat to keep from overheating. A *behavioral adaptation* is something an animal does – how it acts - usually in response to some type of external stimulus, like when birds flying south for the winter. When you look at an animal, you usually can see some of its adaptations like what it is able to eat, how it moves, or how it may protect itself. Different animals have many different ways of trying to stay alive.

Adaptations usually occur because a gene mutates (a random change from an error in replicating DNA). These random changes in the genetic makeup of cells and organisms (mutations) can cause changes in their physical characteristics or behaviors. If the genetic mutations occur in eggs or sperm cells, the changes will be inherited by offspring. Many mutations are harmful, and even deadly, but some mutations can help an animal or plant survive better than others in the species without the mutation.

For example, imagine a bird species. One day a bird is born with a beak that is longer than the beak of other birds in the species (remember, the bird got that longer beak because of a mutation (change) in its DNA). The longer beak helps the bird catch more food. Because the bird can catch more food, it is healthier than the other birds, lives longer and breeds more. The bird passes the gene for a longer beak on to its offspring. They also live longer and have more offspring and the gene continues to be inherited generation after generation.

Eventually, in this species, we will see more birds with longer beaks and only a few with shorter beaks. This doesn't happen overnight. It takes thousands of years for a mutation to be found spread through the majority of the species. Over time, animals that have better adaptations to their environment (have traits that help them survive) survive and breed. Animals that are not well adapted to an environment (have traits that are harmful or not as successful in their environment) may not survive. The characteristics that help a species survive in an environment are passed on to future generations. Those characteristics that are less helpful in the species survive slowly become fewer and may disappear.

Natural selection is one of the basic mechanisms of evolution, along with mutation, migration, and genetic drift. The organism that are the most fit for the environment will survive to reproduce and pass their traits to the next generation of organisms in the species.

Darwin's grand idea of evolution by natural selection is relatively simple but often misunderstood.

What is the probability that a baby will be born male or female? ____
50%

What are the different versions of a gene called? alleles

What does a homozygous genotype mean? ____
the two alleles for the gene are the same DD or dd

What does a heterozygous genotype mean?
 - the 2 alleles for the gene are different Dd

What do geneticists use to represent alleles?
Capital and lower case letters

What do you call the allele that always shows up, even in a heterozygous genotype? dominant allele

What do you call the allele that can only show up if the organism is homozygous? recessive allele

What do geneticists use to represent dominant alleles? Capital letters

What do geneticists use to represent recessive alleles?

Lower case letters

What is an organism's genotype? The genetic makeup represented by the letters.

What is an organism's phenotype? the expressed physical trait that can be seen

How do you show a genotype in genetics? writing the two letters representing each allele together__. Give an example: BB

How do you describe an organism's phenotype?

Using descriptive words for what is seen. Example: Brown hair

What is the relationship between genotype and phenotype?

Genotype determines the phenotype

What is a genetic disorder? A disease or condition that is the result of the genotype for that trait and therefore can be passed on to offspring.

How can a genetic mutation occur?

Environmental factors (UV radiation), some chemicals, DNA does not get copied correctly before cell division.

What is the difference between a chromosomal and a gene mutation?

A gene mutation is a change in the A<G<C<T sequence of the DNA for that gene. Affects one gene. Whereas a chromosome mutation is a deletion of a part of a whole chromosome or part of a chromosome and affects many genes.

Biomolecule Larger Molecule	Subunit Smaller Molecule	Example	Function
Protein	Amino acids	Enzymes	Regulate the speed of a reaction
Lipid	Fatty acids and glycerol	Phospholipids	Make up the cell membrane which controls what gets in and out of the cell
Nucleic Acid	Nucleotide	DNA RNA	Contain the instructions to make proteins
Carbohydrate	Simple sugars	Cellulose Glucose	Make up the cell wall of plants Short term energy storage

Which of these Biomolecules do you need to have in your diet?
All of them

Describe two ways enzymes regulate reactions or cellular activity.

- * **Enzymes act as catalysts (speed up reactions)**
- * **Enzymes break down or build up molecules**

If a cell needs to change the amount of biomolecules that it is making or breaking down for cell activity, what molecule would need to be regulated?

Enzymes

What could the cell do to change the activity of these molecules?

Stop producing enzymes

DNA

Inside the nucleus are the chromosomes which are made of DNA. DNA codes for the production of proteins within the cell. The proteins form structures in the organism and other proteins can control chemical processes (enzymes) within the cell. The proteins made are determined by the sequence of DNA.

- What is the function of DNA? _




Codes for the production of proteins within the cell.

Genes are segments of DNA that code for a specific protein that in turn codes for a trait: blue eyes, brown hair.

- What is a specific sequence of DNA called? **Gene**

In 1953, James Watson and Francis Crick established the structure of DNA. The shape of DNA is a double helix which is like a twisted ladder. The sides of the ladder are made of alternating sugar and phosphate molecules. The sugar is deoxyribose. **Color all the phosphates red (one is labeled with a "p"). Color all the deoxyribose sugars light blue (one is labeled with a "D"). Note, the nitrogenous bases attach to the sugar = "D".**

The rungs of the ladder are pairs of 4 types of nitrogen bases. Each base will only bond to its complementary base. Adenine will only bond to thymine. Guanine will only bond with cytosine. The sequence of the four nucleotide in a gene determines the protein to be made.

Color Thymines (T) orange  Color Cytosines (C) yellow 
 Color Adenines (A) green  Color Guanines (G) purple 

Messenger RNA

DNA is too large of a molecule. It cannot leave the nucleus. The gene sequence on the DNA is used to make messenger RNA which then carries the code for the protein out of the nucleus to the ribosome in the cytoplasm.

- What is the role of messenger RNA in making proteins?

Carry the code for the protein out to the ribosome

Messenger RNA is similar to DNA, except that it is a single strand, and it has no thymine. Instead of thymine, mRNA contains the base Uracil. In addition to that difference, mRNA has the sugar ribose instead of deoxyribose. RNA stands for **Ribonucleic Acid**. Color the mRNA as you did the DNA, except:

Color the uracil brown and ribose ('R') a DARKER BLUE



In rabbits, grey hair is dominant to white hair. Also in rabbits, black eyes are dominant to red eyes. These letters represent the genotypes of the rabbits:

GG = gray hair Gg = gray hair gg = white hair	BB = black eyes Bb = black eyes bb = red eyes
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What are the phenotypes (descriptions) of rabbits that have the following genotypes:

Ggbb grey hair, red eyes ggBB white hair, black eyes
 ggbb white hair, red eyes GgBb gray hair, black eyes

A male rabbit with the genotype GgBb is crossed with a female rabbit with the genotype GgBb. The square is set up below. Fill it out and determine the phenotypes and proportions in the offspring.

How many out of 16 have grey fur and black eyes? 9/16

GGBB, GgBB, GgBb

How many out of 16 have grey fur and red eyes? 3/16

Ggbb or Ggbb

How many out of 16 have white fur and black eyes? 3/16

ggBB or ggBb

How many out of 16 have white fur and red eyes? 3/16 **ggbb only**

	GB	Gb	gB	gb
GG	GGBB	GGBb	GgBB	GgBb
Gb	GGBb	GGbb	GgBb	Ggbb
gB	GgBB	GgBb	ggBB	ggBb
gb	GgBb	Ggbb	ggBb	ggbb

Punnett Squares

In tomatoes, red fruit (R) is dominant over yellow (r). Cross a tomato heterozygous for red fruit with a yellow one, and tell me what percentage of the offspring would you expect to have red fruit? 50%

The cross is Rr x rr

	R	r
r	Rr	rr
r	Rr	rr

In wombats, blue eyes are dominant over green eyes. Cross a homozygous blue-eyed wombat with a green-eyed wombat. What % of the offspring would you expect to have green eyes? 0%

The cross is BB x bb

	B	B
b	Bb	Bb
b	Bb	Bb

In fruit flies, eye color is a sex linked trait. Red is dominant to white

What are the sexes and eye colors of flies with the following genotypes:
 $X^R X^r$ Red Eyed Female $X^R Y$ red eyed male $X^r X^r$ white eyed female
 $X^r Y$ White eyed male

What are the genotypes of these flies:

white eyed, male $X^r y$ red eyed female (heterozygous) $X^R X^r$
 white eyed, female $X^r X^r$ red eyed, male $X^R y$

Located on the X chromosome of a cat is a gene that codes for deafness. The deafness trait is recessive. A female cat that is heterozygous for deafness (Dd) is crossed with a male cat that is not deaf. Show the cross. What are the phenotypes of the offspring, and in what proportions do they occur?

$X^D X^d \times X^D y =$ 1/2 males deaf
 1/2 males hearing
 All females hearing

	X^D	X^d
X^D	$X^D X^D$	$X^D X^d$
y	$X^D y$	$X^d y$

In Japanese four o'clock plants red (R) color is incompletely dominant over white (r) flowers, and the heterozygous condition (Rr) results in plants with pink flowers. For each of the following construct a Punnett square and give phenotypic and genotype ratios of the offspring.

- a) a red plant and a white plant
 = 4 pink : 0 red offspring
 B) a red plant and a pink plant
 1 red : 1 pink offspring

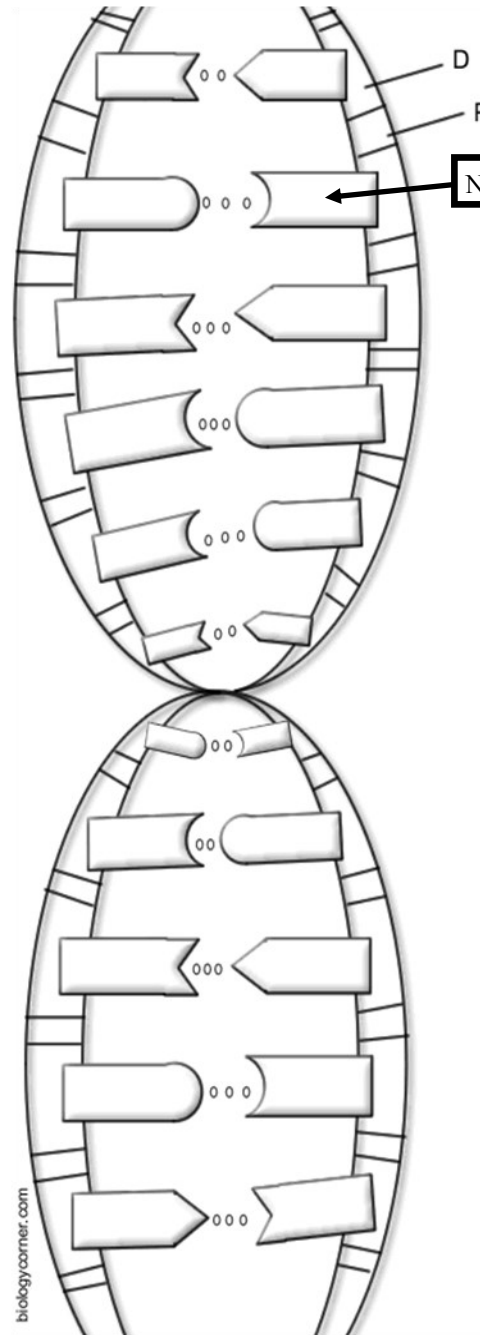
A.

	R	R
Rr	RR	RR
Rr	Rr	Rr

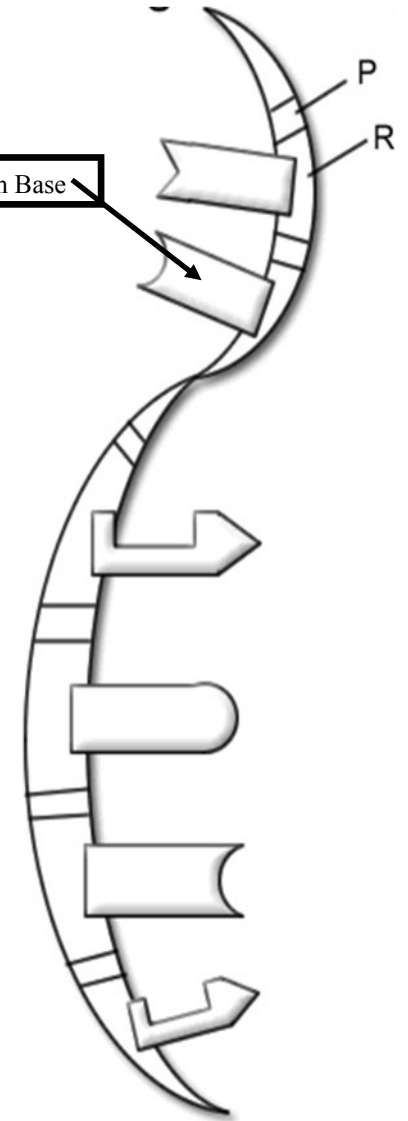
 B.

	R	R
R	RR	RR
r	Rr	Rr

DNA - The Double Helix



Messenger RNA



Transcription & Translation

Transcription

RNA, Ribonucleic Acid is very similar to DNA. RNA normally exists as a single strand (and not the double stranded double helix of DNA). It contains the same bases, adenine, guanine and cytosine. However, there is no thymine found in RNA, instead there is a similar compound called uracil. Transcription is the process by which RNA is made from DNA. It occurs in the nucleus. **Label the box with the R in it near the nucleus with the word TRANSCRIPTION** and proceed to color the bases according to the key below

<p>Thymine - orange </p> <p>Cytosine - yellow </p> <p>Uracil - brown </p>	<p>Adenine - dark green </p> <p>Guanine - purple </p>
--	---

Color the strand of DNA dark blue (D) and the strand of RNA light blue (R). Color the nuclear membrane (E) black.

Translation

Translation occurs in the cytoplasm, specifically on the ribosomes. The mRNA made in the nucleus travels out to the ribosome to carry the "message" of the DNA. Here at the ribosome, that message will be translated into an amino acid sequence. **Color the ribosome light green (Y)** and note how the RNA strand threads through the ribosome like a tape measure and the amino acids are assembled. **The RNA strand in the translation area should also be colored light blue**, as it was colored in the nucleus.

- **Label the box with the "r" in the translation area with the word TRANSLATION.**

Important to the process of translation is another type of RNA called Transfer RNA (F) which function to carry the amino acids to the site of protein synthesis on the ribosome.

- **Color the RNA red.**

At the top of the tRNA is the amino acids. There are twenty amino acids that can combine together to form proteins multiple types of proteins. When you digest your food for instance, you are using enzymes that were originally proteins that were assembled from amino acids. Each tRNA has a different amino acid which link together like box cars on a train.

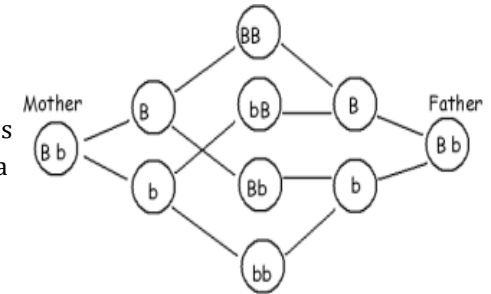
- **Color all the amino acids (M) polka dotted.**

Why do I have blue eyes when both my mother and father have brown eyes?

Each person has two genes for eye color. When a person has two identical genes, he will have eyes of that color. Another person may two different genes, and she will have eyes the color of the dominant gene. With eye color, the gene for brown eyes is dominant (B). The gene for Blue eyes is recessive (b). If a person has one B gene and one b gene or two B genes, then that person will have brown eyes. If a person has bb eye genes, then the person will have blue eyes.

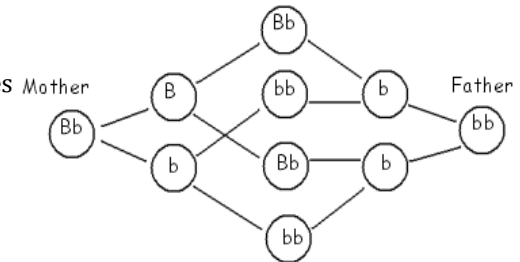
Parents with Brown Eyes and Recessive Genes

In this diagram, both the mother and father have brown eyes, but they both have the recessive gene for blue eyes as part of their genetic makeup. There is a 1 in 4 or 25% chance that their child will have blue eyes.



One Brown Eyed Parent with Recessive Gene

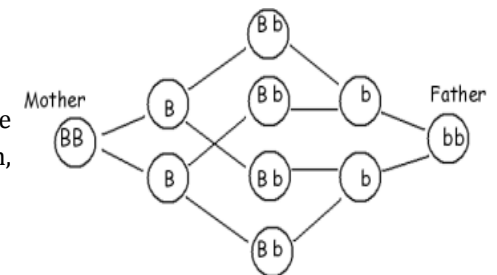
The results would be the same in diagram 2 if the Mother had blue eyes and the Father had Brown eyes with a recessive blue gene, or in diagram 3 if the Father had the brown eyes and the Mother had blue eyes.



In this diagram, the mother has brown eyes with the recessive blue eye gene and the father has blue eyes. There is a 1 in 2 or 50% chance that their child will have blue eyes.

Brown Eyed Parent without Recessive Gene

In this diagram, the father has blue eyes and the mother has brown eyes without the recessive gene. In all of the possible combinations for the children, there is one of the dominant B genes. All of the children will have brown eyes.



Genetics

Inside every cell of each living thing (plant or animal) are sets of instructions called genes. The genes provide the instructions on what is the plant or animal, what it looks like, how it is to survive, and how it will interact with its surrounding environment. The genes are strung together in long stands of material called deoxyribonucleic acid (DNA) and these long strands are called chromosomes. Most living things have pairs of chromosomes (one from each parent), though they may have a different number of chromosomes from another living thing. For example, humans have 23 pairs of chromosomes and the fruit fly has 4 pairs.

Each gene is made up of long combinations of four different nucleotide bases. It is the various combinations of the nucleotide bases that determine everything about a living creature.

The four nucleotides are called:

- Adenine (A),
- Cytosine (C),
- Guanine (G), and
- Thymine (T)

The gene for green eyes might have this nucleotide sequence.

AAACCGGTTT**TT**

The gene for blue eyes might have this nucleotide sequence.

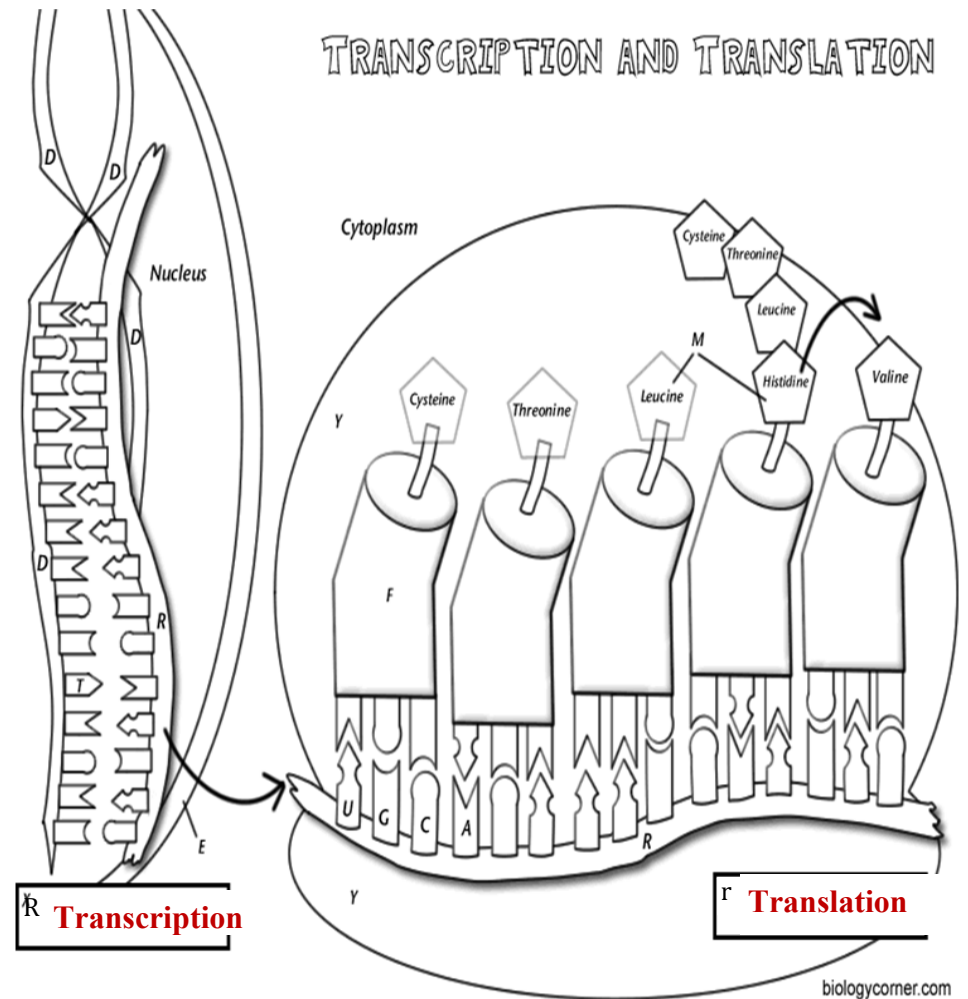
AAACCGGTTT**AA**

Notice how the nucleotide sequences are very similar. The only difference being the last two bases. They both describe an eye with the last two characters stating the color of the eye.

Note: These gene formula are not accurate, the correct sequence could be up to several thousand bases long). Many of the genes have a quality known as Dominant or Recessive. Dominant traits are more common than Recessive traits due to this quality.

Word Definitions

- Dominant - a gene in one strand of DNA that is stronger than the corresponding gene in another strand of DNA.
- Recessive - a gene in one strand of DNA that is weaker than the corresponding gene in another strand of DNA.
- Trait - a distinguishing feature in a person.



Protein synthesis is the process of making proteins. It has two steps: Transcription and Translation.

Describe the process of transcription and where it happens.

During transcription, single stranded RNA is made from DNA. It occurs in the nucleus.

Describe the process of translation and where it happens.

During translation, mRNA carries the instructions for how and what protein to make..(the code) from the DNA to the ribosomes in the cytoplasm, There the "message: will be translated into a chain of amino acids making a protein.

Nucleotides

Below is a diagram of the different nucleotides. Color the diagram as follows:

P = Phosphates - red

D = Deoxyribose (sugar) - light blue

A = Adenine - green

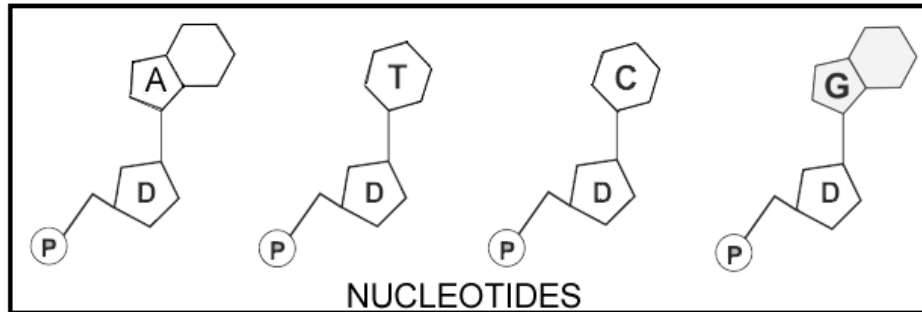
T = Thymine - orange

C = Cytosine - yellow

G = Guanine - purple

Nitrogenous bases

Bond between the Deoxyribose and nitrogenous base = Hydrogen bond - black



Comparing DNA Replication and Transcription

DNA replication is the process by which a cell copies its DNA. During replication both strands of the double helix are used as templates to make complementary, or matching strands of DNA. DNA transcription is the process by which a single strand of DNA is used as a template to generate a strand of mRNA.

Fill in the missing information. One row has been completed for you.

Template DNA	Complementary DNA	Messenger RNA (mRNA)
TTACG	AATGC	AAUGC
CCGC C	GGCGG	GGCG G
TGCATCG	ACGTAGC	ACGUAGC
AGACTC	TCTGAG	UCUGAC
GACCGATG	CTGGCTA C	CUGGCUAC

Positive and Negative Feedback

Feedback is a process in which changing one quantity changes a second quantity, and the change in the second quantity in turn changes the first.

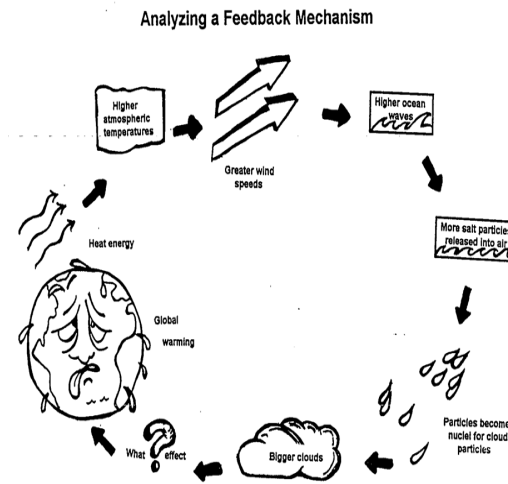
Definitions:

Positive Feedback: A process in which the effects of a disturbance on a system include an increase in the magnitude of the perturbation. That is, *A produces more of B which in turn produces more of A.*

Ex. Child Birth, A cut forming a scab and healing.

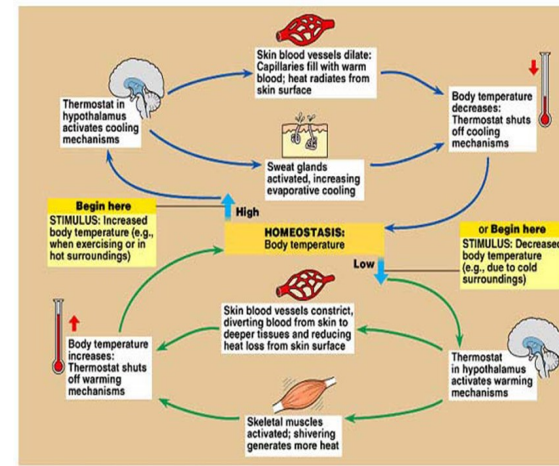
Negative Feedback: A process in which the effects of a disturbance on a system include a decrease or maintenance of the original system.

Examples:



Positive Feedback:

Feedback is important in the study of global warming because it may amplify or diminish the effect of particular process. The global warming feedback is indicated by higher temperatures causes polar ice caps to melt. Reflective surface of energy is reduced. More heat energy is absorbed and global temperature increases.



Negative Feedback:

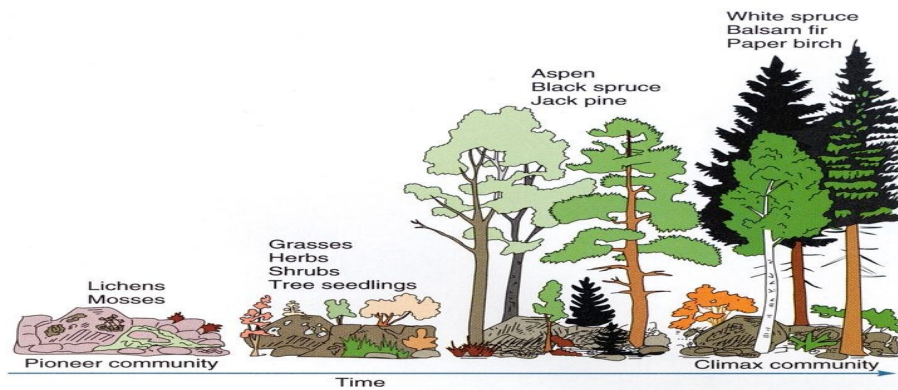
The body's homeostasis systems are maintained by negative feedback mechanisms, sometimes called negative feedback loops. In negative feedback, any change from the normal range of function is resisted. The change in the controlled value initiates responses that brings the function of the organ or structure back to within the normal range.

Ecological Succession

Primary Succession follows the formation of new land surfaces consisting of rock, lava, volcanic ash, sand, clay, or some other exclusively **mineral substrate**. This means that there is **NO SOIL** present. Soil is a mixture of mineral material, decaying organic material, and living organisms.

Secondary Succession follows the destruction or partial destruction of the vegetation of an area by some sort of disturbance, like a fire, windstorm, or flood that leaves the soil intact.

Pioneer species initiate recovery following disturbance in both primary AND secondary successions. Pioneers "pave the way" for later colonists by altering the biotic and abiotic environment.



1. Describe the difference between primary and secondary succession.

Primary develops from rock or land that never had plants . Secondary succession is regrowth in a place where there has been a disturbance (fire)

2. What events/disturbances can lead to primary succession?

Volcanic eruptions, retreating glaciers

3. What events/disturbances can lead to secondary succession (10 minimum)?

Fire, windstorm, flooding, tsunami, landslides, hurricanes, tornadoes

4. Define pioneer species

Species that initiate recovery, new growth, following a disturbance in both primary and secondary succession.

- | | |
|-----------------------------|----------------------------------|
| 1. _N_ DNA | 9. _J_ Transcription |
| 2. _G_ mRNA | 10. _M_ Translation |
| 3. _K_ tRNA | 11. _C_ Replication |
| 4. _L_ rRNA | 12. _B_ Codon |
| 5. _I_ Hydrogen bond | 13. _O_ Anti-codon |
| 6. _D_ Adenine | 14. _H_ Nucleotide |
| 7. _F_ Uracil | 15. _E_ Protein synthesis |
| 8. _A_ Amino acid | |

- A. Building blocks of proteins
- B. 3 consecutive nucleotides on mRNA that code for a specific amino acid
- C. process of making a copy of DNA
- D. Nitrogenous base of DNA
- E. DNA is Transcribed into RNA which is then Translated into Proteins
- F. Nitrogenous base of RNA
- G. Form of RNA that is transcribed from DNA
- H. Subunit of DNA composed of a phosphate, 5 carbon sugar, and nitrogenous base
- I. Type of bond that holds DNA's double helix together
- J. Process in which mRNA is made using DNA
- K. Form of RNA that bonds (attaches) amino acids together inside the ribosome that make up proteins.
- L. Type of RNA that makes up a major part of the ribosome
- M. Process in which cells use information on mRNA to make proteins
- N. Nucleic acid that stores and transmits genetic information
- O. Complement to mRNA codon

Amino Acid Wheel

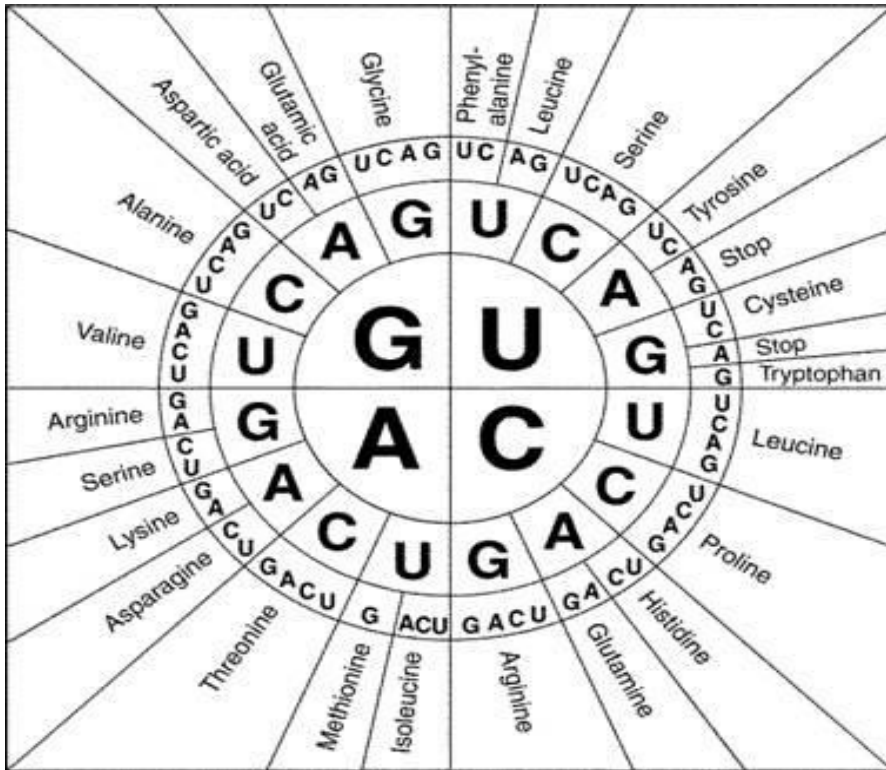
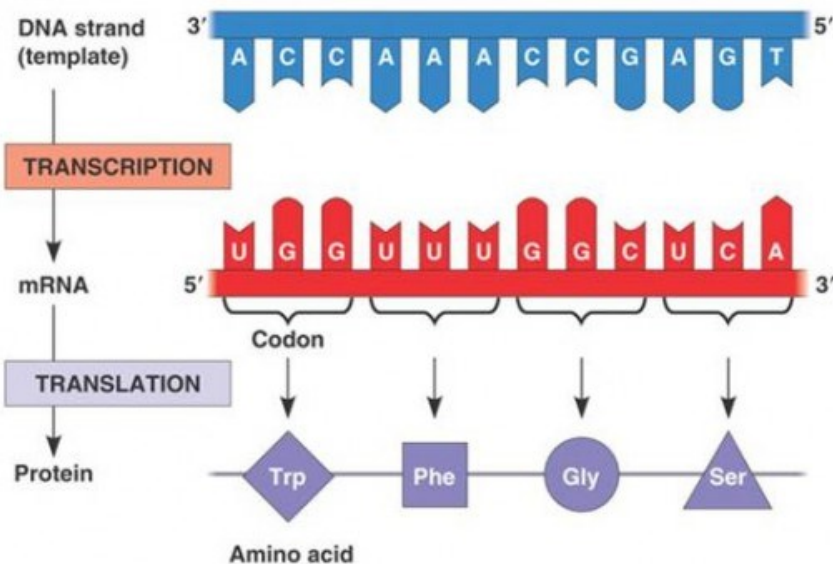


Diagram of Protein Synthesis



1. How would preserving land in a national forest be beneficial?

It would be beneficial because it would mean that the resources in the forest are protected and not touched by humans making them available for wildlife. Forests and trees provide many environmental and economic benefits that can lead to improved environmental quality and human health. These benefits include improvements in air and water quality, richer terrestrial and aquatic habitat, cooler air temperatures, and reductions in building energy use, ultraviolet radiation levels, and noise.

2. What are three ways humans have attempted to reduce their ecological footprint in cities?

- recycling and reusing products instead of throwing them into trash/landfills.
- Reducing time in the shower to conserve fresh water resources
- Carpooling, walking, riding bikes
- Turning off lights when not in room, using more energy efficient appliances

3. How does preservation and sustainability of resources provide for greater diversity of organisms within ecosystems?

By preserving resources they can replenish themselves and become sustainable allowing them to be available for a number of organisms. More different types of resources allows for more different types of organisms = biodiversity.

4. How would preserving pasture land or grasslands be beneficial?

By preserving pasture land or grasslands provides for more producers to be present. Producers are the base of all food chains and food webs. The more pasture land /grassland the more food available to support more organisms in higher trophic levels (primary, secondary, tertiary co

Ecological sustainability refers to the capacity of the biosphere to meet the needs of the present generation, without hindering future generations from being able to meet their needs. This means using our natural resources wisely in the short-term so that these resources are available in the long-term.

Conservation is based on the idea of using the Earth's resources but in a sustainable manner. This means using renewable resources at a rate which ensures they are able to self-replenish. It also means reducing our use of and reliance on non-renewable resources, such as coal and oil.

Preservation is concerned with keeping things in their untouched form. This means reducing the spread of human impact on the physical environment by not touching things that are still in their natural state. This can mean both the natural environment, such as rainforests, and the cultural environment, such as the remains of an ancient civilization. Preservation practices are seen in the creation of national parks and World Heritage Sites.

Ecological Footprint: Our current consumption of the Earth's natural resources is ecologically unsustainable. A balance needs to exist to ensure that humans are not taking more from the environment than it can afford to give. The amount of pressure people put on the Earth can be measured through their ecological footprint. An **ecological footprint** is a way to measure the impact of resource consumption and waste production on the environment. Each person has an ecological footprint. People in urban areas generally have a larger ecological footprint than those people living in rural areas. Developed countries generally have larger ecological footprints than developing countries.

Sustainability: Human activities are placing a great deal of pressure on the Earth's resources. As the demands of humans increase and the rate at which these demands need to be met also increases, the Earth is not being given the chance to replenish its resources. The present levels of human consumption are unsustainable.

Non-renewable natural resources are diminishing and need to either be managed more carefully or conserved by using renewable resources. Everyone can assist in conserving the Earth's resources. To do this, humans need to discontinue doing such things as excessively grazing land, over-fishing the waterways and polluting the air. Individuals can reduce their ecological footprint by turning off lights when they are not being used, recycling newspapers after they have been read, eating more organic vegetables and less meat, and walking or taking public transport rather than driving.

Below is information regarding the differences between the normal and sickle cell hemoglobin alleles which result in different proteins.

Complete the table below in order to compare the DNA for the *Normal Hemoglobin Gene* vs. the *Sickle Cell Hemoglobin Gene*.

What is the difference in the amino acid sequence of the hemoglobin molecules synthesized by translating the sickle cell vs. the normal hemoglobin?

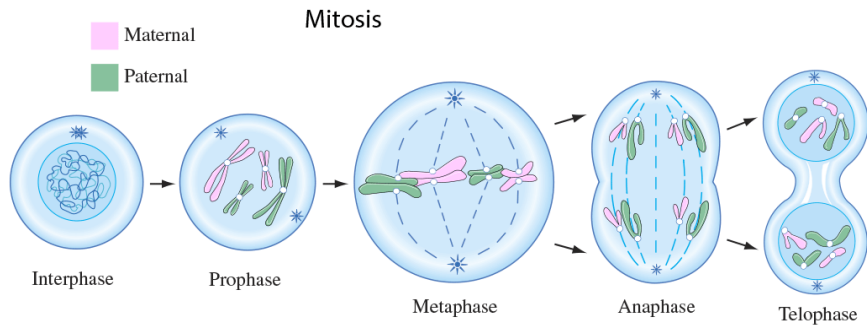
On the last codon, thymine is replaced by adenine which translates to uracil, changing the amino acid from glutamic acid to valine

Complete the table:

Normal Hemoglobin Gene	C A C G T A G A C T G A G G A C T C					
Transcription	Codon1	Codon 2	Codon 3	Codon 4	Codon 5	Codon 6
mRNA	G U G	CAU	C U G	ACU	CCU	G A G
Translation	Amino acid 1	Amino acid 2	Amino acid 3	Amino acid 4	Amino acid 5	Amino acid 6
Protein	Val	His	Leu	The	Pro	Glu
Sickle Cell Hemoglobin Gene	C A C G T A G A C T G A G G A C A C					
Transcription	Codon1	Codon 2	Codon 3	Codon 4	Codon 5	Codon 6
mRNA	G U G	CAU	C U G	ACU	CCU	G U G
Translation	Amino acid 1	Amino acid 2	Amino acid 3	Amino acid 4	Amino acid 5	Amino acid 6
Protein	Val	His	Leu	The	Pro	Val

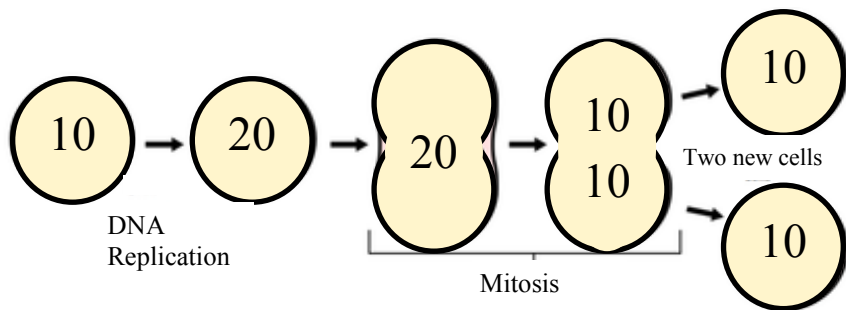
Cell Division

All living things are made of cells. Cells contain two copies of each chromosome, one from each parent. To grow, replace old cells, or repair tissues when they get hurt, organisms must make new cells. To do this, the old cells make a copy of themselves through a process call **mitosis**. The process of **mitosis makes 2 new cells that are exactly the same**.



Mitosis is part of cell division. Before **mitosis** starts the cell makes a copy of the DNA. Then, during **mitosis**, the cell divides into two new cells. **Each new cell has the same number of chromosomes as the original cell.**

Therefore, if a cell started with 10 chromosomes, it would make a copy of each chromosome and have 20. The cell would then go through **mitosis** and divide the cell and chromosomes (DNA) and each new cell would be back to having 10 chromosomes.



LS2F: The concept of sustainable development supports adoption of policies that enable people to obtain the resources they need today without limiting the ability of future generations to meet their own needs. Sustainable processes include substituting renewable for non-renewable resources, recycling, and using fewer resources.

Recently Snohomish PUD decided to put up a dam on the south fork of the Skykomish River to increase the amount of electrical power available to it customers. One argument against this proposal is that it would keep salmon from migrating back upstream. Visit a stream at spawning time and you are sure to see bears, wolves, eagles, ravens, crows and gulls, river otter and mink fishing for nutrient rich salmon. Bears often drag their catch onto stream banks or into forest edges to eat, and once they consume the fish eggs, belly, brain and skin, the rest of the carcass is left untouched and available to other animals, like insects and small mammals. As bacteria break down carcasses even further, nutrients become available to plants in the riparian zone (stream side) and forest edge.

Explain why using the salmon as the argument against putting in the dam is scientifically important when thinking about sustainability of the forest ecosystem? Salmon are a food source for bears as well as for other organisms in the ecosystem. Also the salmon that get decomposed in the riparian zone provide nutrients to plants.

What was the purpose of building a dam on the river?

To increase the amount of electrical power available for human energy needs.

What is an advantage of generating electricity in wind farms rather than using fossil fuels? _____

Because wind is a renewable resource. Fossil fuels take more than many lifetimes to renew themselves so get used up faster than they can be made. Wind can be used over and over again without running out of it.

If the dam is built, what might be an unintended consequence of the river being dammed?

If the river is dammed salmon will not be able to go up to the place where they reproduce. If they do not reproduce the population numbers will go down. This means bears and other organisms that count on them for food will have less food and the forest where the scraps dropped and normally decompose replacing nitrogen and other nutrients in the soil will not be available to the plants in the forest.

Renewable vs. Non-renewable Resources and Sustainability of Ecosystems

A renewable resource is one that naturally replaces itself at a rate near or equal to the rate at which you are using it.

A non-renewable resource does not replace itself at the rate it is being used.

Circle all of the following that would be considered to be a renewable resource.

coal wind biomass plastics
water tides petroleum

What is a natural resource?

- A. **A natural resource is anything found in nature.**
- B. A natural resource is something that lives outdoors.
- C. A natural resource is something found in nature that people use.

What is a renewable resource?

- A. **A natural resource that can replace itself before used up.**
- B. A natural resource that is used up faster than it can replace itself.
- C. A natural resource that can be recycled, like glass and paper.

What does recycling mean?

- A. To use a natural resource to make something new.
- B. To use less of a natural resource than is possible
- C. **To reuse natural resources or old products to make new things**

What are some advantages and disadvantages of using renewable resources in place of non-renewable resources?

- **Advantages: protection of non-renewable resources. Disadvantage is cost**

What would be the effects of each of the following on the availability of resources in an environment:

- A. exponential population growth **resources will decrease**
- B. natural disasters like a floods or hurricanes **resources will decrease**
- C. disease that only effects the producers in the environment **resources will decrease**

How would using recycled materials instead of cutting down more trees and producing more building materials be more effective form of sustainable Development?

By using recycled materials we allow the tree population to grow back, therefore proving more resources for other species.

Mitosis Questions

1. What are all living things made of? **Cells**

2. List 3 reasons that an organism (living thing) would need to make new cells.
 - a. **Grow**
 - b. **Replace old cells**
 - c. **Repair tissues when they get injured (hurt)**

3. Where do new cells come from? **The process of mitosis**

4. Before new cells can be made, what does the DNA have to do? **DNA has to replicate (make an exact copy of itself...so the instructions can be passed on.)**

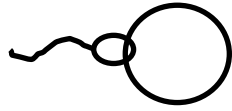
5. Earthworms have 36 chromosomes in each of their cells. How many chromosomes will there be after DNA replicates (makes a copy)? **72** How many chromosomes will there be in each new cell after they divide? **36**

6. After mitosis, two cells are made. The two new cells _____ the old cell.
 - a. **Are the same as the old cell**
 - b. **Are different than** the old cell
 - c. **Have half as much DNA as** the old cell

7. Describe the process of mitosis.
Before mitosis, the cell replicates its DNA. Then the cell divides into 2 new cells.
The new cells are the same as the original cell.

Reproduction

All living things can reproduce to help their species continue on earth. Some organisms can make a copy of themselves. This is called **asexual reproduction**. Other species use **sexual reproduction** to make offspring (babies). In sexual reproduction, a sperm and an egg come together. The sperm fusing with the egg is called **fertilization**.

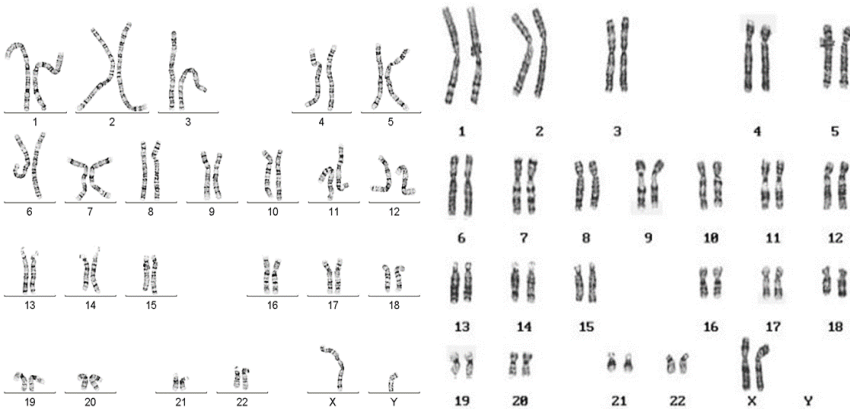


1. What is the difference between asexual reproduction and sexual reproduction? **In asexual reproduction, the organism make a copy of itself, and insexual reproduction a sperm and an egg come together to make a zygote (baby).**

Chromosomes in Cells

Each body cell has 2 copies of each chromosome. One copy of the chromosomes came from the mom in the egg, the other copy came from the dad in the sperm. In humans, there are 46 total chromosomes. 23 come from mom's egg, 23 come from dad's sperm.

2. If a mouse's sperm has 20 chromosomes, how many chromosomes will a fertilized egg have? **20**
3. If a cow has 60 chromosomes in its body cells, how many chromosomes will be in a cow's egg cells? **30**



Bioaccumulation and Biomagnification

Bioaccumulation is when an organism takes in and **cannot get rid of a chemical** in its body at a **concentration** greater than the concentration of that chemical in the environment.

Biological magnification occurs **when bioaccumulation occurs in several links in a food chain**. A consumer (of any level) has to eat a lot of organisms from the lower trophic level. If those organisms contains the chemical pollutant, **the pollutant will build up in large quantities over time** in the consumers in the **higher trophic levels**.

This can happen when the pollutant chemical is:

- Long-lived (does not degrade (break down), or is not easily broken down inside organisms).
- The pollutant gets into the organism's body tissues permanently (is not excreted). This often occurs with pollutants soluble in fat.
- Water-soluble pollutants usually cannot biomagnify in this way because they would dissolve in the bodily fluids of the consumer and get excreted in the urine..
- **Examples** of biomagnification include organic compounds; **DDT Mercury, PCB's, Heavy metals (lead)**

1. **Explain the difference between bioaccumulation and biomagnification. Bioaccumulation is when an organism takes in ?? Cannot get rid of a chemical in its body and biomagnification happens when bioaccumulation happens in several links in the food chain and reaches the top**

2. Which trophic level if most affected by biomagnification of a pollutant?
The top predator

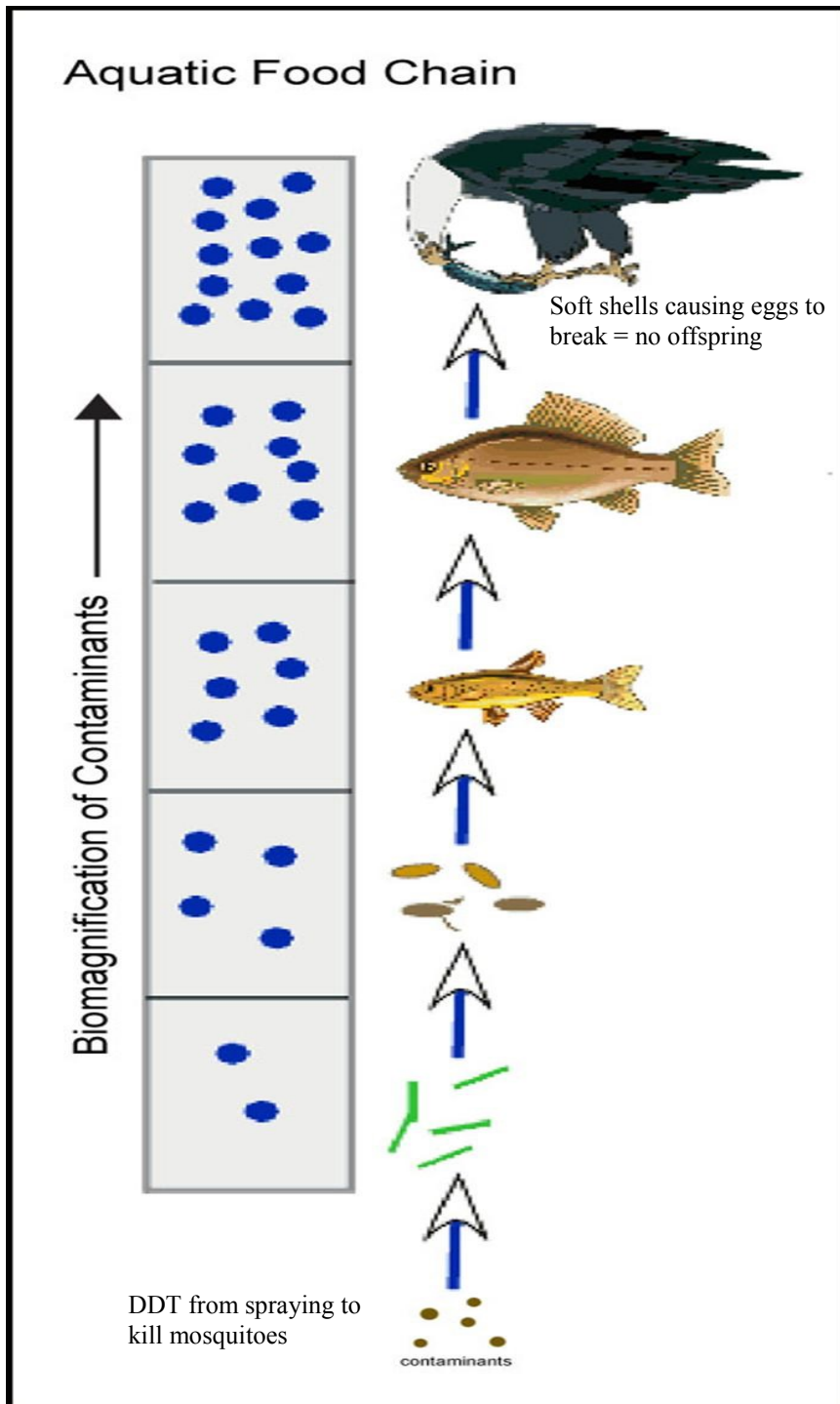
Marsh plants $\xrightarrow{1}$ **minnow** $\xrightarrow{100}$ **perch** $\xrightarrow{5000}$ **hawk** $\xrightarrow{100,000}$

1. Suppose that a minnow eats 100 marsh plants in one year. How much DDT builds up in the body of the minnow? Write that number below the minnow in the food chain. **100 units of DDT**

2. A perch eats 50 minnows in one year. How much DDT accumulates in its body? Write that number below the perch in the food chain.
100 units minnow X 50 = 5000 units of DDT

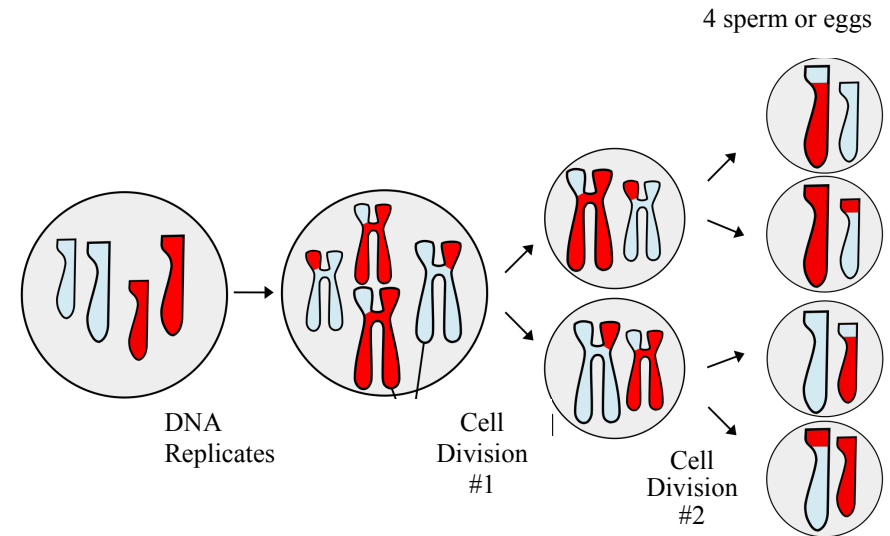
3. The red-tailed hawk consumes 20 perch in one year. What amount of the pesticide builds up in this consumer? Write the number underneath the red-tailed hawk in the food chain.

5,000 units DDT perch = 100,000 units of DDT/yr



Meiosis

Meiosis is the process that makes the sperm in males and the eggs in females. During **meiosis**, a reproductive cell makes a copy of its chromosomes (DNA), then it divides twice. Dividing twice makes a different combination of chromosomes in each sperm or egg that is made. Also, each sperm or egg has half as much DNA as a body cell because it only has one copy of each chromosome instead of two copies.



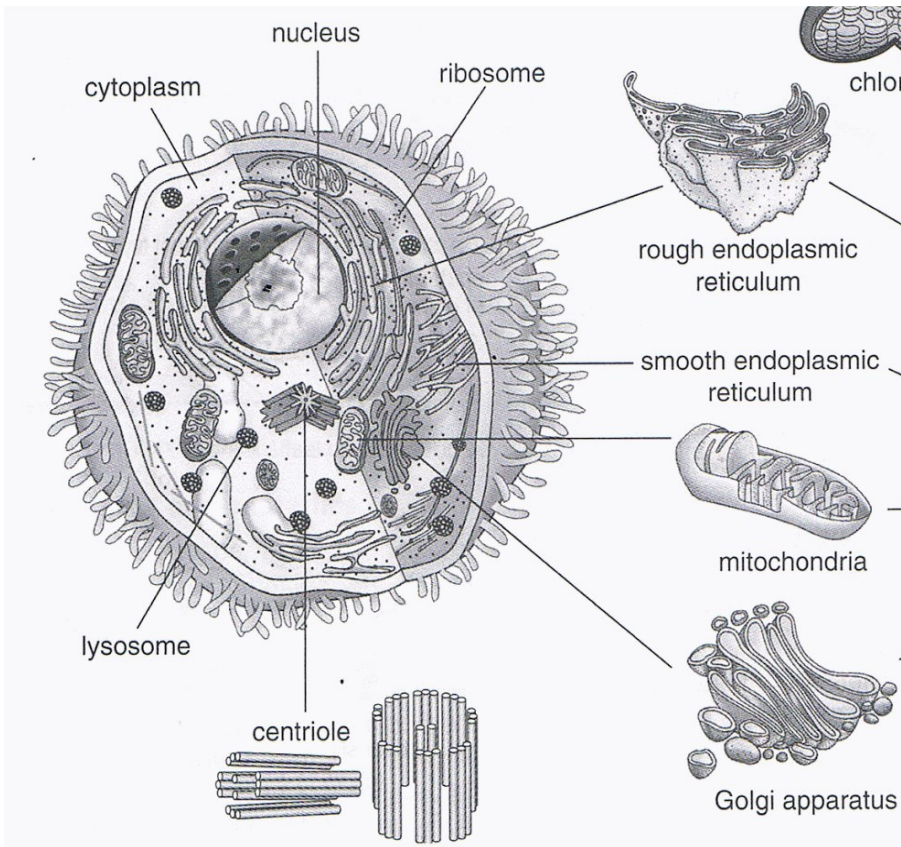
1. If a cat's body cell has 38 chromosomes, how many
2. chromosomes would be in the cat's egg cells? **19**
3. How many sperm cells are made during meiosis? **4**
4. Are the chromosomes in each of the sperm cell the same? Explain. **Meiosis makes different combinations of chromosomes in each sperm or egg made.**
5. If a couple has three children, the children will not be exactly the same. Explain how meiosis makes the children different. **Each egg/sperm will have different combination of chromosomes, therefore each kid will get different traits.**
6. Explain how fertilization makes the children different. **Not 2 eggs/sperm will be the same, so when a sperm fertilizes an egg, the combinations of chromosomes will be different making the children different.**

Animal Cell

Color each part of the cell its designated color:

Cell membrane – light brown
 Nucleus– light green
 Chromosomes - multi colored
 Ribosome – red
 Mitochondria – yellow
 Cytoplasm – white

Lysosome – purple stripe
 Golgi apparatus – light blue
 Rough endoplasmic reticulum – dark blue
 Smooth endoplasmic reticulum – orange
 Centrioles – black polka-dots
 Flagella or cilia – dark green polka-dots



▲ Figure 2.7 Structure of an animal cell and a plant cell

Factors that affect Population Size

Abiotic factors

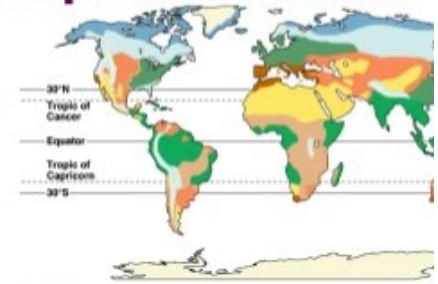
- ◆ sunlight & temperature
- ◆ precipitation / water
- ◆ soil / nutrients

Biotic factors

- ◆ other living organisms
 - prey (food)
 - competitors
 - predators, parasites, disease

Intrinsic factors

- ◆ adaptations



Factors that Limit Populations		
	Factors Contributing to Increasing Population	Factors Contributing to Decrease in Population
Abiotic	<ul style="list-style-type: none"> • Favorable light • Favorable temperature • Favorable chemical environment 	<ul style="list-style-type: none"> • Too much or too little light • Too cold or too warm • Unfavorable chemical environment
Biotic	<ul style="list-style-type: none"> • Sufficient food • Low number of low effectiveness of predators • Few or weak diseases and parasites • Ability to compete for resources 	<ul style="list-style-type: none"> • Insufficient food • High number or high effectiveness of predators • Inability to successfully compete for resources • Many or strong diseases and parasites

LS2C: Population growth is limited by the availability of matter and energy found in resources, the size of the environment, and the presence of competing and/or predatory organisms.

Explain using, an example, how the availability of matter and energy limit the growth of a population? **Each trophic level needs an amount of matter and energy to be supported. If there is not enough food, the population will not be able to be supported, Therefore, it will decrease.**

How does the size of the available environment limit the growth of a population?

Each environment had a carrying capacity, which is how many for each organisms it can sustain. A bigger environment will allow for more growth in a population.

How does the presence of competing organisms limit the growth of a population?

The more organisms compete for a resource, less organisms from a population will be supported.

How does the presence of predatory organisms limit the growth of a population?

The presence of predators will limit the trophic level underneath it because predators will eat other organisms

How can decreasing the size of an environment limit the population of a species?

If there is a smaller environment then less organisms will have the resources they need to survive, therefore their population will decrease.

How can decreasing the availability of matter limit the population of a species?

If there is not enough matter for organisms

How can decreasing the number of predators limit the population of a species?

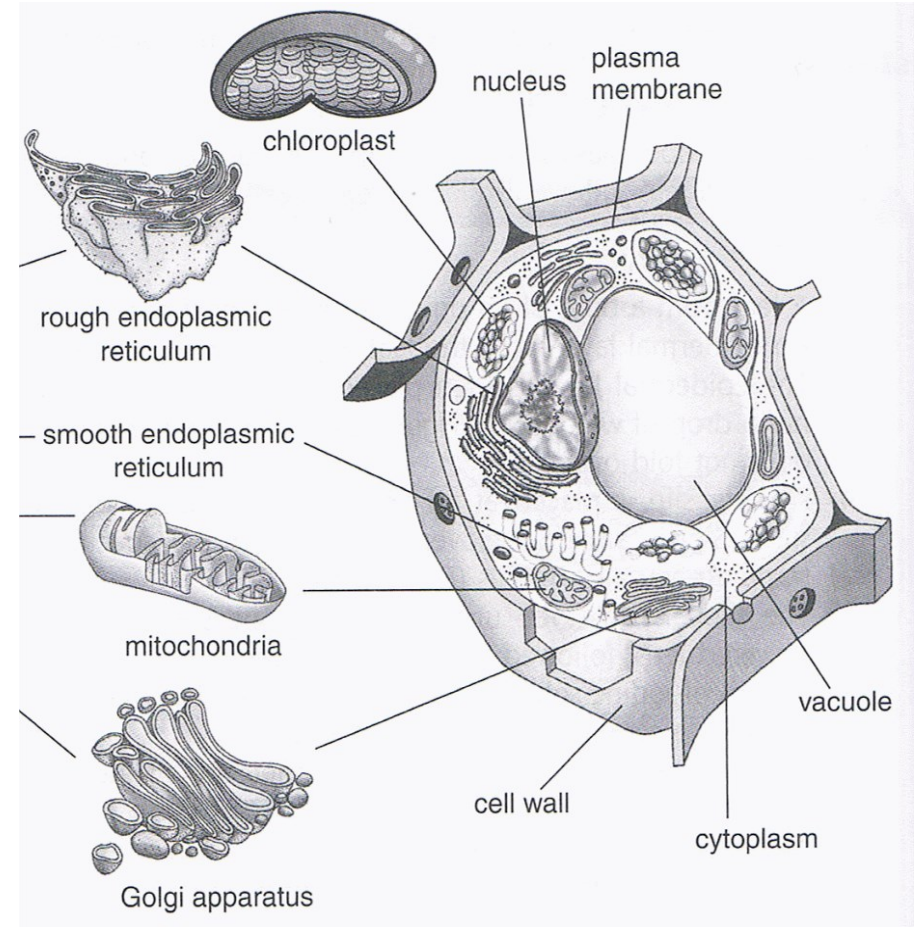
If the number of predators decrease the number of organisms in the trophic level below (e.g. 2ry consumers) will increase putting more pressure on the level below (e.g. primary consumers limiting their population).

Plant Cell:

Use the same colors as you did for the animal cell color and add:

Cell wall - purple
Vacuole - black

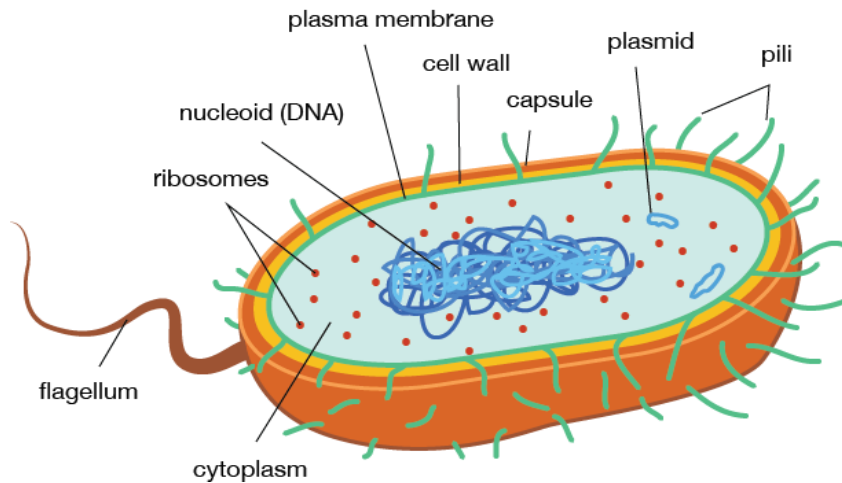
Chloroplasts - dark green



▲ **Figure 2.7** Structure of an animal cell and a plant cell

Bacterial Cell:

Use the same colors as you did for the animal cell and plant cell:



Based on the cellular organelles and structures what are the differences between prokaryotes (cells without nucleus) and eukaryotes (cells that have nucleus)?

Prokaryotes: **Do not have a nucleus, but have a cell wall flagella and/or pili**

Eukaryotes: **Have nucleus, has flagella but not pili.**

Based on the cellular organelles and structures what are the differences between Animal and Plant cells?

Animal:

- * **Do not have a cell wall**
- * **has mitochondria**
- * **Does not have a large central vacuole**
- * **have small vacuoles**
- * **has flagella**

Plant:

- * **has a cell wall**
- * **Has mitochondria and chloroplasts**
- * **Has a large central vacuole**
- * **Has flagella only in gametes**

How would the Food Web be affected if the Magpie was removed?

If the Magp's was removed , the termite and crickets populations will increase, reducing the population of grass. By doing so, other organism will not have enough food..

What factors could increase the number of Kookaburras?

If the population of organisms below it in the food web increase.

What factors could limit the frilled lizard population?

An increase in the laughing kookaburra , or a decrease in the cricket population.

What could be unintended consequences in adding another herbivore like a rabbit to the ecosystem?

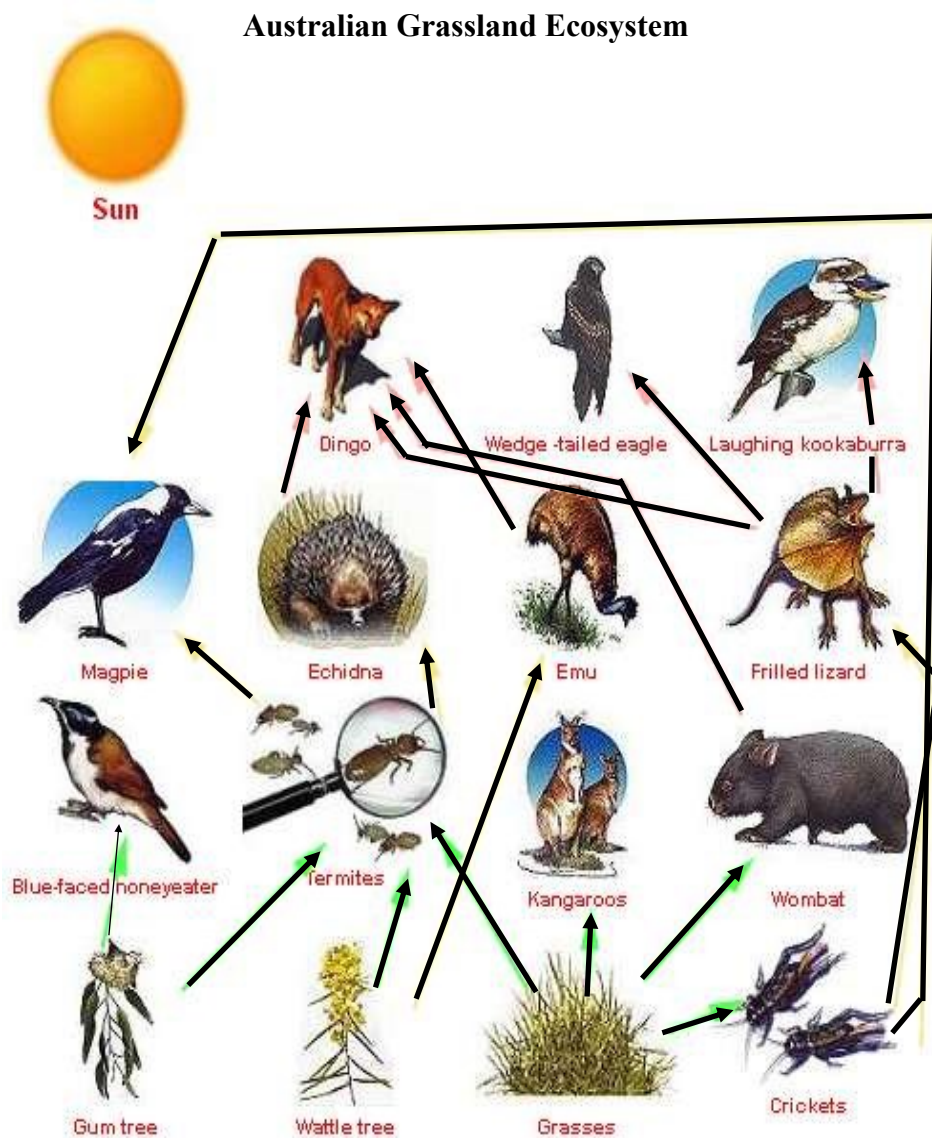
The grass population would decrease putting stress on other organisms that need to eat grass to survive by increasing competition for the grass.

What could be unintended consequences in adding another predator like a snake to the ecosystem?

The population of primary consumers would decrease because there will be more predators eating them, but the producer population will increase because there are not as many primary consumers.

The Australian population is increasing and developers are planning on building a new development in the area. What are two things that scientists should consider about the ecosystem when planning the new development.

- * **Producer species that may be specific food for primary producers.**
- * **The space every organism need**
- * **The bodies of water being compromised**
- * **The plan life that provides habitat and shelter for animals**











Cell Organelle or Structure	Function
Cell membrane	Cell's Border Regulates what enters and leaves the cell Found in all cells
Cell wall	Provided structural Support for the cell. Ridged and Strong Found in Plant and Bacterial Cells
Cytoplasm (Cytosol)	Jelly like substance that supports and hold the cells organelles Found in all cells
Nucleus	Holds the DNA of the Cell Controller of the cell Found in Plant and Animal cells
Chromosome DNA	Instructions for all cellular functions. Blueprint for how to make proteins Found in all cells
Ribosome	Builds proteins in cells from instructions in the DNA Found in all cells
Mitochondrion or Mitochondria	Performs Cellular Respiration Converts Sugar into ATP energy for the Cell Found in Plant and Animal cells
Chloroplast	Performs Photosynthesis Converts Light energy into Sugars Found in Plant cells
Vacuole	Stores water and other molecules for later use Found in Plant and Animal cells

Cell Organelle Fill-in

- Which cellular organelle provides energy to the cell?
mitochondrion
- Which cellular organelle carries out photosynthesis?
chloroplast
- Which cellular organelle holds the DNA and controls the cells activities?
nucleus
- Which cellular organelle makes proteins in a cell?
ribosome
- Which cellular structure is composed of the DNA?
chromosome
- Which cellular structure regulates which molecules to move in and out of a cell?
cell membrane
- Which cellular organelle are membrane-bound sacs used for storage, digestion, and waste removal?
vacuoles
- Which cellular structure is ridged, strong, protects a cell and provides support to the cell?
cell wall
- Which cellular structure is a jelly-like substance that supports and protects cell organelles?
cytoplasm
- If the cells chloroplast was not working properly what process will the cell not be able to carry out?
photosynthesis
- If the cells mitochondria was not working properly what process will the cell not be able to carry out?
cellular respiration
- If the cells ribosomes were not working properly what process will the cell not be able to carry out?
protein synthesis

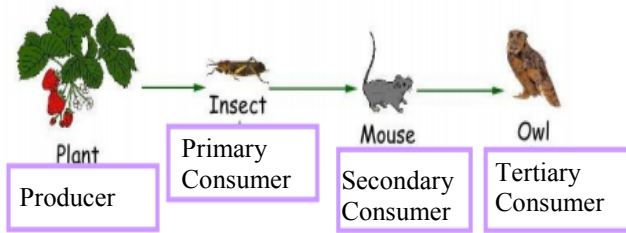
Food Webs and Trophic Levels Multiple Choice

Name: _____ Date: _____ Class: _____

<p>1 The source of all energy comes from green plants changing sunlight into food through the process of:</p> <p>A Consumption B Photosynthesis C Decomposition D Tropism</p> 	<p>5 The living things that eat and recycle dead animals and plants are called:</p> <p>A Consumers B Carnivores C Animals D Detrivores</p> 
<p>2 Each part of this food chain is called a:</p> <p>A Trophic Level B Food Stage C Energy Level D Eating Level</p> 	<p>6 The animals (insects, mice, chipmunks, squirrels, rabbits, deer, etc.) that eat the plants are:</p> <p>A Producers B Carnivores C Primary Consumers D Secondary Consumers</p> 
<p>3 Plants that make their own food – using water, sunlight and carbon dioxide are called:</p> <p>A Consumers B Herbivores C Producers D Decomposers</p> 	<p>7 Energy flows through an ecosystem as animals eat plants or eat other animals in a:</p> <p>A Food Web B Herbivore Web C Producer Web D Decomposer Web</p> 
<p>4 Animals that eat both plants and animals are called:</p> <p>A Carnivores B Herbivores C Omnivores D Decomposers</p> 	<p>8 Animals that eat only plants are called:</p> <p>A Carnivores B Herbivores C Omnivores D Decomposers</p> 

Section L: Food Chains/Webs

1. In the diagram, label the trophic levels.
2. Explain how the energy is flowing.



Energy flows from producer to consumers but some of the energy is lost as heat.

3. Does the amount of available energy increase or decrease in a chain? decrease
4. What are trophic levels? The position the organism occupies in the food chain
5. What is the main source of energy for life on Earth? Sunlight

6. Which organism in the web has the greatest amount of energy available?

Grass (producers)

7. Which organism in the web has the least amount of energy available?

Wedge Tailed Eagle

8. What is the rabbit in this web?

Primary Consumer

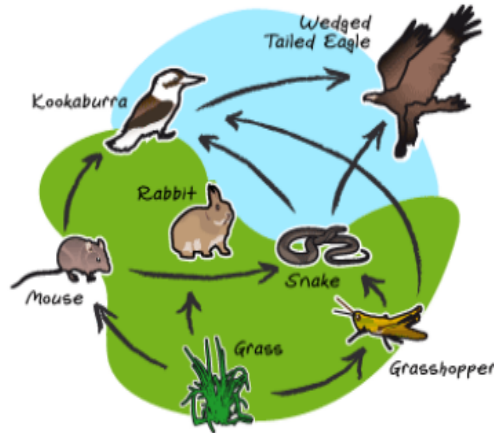
9. What organism is missing from this web? It feeds at all levels.

Decomposers

- a. Why are these organisms beneficial for the environment?

Break down dead/dying organisms and return their carbon, nitrogens to the soil.

10. How would the extinction of the snake affect this food web? Mouse & grasshopper population would increase, grass population decline. Kookaburo and eagle would need to eat other animals.



Section M: Food Pyramids

1. Suppose 10,000 units of energy are available for the grass. What is the amount of energy available for the hawk? Only 1 unit of energy
2. How much energy is lost at each level and what is it lost as? 90% of the energy is lost as heat at each level
3. Who has the greatest biomass in the food chain? Plants
4. What is biomass? The amount of matter (atoms and molecules) that makes up all of the organisms.
5. Why does the population decrease as you move up the pyramid? Because the organisms at the top get their matter and energy from the bottom and they require more than those at the

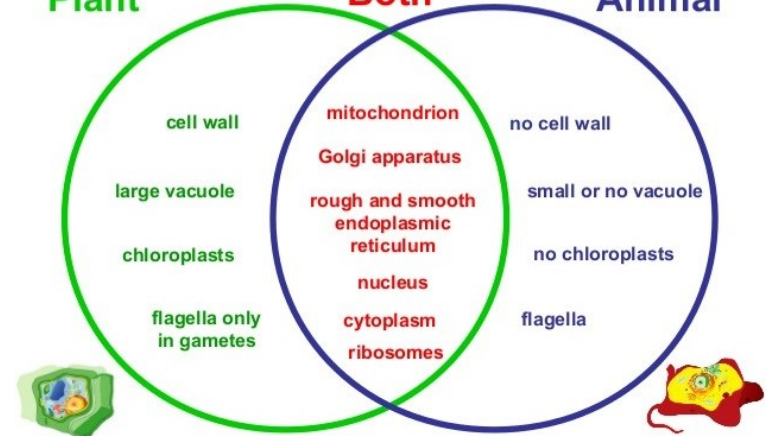


Match the Cell Part to the Function

1. D Cell membrane
2. I Nucleus
3. E Ribosome
4. H Mitochondria
5. B Cytoplasm
6. G Chromosomes
7. F Cell Wall
8. C Vacuole
9. A Chloroplast

- A. Use the energy from sunlight to make energy rich foods molecules in plants
- B. Solution that suspends the organelles of the cell
- C. Stores water, salts, proteins and carbohydrates
- D. Thin flexible barrier around the cell; lipid bilayer
- E. Make proteins for the cell
- F. Supports and protects the cell; not found in animal cells
- G. Threadlike structures that contain genetic material
- H. Use energy from food to make high energy compounds
- I. Stores the DNA of the cell

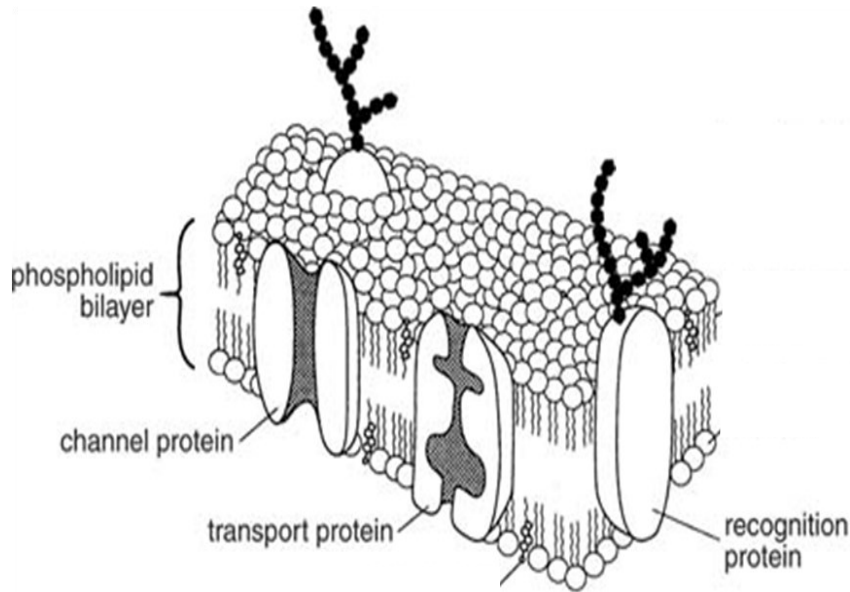
Plant Both Animal



Cell Membrane

Coloring the phospholipid bilayer:

Proteins → blue
Phospholipids → yellow



1. What is the purpose of the cell membrane?

To control what goes in and out of the cell

2. Describe the structure of the cell membrane (what is it made of?).

The cell membrane is made up of a double (two) layers of phospholipids (phospholipid bilayer) and proteins.

3. Which of the structures in the cell membrane allow for the transport of molecules? **Transport proteins**

From your experience with living things create your own energy pyramid:

1. Name a producer : **Phytoplankton**

2. Name an herbivore that eats that producer: **Zooplankton**

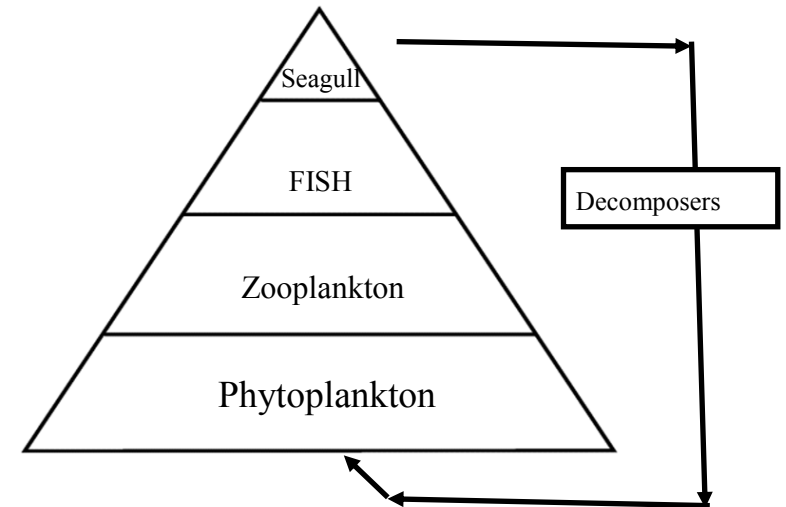
3. Name a carnivore that eats that herbivore: **Fish**

4. Name a carnivore that eats that carnivore: **Seagull**

5. Identify two types of decomposers: **bacteria** and **fungi**

6. Place the organisms in their appropriate trophic level in the pyramid.

7. Label the trophic levels on the pyramid.

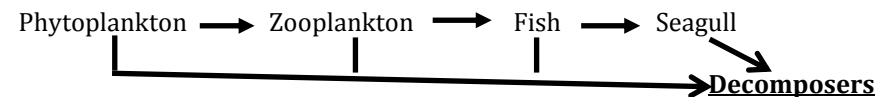


8. If the 1st trophic level in your pyramid has 1000 units of energy.

1. How many units of energy will the 2nd level consumer have? **100 units**

2. How many units of energy will the top predator receive? **0.1 units**

9. Draw a food chain with your organisms. Be sure to include the original source of energy for the first trophic level in your drawing.

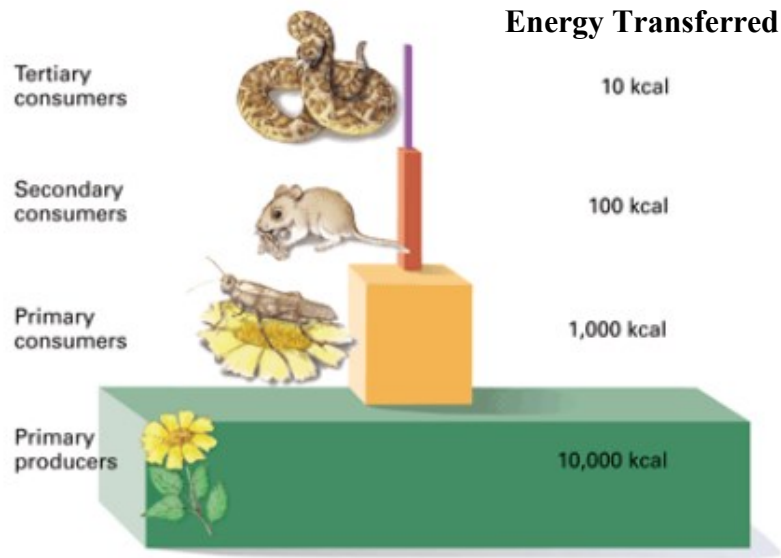


10. Explain what the arrows represent.

The arrows show the directions of energy transfer from one group of organisms to the next.

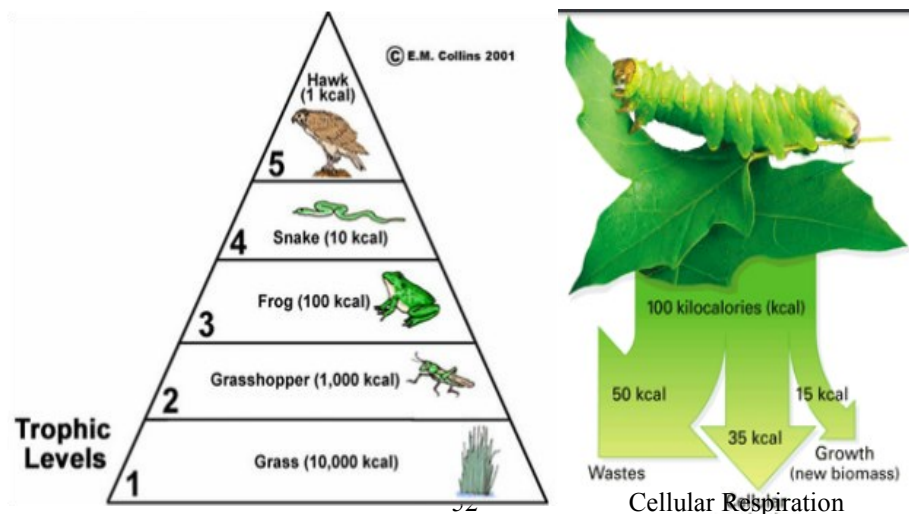
Cell Membrane and Cellular Transport

The amount of energy passes from one trophic level to the next is not much. The organism has to use about 90% of its own food energy to keep it alive. This leaves only 10% of the original energy the organism took in that is available to the next trophic level. This is called the 10% Rule. Because of this, there are way more plants than there are plant-eaters, way more autotrophs than heterotrophs, and way more plant-eaters than meat-eaters. Remember, some of the energy is also lost as heat at each level.



1. What loss of energy is not shown on the Pyramid of energy above?

The energy that is lost as heat



The cell membrane regulates what enters and leaves a cell. The cell membrane is a phospholipid bilayer with embedded proteins. The proteins in the cell membrane are capable of regulating the flow of molecules into and out of the cell.

Molecules move into and out of the cell based on the concentration gradient of the molecules. They generally move from an area of high concentration to an area of low concentration. Passive Transport and Active Transport are the two major processes that molecules use to enter and leave the cell.

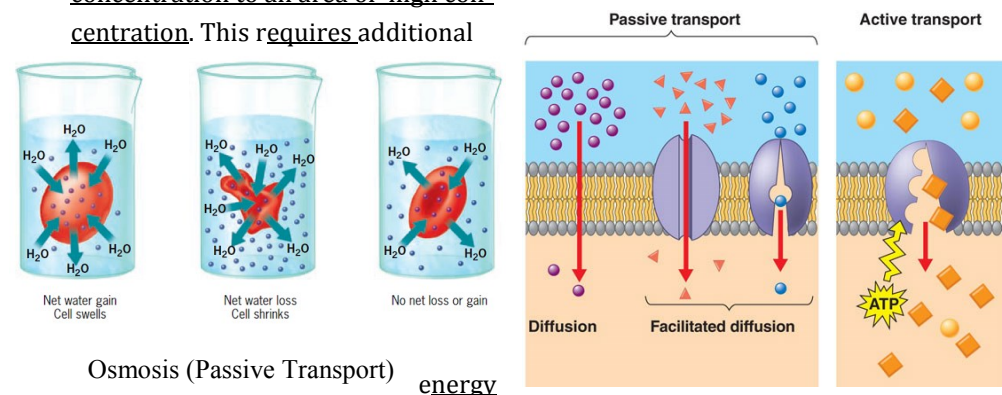
Passive Transport

During passive transport the molecules move from an area of high concentration to an area of low concentration. This process does not require additional energy. Listed are three types of passive transport:

- **Osmosis**: is the movement of water molecules across a membrane from an area of higher concentration to a lower concentration.
- **Diffusion**: in a cell the movement of small uncharged molecules across a membrane from an area of higher concentration to a lower concentration.
- **Facilitated Diffusion**: is the use of proteins to help in the movement of molecules across a membrane from an area of higher concentration to a lower concentration.

Active Transport

In Active Transport, the molecules are moving from an area of low concentration to an area of high concentration. This requires additional energy.



Cellular Transport Processes

Define the following processes:

Passive Transport: any molecules move from area of high concentration to area of low concentration without using energy.

Simple Diffusion: small molecules (CO₂, O₂, some water) move across the membrane from where they are in high concentration to where they are in low concentration, without the use of energy.

Facilitated Diffusion: molecule have a transport protein in the membrane help them move from where they are in high concentration to where they are low concentration on the other side of the membrane, without the use of energy.

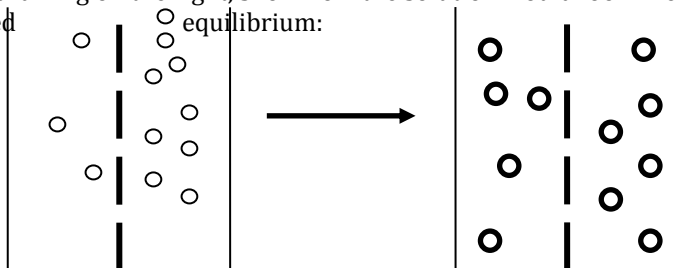
Osmosis: movement of water across a membrane from area of high water concentration to area of low water concentration.

Active Transport: movement of molecules from area of LOW conc. To area of HIGH conc.. Requires the use of energy (ATP).

Fill in the chart below:

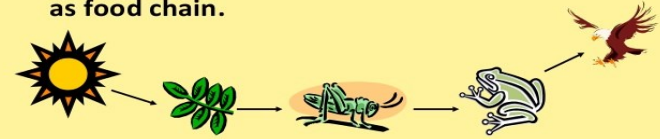
Process (Type of Transport)	High to Low? Low to High?	Energy Required? No Energy Required?
Diffusion	High → Low	No energy required!
Facilitated diffusion	High → Low	No energy required!
Osmosis	High → Low	No energy required!
Passive transport	High → Low	No energy required!
Active transport	Low → High	Energy is Required

Consider the solution in the drawing below with the two sides divided by a semi-permeable membrane. The dots (circles) represent the solute. In the blank drawing on the right, show how the solution would look like once it reached equilibrium:



What is Food Chain?

Flow of energy in an ecosystem is one way process. The sequence of organism through which the energy flows, is known as food chain.

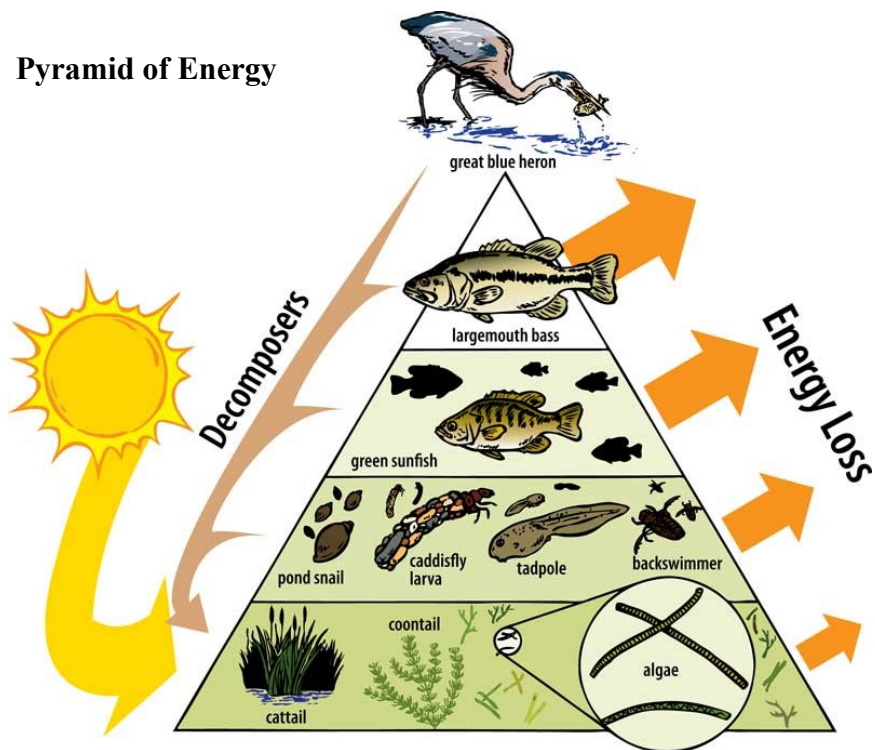


Note: for questions 1, 2, 4 and 6 CIRCLE THE CORRECT ANSWER

- Energy (increases, decreases, stays the same) as you move up through a food chain or pyramid.
- A (Food web, Food Chain, Food Pyramid) shows **one** possible pathway for energy.
- What is the role of the producers in an ecosystem?
Producers carry out photosynthesis to make their own food and become the basis of food for all organism above them.
- Producers are organisms that (makes their own food, obtain energy from non-living matter, or obtain food from other organisms).
- How is a consumer different from a producer?
Consumers cannot produce their own food. They have to eat other organisms.
- Consumers are organisms that (makes their own food, obtain energy from non-living matter, or obtain food from other organisms).
- What is the role of detritivores in an ecosystem?
To eat/decompose dead matter. They break down and get their food from dead things, putting what they don't use back into the soil.
- Where do decomposers (detritivores) fit in a food chain? Explain.
Decomposers fit in each level of the food chain because the eat and break down the organisms that die in each level

Every organism needs to obtain energy and matter in order to live. For example, plants get energy from the sun, some animals eat plants, and some animals eat other animals.

Pyramid of Energy



A food chain is the sequence of who eats whom in a biological community (an ecosystem) to obtain nutrition.

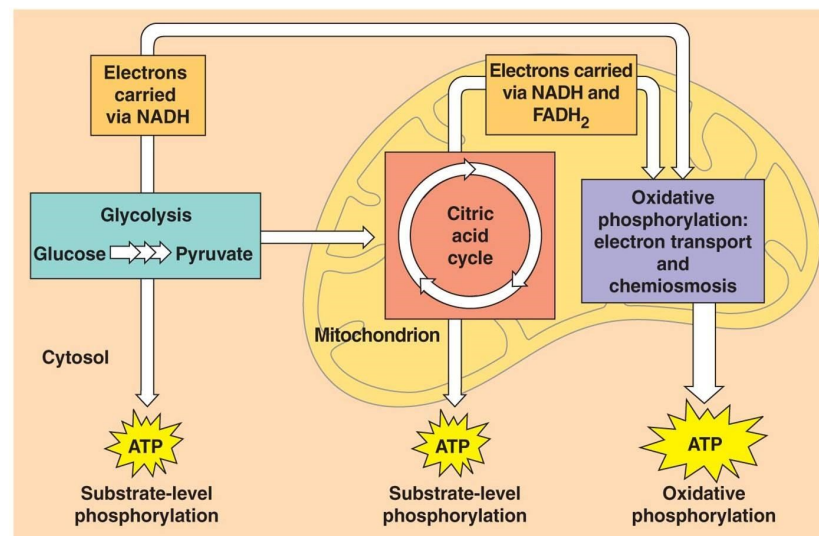
The arrows in a food chain point in the direction of the flow of energy, from the sun or hydrothermal vent to a top predator. As the energy flows from organism to organism, energy is lost at each step. Each organism

When any organism dies, it is eventually eaten by scavengers (like vultures, worms and crabs) and or detritivores who are organisms who eat and break down dead things. The detritivores are also known as decomposers (bacteria and fungi).

Some organisms' position in the food chain can vary as their diet differs. For example, when a bear eats berries, the bear is functioning as a primary consumer. When a bear eats a plant-eating rodent, the bear is functioning as a secondary consumer. When the bear eats salmon, the bear is functioning as a tertiary consumer (this is because salmon is a secondary consumer, since salmon eat herring that eat zooplankton that eat phytoplankton, that make their own energy from sunlight).

Cellular Respiration

LS1B: The gradual combustion of carbon-containing compounds within cells, called cellular respiration, provides the primary energy source of living organisms; the combustion of carbon by burning fossil fuels provides the primary energy source for most of modern society.



Living things get most of the energy they need from glucose. Autotrophs make glucose using photosynthesis, and heterotrophs get glucose from the food they eat.

Cellular respiration is a process that releases energy by breaking down glucose in food molecules in the presence of oxygen. The chemical equation for cellular respiration is:



1. In words, cellular respiration is: **the process that breaks down sugar (glucose) from food and transfers the energy in it to ATP molecules in the cell.**
2. What does the organism need to carry out cellular respiration? **1 Glucose Molecule (C6H12O6) and 6 Oxygen (O2) molecules**
3. What does the organism make during cellular respiration? **6 molecules of Carbon dioxide, 6 molecules of Water, and 34-36**

Cellular Respiration

Cellular respiration occurs in the **mitochondria**. This reaction starts with oxygen (O₂) and glucose (C₆H₁₂O₆) that comes from the food organisms eat [inputs]. It produces water (H₂O) and carbon dioxide (CO₂) [outputs]. During this process, ATP is made, which is usable energy that comes from the chemical energy in glucose. Cells need ATP to carry out different functions. For example, without ATP our muscle cells would not contract or relax, and we would not be able to move!

This process can be compared to the combustion (burning) of carbon based fuels (Examples+: fossil fuels, wood, gas). When fossil fuels are burned, big molecules that have carbon are broken down into smaller molecules in the presence of oxygen. Carbon dioxide, water and energy are produced.



- The inputs for cellular respiration are:

1 glucose (C₆H₁₂O₆) + 6 oxygen molecules (O₂)

- The outputs for cellular respiration are:

6CO₂ + 6 H₂O + energy (ATP)

- What kind of energy is in glucose?

chemical

- The energy in glucose gets turned into a form of energy that cells can use called: **ATP**

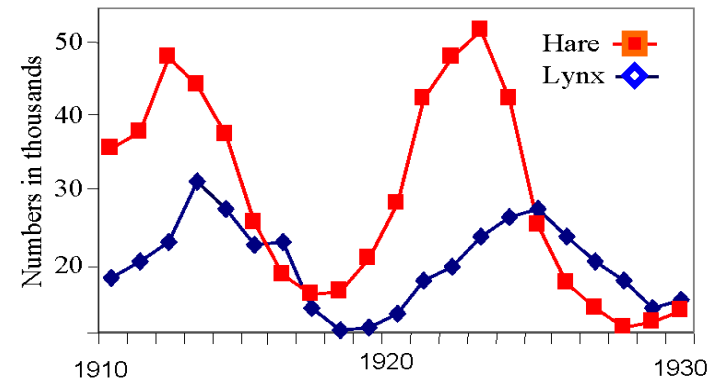
- What do cells use ATP for? ATP is used for any cell process that needs energy to work. Like muscle cells moving or chemical reactions,

- All organisms do cellular respiration because they need energy to do work.

- When you burn a fossil fuel like gas in your car the following reaction takes place: **C₃H₈ + O₂ → CO₂ + H₂O + energy**. How is this similar and different to cellular respiration?

Similar	Different
both use organic molecules for fuel	Fossil fuels give off light
both require oxygen	energy when burned, cell
Products of both are CO ₂ and H ₂	respiration does not give off
	light energy
	Cell respiration only occurs in
	living things

LS2D: Scientists represent ecosystems in the natural world using mathematical models.

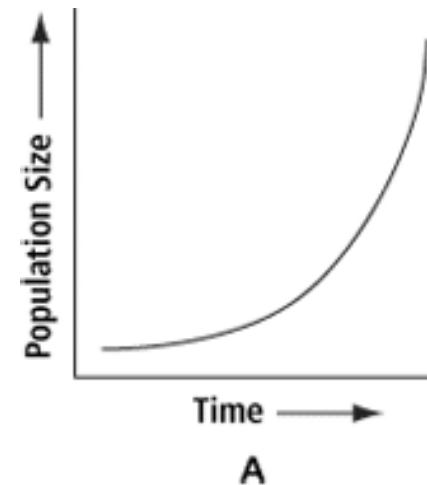


Based on this graph, what will happen to the hare population over the next 10 years, between 1930 and 1940? **It will increase.**

How will this be different than what happens to the lynx population?

This increase will happen before the population of lynx starts increasing again.

Examine the graph below. What will happen to the population when it reaches the carrying capacity? **It will plateau or stay the same until the lack of resources make the population decrease.**



Effects of Limiting Factors on Population Growth

Although there is intense competition between animals, there is also interdependence. When one species goes extinct, it can affect an entire chain of other species and have unpredictable unintended consequences.

As the number of carnivores in a community increases, they eat more and more of the herbivores, decreasing the herbivore population, increasing competition among themselves. It then becomes harder and harder for the carnivores to find herbivores to eat, and the population of carnivores decreases. In this way, the carnivores and herbivores stay in relatively stable equilibrium, A similar equilibrium exists between plants and plant-eaters.

Limiting Factors can affect the growth of any type of population.

What would be four possible limiting factors for growth of a human population on an island?

- A. **Space**
- B. **Food**
- C. **Shelter**
- D. **Predators -Competition**

What are five possible limiting factors for growth of a plant population?

- A. **Sunlight**
- B. **Temperature**
- C. **Predators**
- D. **Nitrogen**

What are four possible limiting factors for a population in a marine (salt water environment)?

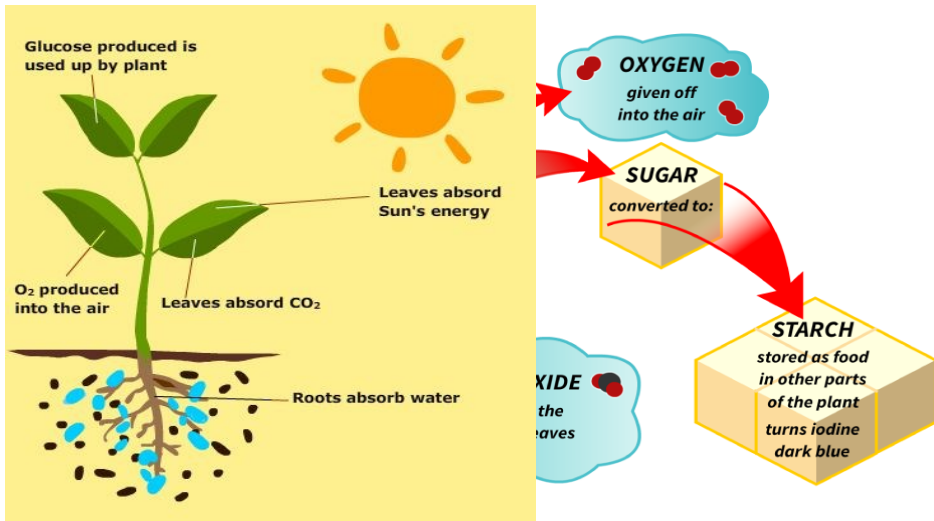
- A. **Sunlight**
- B. **Phosphorous**
- C. **Temperature**
- D. **Salt concentration**

Within a given area if the population of a specific predator increases, what will be the likely affect on this predator's prey population? Provide reasoning for your answer.

If the number of predators increases, the number of prey will decrease because there will be more organisms consuming prey.

Vocab: Match the term with the correct definition

- | | |
|-----------------------------------|-------------------------|
| 1. B___ Aerobic | 10. _C__ Mitochondria |
| 2. D___ Anaerobic | 11. _L__ Krebs Cycle |
| 3. J___ ATP | 12. _A__ Photosynthesis |
| 4. _I__ Calorie | 13. _O__ EnerKgy |
| 5. _K__ Chloroplast | 14. _G__ GlucFose |
| 6. _F__ Carbon dioxide (CO2) | 15. _H__ GlycNolysis |
| 7. _N__ Cellular respiration | 16. _R__ LightE energy |
| 8. __E__ Chlorophyll | 17. _M__ InpOut |
| 9. __Q__ Electron transport chain | 18. _P__ Output |
-
- A. The process in which the energy of sunlight to convert water and carbon dioxide into oxygen and high energy sugars
 - B. With oxygen
 - C. Found in the cytoplasm of most cells and produces enzymes for the metabolic conversion of food to energy
 - D. Without oxygen
 - E. Green pigment in plants that aid in photosynthesis
 - F. A molecule composed of carbon and oxygen; a product of respiration and a reactant in photosynthesis
 - G. A 6 carbon monosaccharide produced in plants by photosynthesis; formula $C_6H_{12}O_6$
 - H. 1st step in cellular respiration
 - I. Measure of energy required to raise 1 gram of water 1° Celsius
 - J. Chemical energy used by organisms; adenosine triphosphate
 - K. Organelle used in the process of photosynthesis
 - L. 2nd step in cellular respiration
 - M. Reactant ; heat energy from the sun
 - N. Process that releases energy by breaking down food molecules in the presence of oxygen
 - O. Light, heat, electricity; ability or power to work
 - P. Product; energy for cellular work
 - Q. 3rd step in cellular respiration
 - R. Plants and other types of organisms use this type of energy from the sun to produce food



Photosynthesis is the process plants use to make their own food. This gets more carbon, hydrogen and oxygen (matter) into plants so they can grow, develop and reproduce. It also gets energy into the plant by transforming light energy (sunlight) into chemical energy (glucose), which the plant can use to rearrange the C, H, O atoms into the macromolecules the plant needs. Plants take in mineral nutrients from the soil and combine them with the C, H, O taken during photosynthesis to make carbohydrates, proteins, lipids and nucleic acids.

What is the **process plants use make their own food so they can grow and develop?** Photosynthesis

What is the purpose of photosynthesis? To make food (glucose) for the plant.

What types of macromolecules (biomolecules) can plants make from the products of photosynthesis? Proteins, carbohydrates, lipids, nucleic acids.

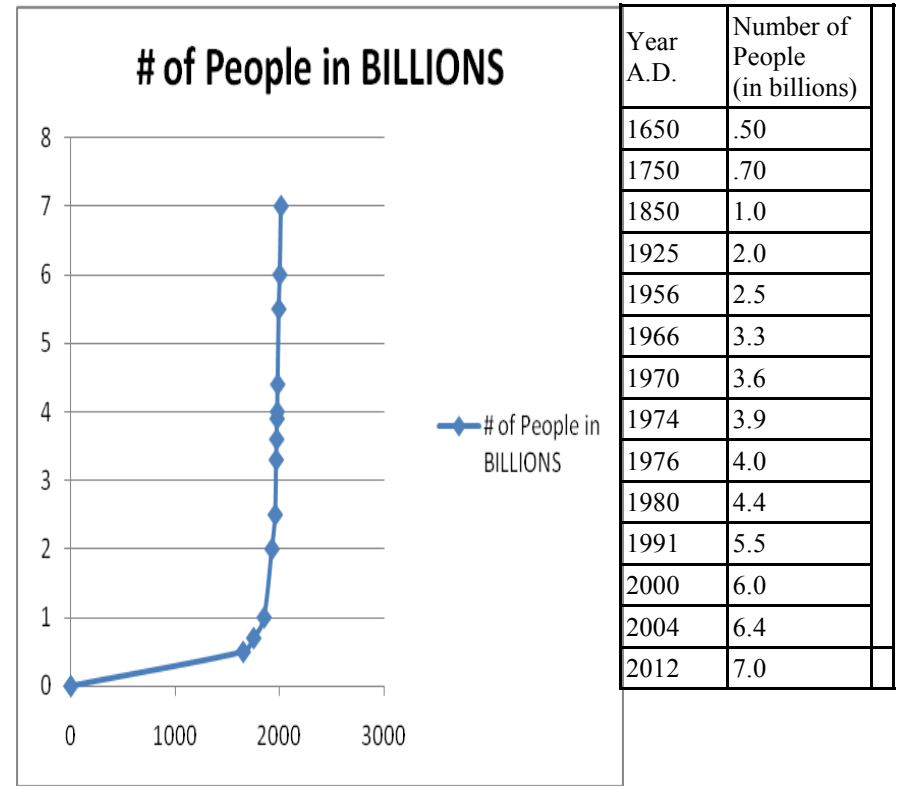
During photosynthesis plants combine the energy from sunlight with six molecules of carbon dioxide (6CO₂) from the atmosphere and six water molecules (6H₂O) from the soil to make energy-rich molecules of glucose (C₆H₁₂O₆) and oxygen (O₂). The oxygen produced is released (6O₂) back to the atmosphere as a waste product of the plant.

What is the chemical equation for photosynthesis?
 $6\text{CO}_2 + 6\text{H}_2\text{O} + \text{Light Energy} \rightarrow \text{C}_6\text{H}_{12}\text{O}_6 + 6\text{O}_2$

What inputs are needed for photosynthesis? CO₂ and H₂O

What are the outputs of photosynthesis? C₆H₁₂O₆ + 6 O₂

Human Population Growth



Analysis of the graph

- It took 1649 years for the world population to double, going from .25 billion people to .50 billion people. How long did it take for the population to double once again? 1850 yrs.
- How long did it take for the population to double a second time? 1925 yrs.
- Based the graph/data, in what year will the population reach 8 billion? 2016
- Based the graph/data, how many years will it take for the population of 2004 to double? 2035
- What could be some *biotic limiting factors* that affect the population growth? Availability of food
- What could be some *abiotic limiting factors* that affect the population growth? Availability of shelter

LS2B: Living organisms have the capacity (ability) to produce very large populations. Populations can continue to grow as long as there is an overabundance of living and nonliving resources (food, water, shelter, space, no disease and no predators) for that population. Population density is the number of individuals of a particular population living in a given amount of space.

What are conditions necessary for a population to increase rapidly?

Unlimited food, water, shelter, space, no disease and no predators.

What is population density?

The number of individuals of a population living in a given amount of space.

What are some factors that would affect population density? _____

Not enough food, shelter, water, increased numbers of predators and disease

Population density is the number of individuals in an area:

The equation is: number of organisms in the **population ÷ area**

Calculate the population density for the questions below. Be sure to INCLUDE UNITS!

1. A herd of 12 deer live on my uncle's 1000 acre ranch.

$$\underline{12 \text{ deer} \div 1000 \text{ acre} = 0.012 \text{ deer/acre}}$$

2.

There are 150 earthworms in 3 cubic meter (m³) of soil.

$$\underline{150 \text{ earthworms} \div 3\text{m}^3 = 50 \text{ earthworms/m}^3}$$

3. Everett is 50.0 mi² and 107,000 people live here. ____

$$\underline{107,000 \div 50\text{mi}^2 = 2,140 \text{ people/mi}^2}$$

4. How does population density relate to carrying capacity?__

The population density (# of individuals of a population living in a given amount of space) is determined by the carrying capacity of the ecosystems (how many organisms from a population the ecosystem is able to support).

The chloroplast is the organelle in plant cells, and algae where photosynthesis is carried out. It takes in the carbon dioxide, water and light energy using them to make glucose (C₆H₁₂O₆), which is the plant's food. This provides matter (carbon atoms, hydrogen atoms and oxygen atoms) for the plant. The light energy was transformed into chemical energy and is stored in the chemical bonds that hold the atoms together in the glucose molecule. So, the glucose product of photosynthesis provides both the matter and energy for the plant. The glucose made in photosynthesis provides the chemical energy for all living things to grow and develop.

The sun provides what form of energy for photosynthesis:

Light (Solar) energy

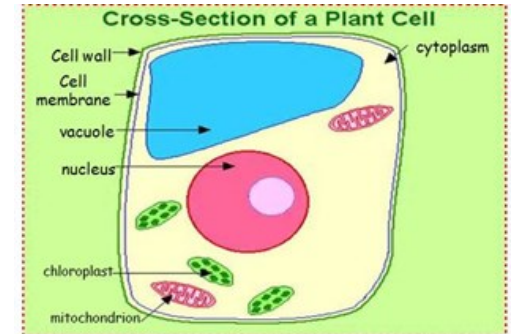
During photosynthesis what type of energy is the sun's energy converted to?

Chemical

The food the plant makes for itself during photosynthesis is **Glucose**.

Draw a diagram of a plant cell. Include and label the following organelles:

cell membrane, cell wall, nucleus, large vacuole, mitochondria and chloroplasts.



Which organelle carries out photosynthesis? **chloroplast**
Circle this organelle in your diagram.

Why do plants need to carry out photosynthesis?
to gain food (matter) and matter for the plant

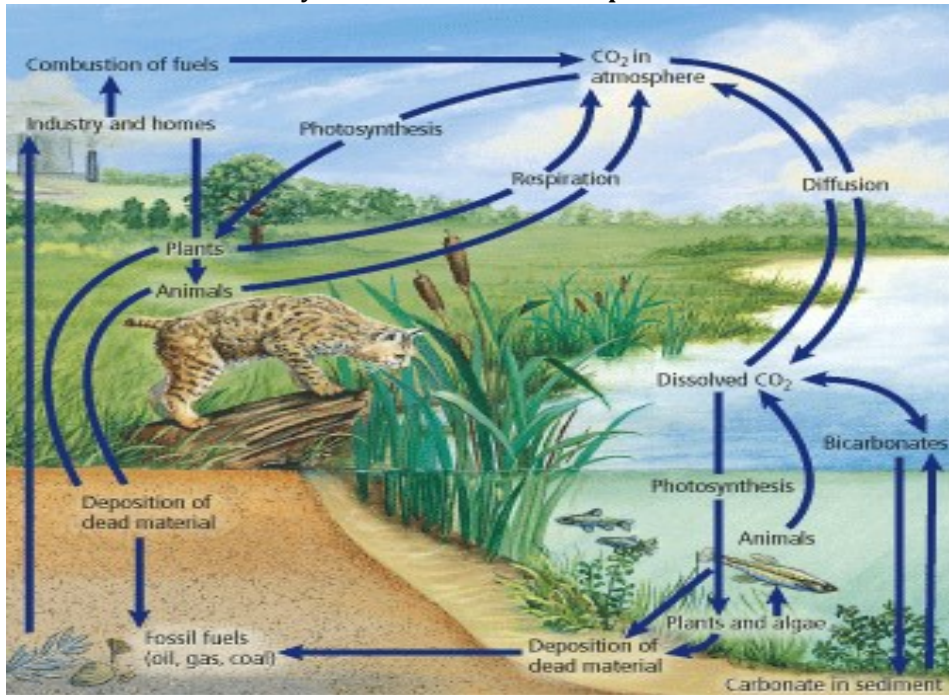
What can plants do with the glucose they make?

1. **Use it for an energy source**
2. **Use it to make other biomolecules (lipids, proteins, nucleic acids)**

Why do animals need the glucose plants make? _____
The glucose provides the chemical energy and matter the animal needs to grow and develop.

Why do animals need the oxygen plants make? _____
To be able to carry out cellular respiration

Photosynthesis and Cellular Respiration



Through photosynthesis, carbon dioxide in the air becomes large carbon-containing molecules in the tissues and organs of plants. These molecules can be cycled into animals that eat (consume) the plants, then returned as carbon dioxide to the atmosphere through cellular respiration, combustion, and decomposition. These processes help carbon cycle through ecosystems. Use the diagram to help you explain how they do this.

Explain how carbon could cycle from the atmosphere into two different living things and back into the atmosphere again. Use the diagram to help you describe a specific pathway the carbon takes.

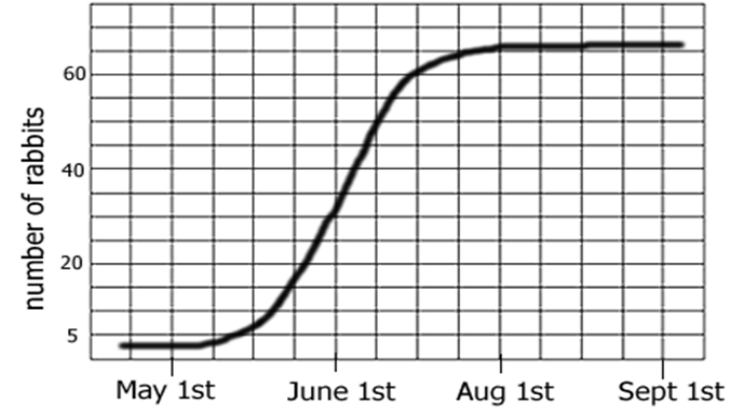
Use at least three of the following processes in your explanation. Circle them as they are used.

Diffusion, decomposition, photosynthesis, cellular respiration, combustion

CO₂ from the atmosphere is diffused into the plants when they do photosynthesis. When animals eat plants they get glucose and with the oxygen they breath, animls can out cellular respiration. When ex-haling, animals release CO₂ into the atmosphere.

Review Ecology Part II: Interpreting Ecological Graphs & Data

Graph 1: Rabbit Population Growth Over Time



C The Rabbit Population graph shows a _____ growth curve.

- A. Exponential
- B. Linear
- C. Logistic**

D The carrying capacity for rabbits is?

- A. 5
- B. 30
- C. 40
- D. 65**

B During which month were the rabbits in exponential growth?

- A. May to June
- B. May to August**
- C. August to September
- D. May to September

D What allows a population to increase at an exponential rate?

- A. Limited resources for food
- B. Limited resources for shelter
- C. An increased number of predators
- D. Little or no competition for food and shelter**

D What environmental characteristics result in logistic grow of a population.

- A. Competition for resources
- B. Increased number of predators
- C. Drought limiting water resources
- D. All of these would lead to logistic growth**

Niche

All organisms in an ecosystem have their own niche. A niche refers to the role of a species in its ecosystem. It includes where they live, their place in the food chain (e.g. top predator), what they eat (carnivore), how they get their food (predator), what eats them (decomposers). No two species can occupy the same niche. Each species having its own niche gives the species a greater chance of survival. This also allows for multiple species to share the same habitat.

Carrying capacity is the maximum population of organisms that an ecosystem can maintain. The carrying capacity for a species is determined by the availability of resources in the ecosystem. These resources are called limiting factors are unique for each niche in an ecosystem (climate, habitat area, food resources, etc.) .

___ Circle the words in the list that describes the niche of an organism

- role as a producer
- need for sunlight.
- use of soil nutrients.
- grows in the shade
- genetic makeup.

___ The niche of a plant includes all of the following except its

- A. role as a producer.
- B. need for sunlight.
- C. use of soil nutrients.
- D. genetic makeup.

___ Aspects of a species' habitat include

- A. the average rainfall it receives.
- B. the amount of sunlight it gets.
- C. the range of temperatures it experiences.
- D. all of above.

___ If two species occupied the same niche in the same area, they would

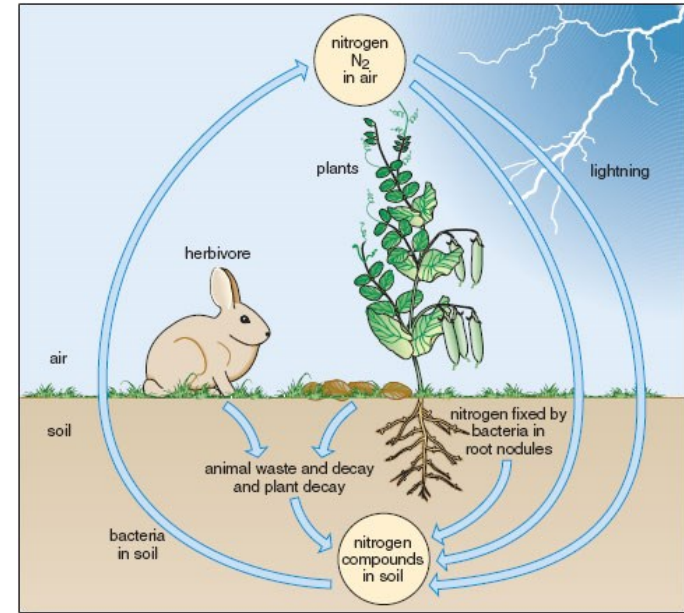
- A. outcompete species in other niches.
- B. move to a different habitat.
- C. be in competition with each other.
- D. both go extinct.

___ The maximum number of organisms that can be sustained in a particular niche of an ecosystem is determined by

- A. available resources
- B. individual needs
- C. total population
- D. human input

Nitrogen Cycle

Almost all of the nitrogen on Earth is found as a gas in the atmosphere (N_2). Bacteria in soil are the only organisms that can take in the Nitrogen from the air and keep it to make its proteins and nucleic acids. The bacteria produce a waste product that contains nitrogen that once in the soil makes nitrogen available to plants. Plants can also get nitrogen through decomposed animal waste. When plants and animals decompose the nitrogen containing molecules in their cells becomes available to other organisms. Bacteria in the soil can also release nitrogen back into the atmosphere.



What major role do decomposers play in the nitrogen cycle?

- A. Break down nitrogen containing molecules and return the nitrogen back into the environment (soil) for plants to get
- B. They convert nitrogen into a fuel source for cells.
- C. Convert nitrogen gas into a protein

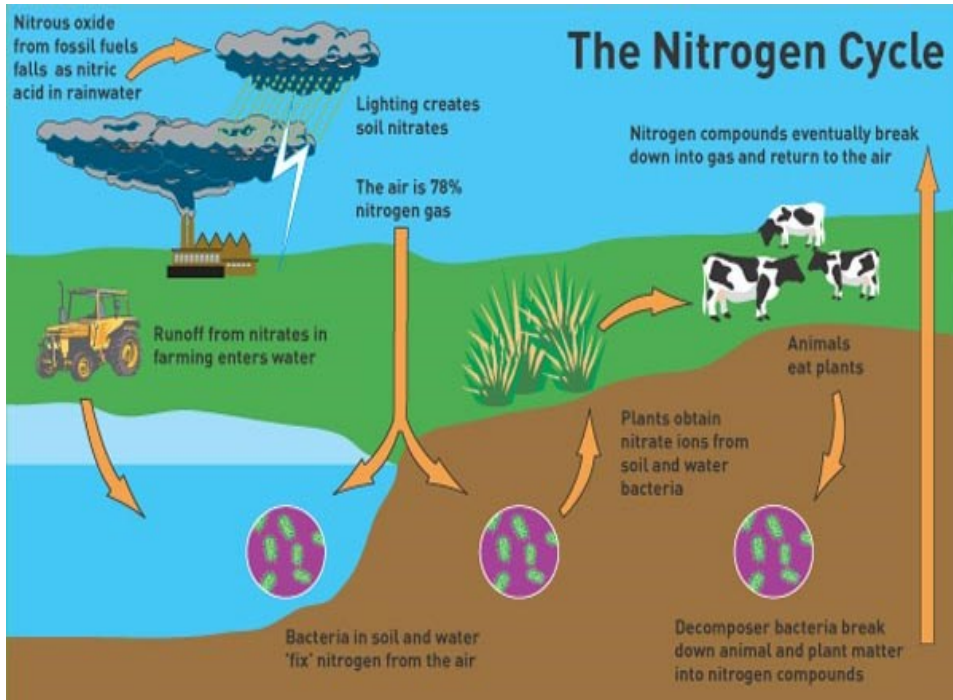
What organisms can take in atmospheric nitrogen gas and put it into molecules that can be used by plants?

Bacteria (nitrogen fixing bacteria)

How do plants get nitrogen? from the soil

How do animals get nitrogen? from eating plants or eating animals that ate plants.

What is another way nitrogen gets into the soil other than by nitrogen-fixing bacteria? Animal waste, decomposing organisms after they die and lightning.



Nitrogen, Farms, Fish, Bears, and Salmon

Farmer A has a large farm on which he grows corn. A small creek flows through his farm and empties into a lake. This farmer sprays fertilizer containing phosphorous and nitrogen on his crops several times a year. Due to climate where he lives, it often rains within several days of the application of the fertilizer. The lake near him has been a major recreation area with clear water and good fishing. Recently, clear water has become brownish green with mats of algae floating on the surface by late summer, resulting in fish kills. Recreation at the lake is coming to a halt because of the murky water and the dead fish.

Farmer B has a similar large farm in which he grows corn one year and soybeans the next. Through his farm also flows a small creek, which empties into a similar lake. This farmer does not spray any nitrogen fertilizer on his crops. He knows that soybeans have bacteria on their roots which take the atmospheric nitrogen and convert it into a form of nitrogen that the plants can use so he rotates his crops each year. He uses his soybeans as a compost on the field instead of fertilizer. The rainfall is similar to Farmer A's area. The lake near him has remained a major recreation area with clear water and healthy fish for good fishing. There is no algal mats floating along the waters surface and there are no fish kills.

Habitat

A species' habitat is the physical environment in which it can survive. A habitat is generally described in terms of abiotic factors, such as the average amount of sunlight received each day, the range of annual temperatures, and average yearly rainfall. These and other factors in a habitat determine many of the traits that allow an organisms to survive there or limit its existence there.

Consider a habitat with very low temperatures. Mammals that live in the habitat must have insulation to help them stay warm. Otherwise, their body temperature will drop to a level that is too low for survival. Species that live in these habitats have fur, blubber, and other traits that provide insulation in order for them to survive in the cold. These are called adaptations.

Human destruction of habitats is the major factor causing the decrease in number of many species to the point they are endangered of going extinct (no more exist in this environment). This leads to a decrease in biodiversity. Small habitats can support only small populations of organisms.

WORD LIST

Ecology	biotic factors	habitat
Biosphere	abiotic factors	niche
Ecosystem	organism	Sun
Community	Population	

Complete the matching using the word list .

- biotic factors Living organisms in the environment are called what?
- sun What is the ORIGINAL source of energy in an ecosystem?
- habitat Physical environment an organism lives in
- Community Populations of different species that live in the same area and interact with one another
- ecology Scientific study of the interactions of living things with each other and their environments
- niche Role of a species in its ecosystem
- biosphere Areas of Earth where all organisms live
- organism Life form consisting of one or more cells
- ecosystem made up of all the living and non-living things in an area
- abiotic factors Nonliving physical aspects of the environment
- population Organisms of the same species that live in the same area

Review Ecology Part I: The Science of Ecology

Ecosystem

An ecosystem is made up of all the living thing (plants, animals, bacteria, fungi, protists) in an area as well as all the nonliving physical factors (sun, weather, water, rocks, minerals) of the environment. Ecosystems can be really large (an ocean) or small fresh water lake or forest or even a small piece of dead wood. They all contain a community of different species that interact with one another and with the abiotic (nonliving) components of their environment.

Ecosystems are considered open systems because they depend on continuous inputs of energy from outside the system and organisms can move into and out of the system. Most ecosystems obtain energy from sunlight. This energy from the sun gets used up as it flows through an ecosystem. However, matter is recycled in ecosystems and its atoms, such as carbon and nitrogen, get rearranged and used over and over again as organisms die and are broken down (decomposed) to smaller molecules again and released back into the environment.

1. What are the biotic components of an ecosystem? living things
Give two examples: plants , animals

2. . What are abiotic factors in an ecosystem? _____
Non-living things _____

Give three examples: water, minerals, carbon dioxide in air, sunlight

3. What is the energy source for all ecosystems? sunlight (solar energy)

4. Give an example of how energy flows but matter cycles in an ecosystem.
As food is eaten, the energy in the food is used to help the organisms body function and is released as heat energy that can't be gotten back to use again, so is "used up". Flows from energy present for use, to no more energy left for use. The atoms in molecules last forever and get broken down rearranged and used over and over so they cycle through the ecosystem from one organism to another or back out to the environment

5. Which of the following describe a species' habitat.
A. the average rainfall it receives.
B. the amount of sunlight it gets.
C. the range of temperatures it experiences.
D. all of above.

Answer the following questions based on the nitrogen story.

CIRCLE YOUR ANSWER (for #1-4).

1. What is the most probable cause of the algae growing in the lake near farmer A's farm?
A. Corn
B. All the rain
C. Warm weather
D. Fertilizer runoff
2. Why does Farmer A use a nitrogen fertilizer?
A. It helps plants other than corn grow in the field
B. It's a limiting factor for plant growth
C. It kills all the bugs that infect corn
D. It produces a smaller crop
3. Why would increased fertilizer runoff cause excess algae growth?
A. Fertilizer runoff stirs up the nutrients on the lake bottom
B. Fertilizer runoff is a limiting factor for algae growth
C. Fertilizer runoff provides excess nutrients for algae
4. What would cause the fish to die?
A. They eat the algae, which kills them.
B. Lower levels of oxygen due to the algae bloom
C. Nitrogen is extremely toxic to fish (kills them instantly)

5. What did farmer B do to have a healthy crop from year to year without causing an algae bloom in the lake?

He grows corn one year and soy beans the next year to replace the nitrogen in the soil without using fertilizer.

6. As human populations increase, more food is needed. To meet the increasing demand crops are grown using fertilizer to increase their yield. Crops are always planted in the spring and watered on a regular basis and spring provides much rain. What happens to the excess fertilizer?







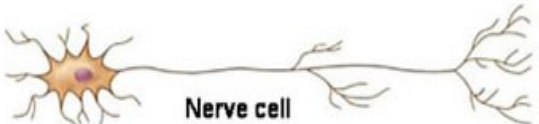
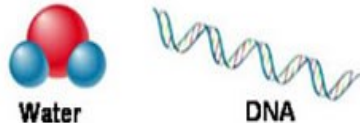
The rain causes the fertilizer to "run off" the soil and into the streams, rivers and ponds.

7. What would you predict would happen if water from Farmer A's Lake flowed out to coastal marine fisheries at the oceans edge? **It could cause a really bad algal bloom depleting the oxygen in the water and causing fish to die.**

8. How might this affect area fishermen?

They would have less fish to catch to sell at market and lose money.

9. Farmers raise cattle, hogs and chickens in large numbers. Their waste contains large amounts of nitrogen. What takes place when that waste enters a water system such as a creek, lake or river?

Biosphere	The part of Earth that contains all ecosystems	 Biosphere
Ecosystem	Community and its nonliving surroundings	 Hawk, snake, bison, prairie dog, grass, stream, rocks, air
Community	Populations that live together in a defined area	 Hawk, snake, bison, prairie dog, grass
Population	Group of organisms of one type that live in the same area	 Bison herd
Organism	Individual living thing	 Bison
Groups of Cells	Tissues, organs, and organ systems	 Nervous tissue Brain Nervous system
Cells	Smallest functional unit of life	 Nerve cell
Molecules	Groups of atoms; smallest unit of most chemical compounds	 Water DNA

LS2E: Interrelationships of organisms may generate ecosystems that are stable for hundreds or thousands of years.

The **six major types of biome/ecosystem** are outlined in the table below

Biome	Temperature	Rainfall	Vegetation
Desert	Hot (>30°C) in day Cold (<0°C) at night	Low precipitation Less than 30 cm per year	Xerophytes (e.g. succulent bushes) Adapted to water conservation
Grassland	Warm (20 – 30°C)	Seasonal droughts common Medium amounts of moisture	Grasslands with widely spaced trees Fires prevent trees from invading
Shrub land	Moderate (15 – 25°C)	Rainy winters, dry summers	Dry, woody shrubs Regrow quickly (fire a constant threat)
Coniferous Forest (Taiga)	Cold (0 – 15°C)	Small amount of precipitation Wet due to lack of evaporation	Coniferous trees densely packed Little variation in species
Tropical Rainforest	Hot (25 – 30°C)	Very high precipitation More than 250 cm per year	Epiphytes, tall trees and undergrowth Large diversity in species
Tundra	Freezing (<0°C)	Little precipitation	Small, close to the ground (e.g. moss) Perennial plants grow in summer

Why does a rain forest have different biodiversity than a grassland? Be specific. The tropical rain forest receives 220cm more rain (precipitation and a higher temperature that does not vary much (25-30 degrees) than grasslands . Grassland temp. varies 20-30 degrees.

Why does a desert have a different biodiversity than a grassland? Be specific. The desert has extreme temperature changes (less than 0 at night and above 30 degrees during the day and very little rainfall—less than 30cm a year. Grassland temperatures are not extreme (20-30 degrees and they get much more rainfall—medium amounts and only seasonal droughts.

How do nutrient cycles support stability of the rainforest? As plants and animals decompose their atoms/molecules go back into the ground or into other organisms that eat them, so they are continually cycling.

How do food relationships support stability of the grasslands? The grasses provide food for the herbivores (plant eaters) and the herbivores provide food for the carnivores (meat eaters). The carnivores provide food for the omnivores (eat meat and plants).

How does biodiversity contribute to the stability of an ecosystem? The more biodiversity the more different food resources there are for more different organisms so if one type of organism died out and was no longer there the organisms would still have other things to eat.