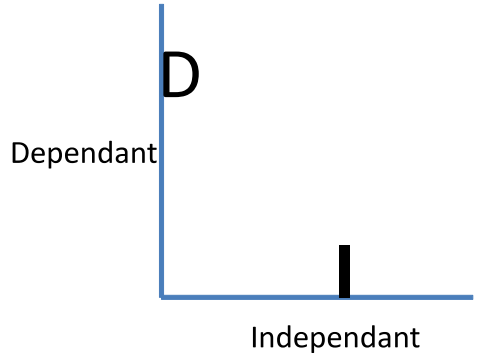
BIOLOGY EOC STUDY GUIDE

This is not a replacement for your notes!
There are details we went over in class that are not mentioned here.

Dependent variable = what is measured
Independent variable = what is controlled

For a meaningful experiment, only have one Independent variable at a time.
Otherwise you can't tell what is causing a change to the Dependant variable
Example: if we change both the type of food and the amount of food of someone dieting, can we really say their weight loss is caused only by them eating less? Or is because they are eating apples instead of fries? Or both?

Which goes on which axis?



1. **Recognize cells both increase in number and differentiate, becoming specialized in structure and function, during and after embryonic development.**
   A fertilized egg will replicate (using mitosis) making more undifferentiated cells (cells that haven't yet decided what type of cell they need to become). These are called *stem cells*. Remember that *all* cells contain the DNA instructions to become *any* type of cell. After a time, in response to certain genes "turning on" they will activate certain parts of their DNA and differentiate (turn into) into liver cells, skin cells, brain cells etc
   Links: mitosis, DNA structure, diploid

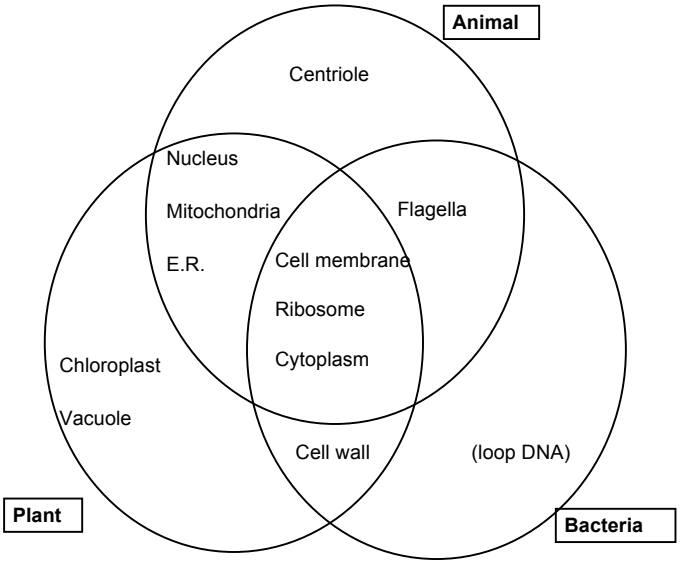
2. **Describe the nature of cell parts (e.g. cell wall, cell membrane, cytoplasm, nucleus, chloroplast, mitochondrion, ribosome, vacuole) found in different cells (e.g. bacteria, plant, skin, nerve, blood, muscle) and the functions they perform (e.g. structural support, transport of materials, storage of genetic information, photosynthesis and respiration, synthesis of new molecules, waste disposal) that are necessary to the survival of the cell and organism.**

   Know the terms: prokaryote, eukaryote

   Prokaryotes: No nucleus, no membrane bound organelles. Example: *Bacteria.*
   Too small to need specialized compartments for different functions.
   Note: Bacteria are the same size as mitochondria and chloroplasts.
   Prokaryotes still have DNA (in a loop) and ribosomes.

   Eukaryotes: Nucleus, lots of membrane bound organelles. Examples: *Plants, Animals.*
   They are big enough that they need specialized compartments for making proteins, storing DNA, releasing energy, etc.

Name	Function	Found in
Cell wall	Protection, structure	Plants, bacteria
Cell membrane	Controls stuff going in/out	All
Cytoplasm	Fluid inside cell	All
Nucleus	Stores DNA, controls cell	Plants, animals
Chloroplast	Photosynthesis, makes glucose	Plants
Mitochondrion/mitochondria	Cellular respiration, releases energy from glucose	Plants, animals
Endoplasmic Reticulum (E.R.)	Makes lipids (Smooth ER), holds ribosomes (Rough ER)	Plants, animals
Ribosome	Makes proteins	All
Golgi body	Transports proteins	Plants, animals
Vacuole	Stores water	plants
Centriole	Mitosis, meiosis (replication)	animals



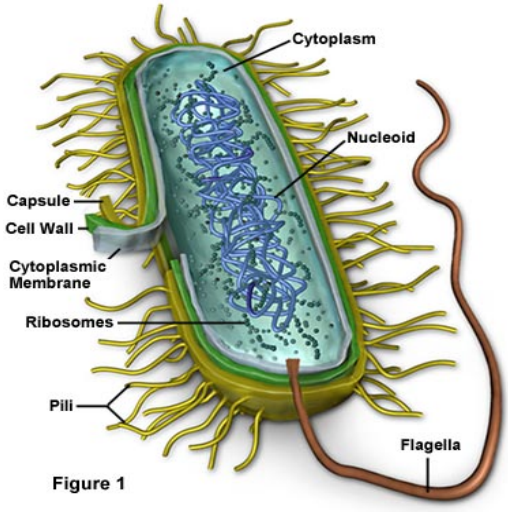
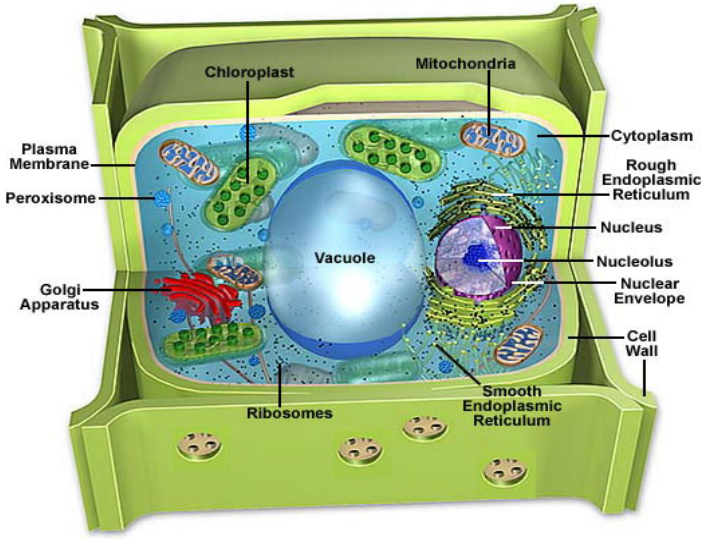
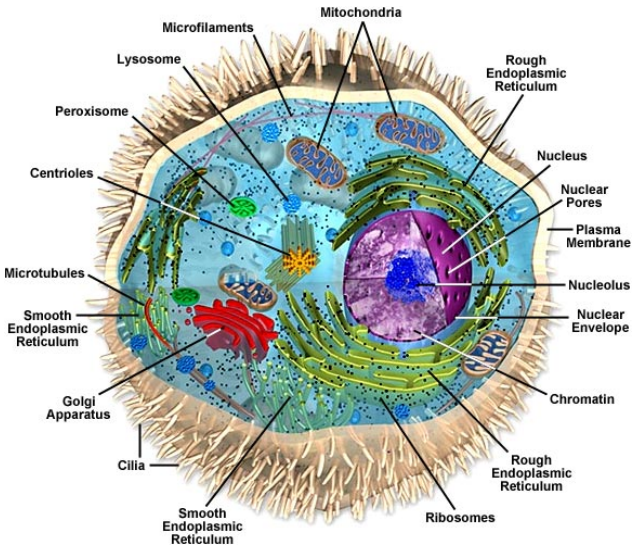


Figure 1





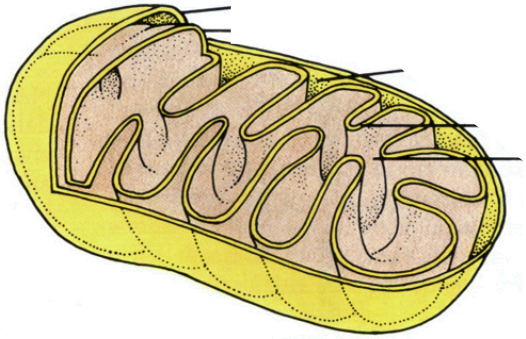
3. Compare and contrast the structure and function of mitochondria and chloroplasts

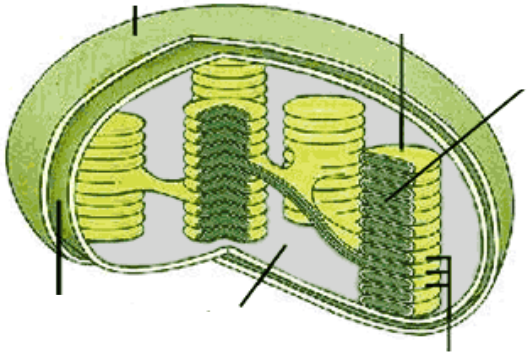
	MITOCHONDRIA	CHLOROPLAST
Function	Breaks down glucose to release energy	Uses photosynthesis to make glucose to store energy
Found in	Animals AND plants	Plants

Both have double membranes. This suggests that they both used to be bacteria that were absorbed by another organism billions of years ago. This is called *endosymbiosis*.

They both have folded inner membranes- this increases the surface area that increases the efficiency of their chemical reactions.

NOTE: plants still need mitochondria to release the energy from the glucose that they make with chloroplasts. They can only use the sun's energy for photosynthesis to make glucose, not for other uses. For all other uses, they need glucose.



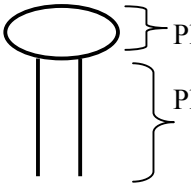


Links: energy transfer in food webs, consumers and producers

4. Compare and contrast the structure and function of cell wall and cell membrane

	CELL MEMBRANE	CELL WALL
Function	Controls/regulates what gets in and out of the cell	Structure and protection
Found in	Animals, Plants, Bacteria	Plants and Bacteria NOT Animals

Cell membrane is made of Phospholipids (a type of fat)



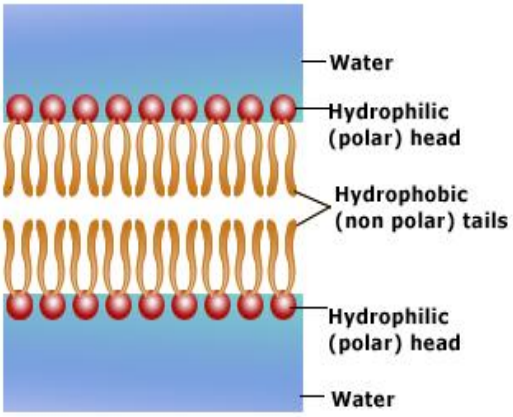
Phospholipid head: hydrophilic (attracts to water)

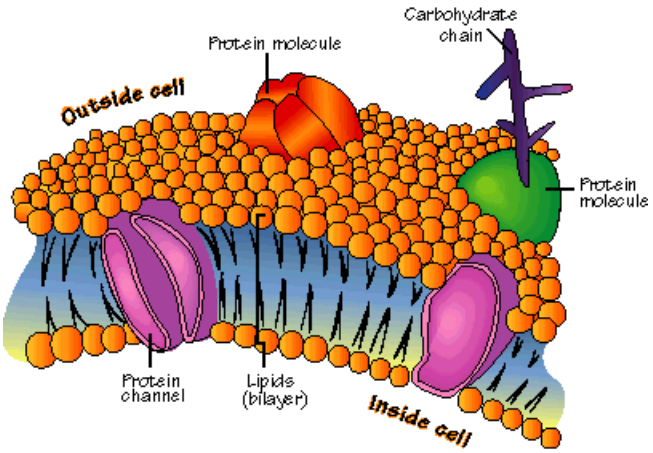
Phospholipid tail: hydrophobic (repels water)

Note: you don't actually need to know the cell wall structure; just that it DOES provide structure to a cell.

Animals use cytoskeleton to provide structure as they have no cell wall.

The cell membrane is made of millions of phospholipids arranged in a double layer surrounding the cell (Phospholipid Bilayer)





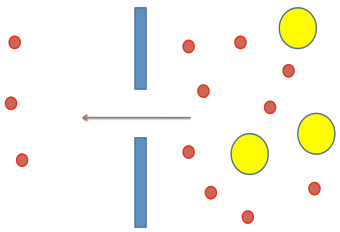
5. **Explain the significance of the selectively permeable membrane to the transport of molecules.**

Because of the phospholipids in the membrane, not everything can get through it, which is sort of the point. There are gaps where small things can get through, but anything charged/polar or large cannot.

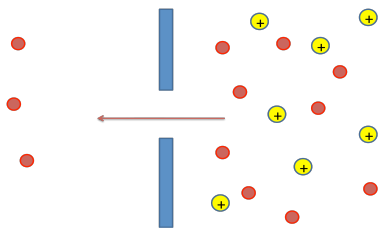
Water	Small enough to get through
Small uncharged/non-polar particles	Gets through
Small charged/polar particles	Cannot get through; charge repels
Large particles	Too big to fit through gaps between phospholipids (charged or not)

If a large or charged particle needs to get through it needs to use a membrane transport protein channel

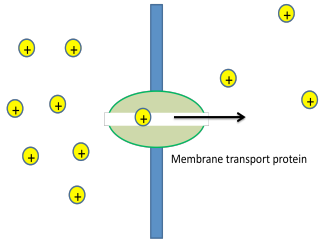
The yellow particles are too big



Charged/polar molecules cannot go through the cell membrane

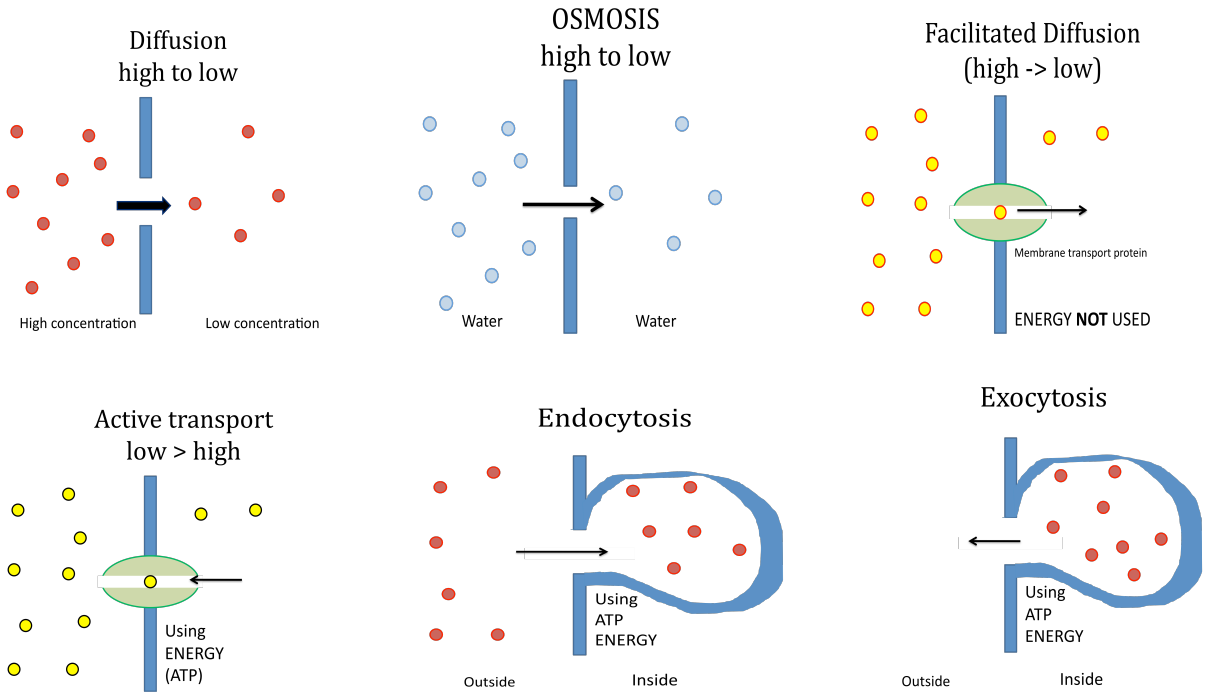


Going through transport protein



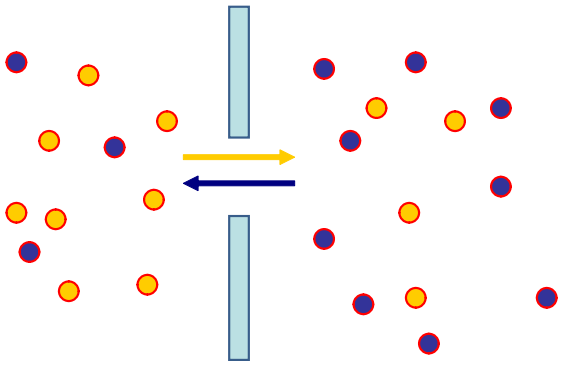
6. **Predict the movement of molecules across a selectively permeable (i.e. diffusion, osmosis, active transport) needed for a cell to maintain homeostasis given concentration gradients and different sizes of molecules.**

PASSIVE TRANSPORT Does NOT use energy	**ACTIVE TRANSPORT** Uses energy
Diffusion- high to low through membrane	Active transport- low to high with transport protein
Osmosis- high to low through membrane (water only)	Endocytosis- membrane folds in on itself to bring stuff inside cell as a vesicle
Facilitated diffusion- high to low through a transport protein	Exocytosis- vesicle containing stuff merges with membrane put stuff outside cell



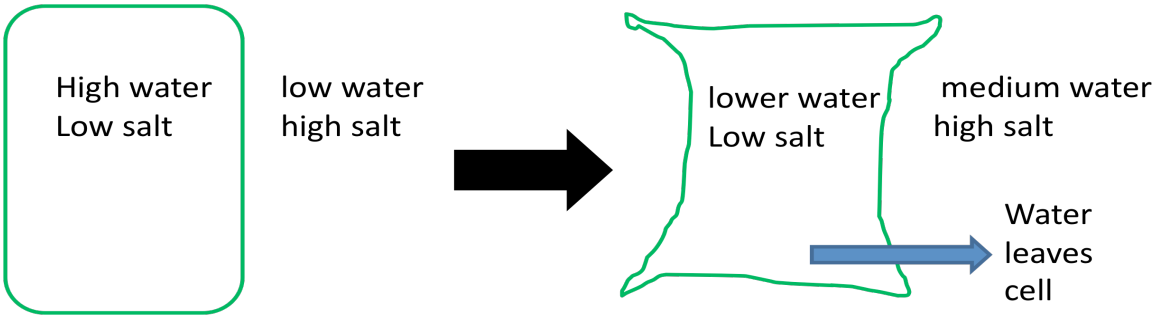
Particles will naturally go from a high concentration of that particle to a lower concentration (i.e. downhill) without using energy. If a cell wants particles to go from low to high (i.e. uphill) it needs to use energy.

Diffusion is independent:
movement of one type of particle does not affect movement
of a different type of particle



Where it gets interesting is with a membrane that restricts certain things getting through (as it does).

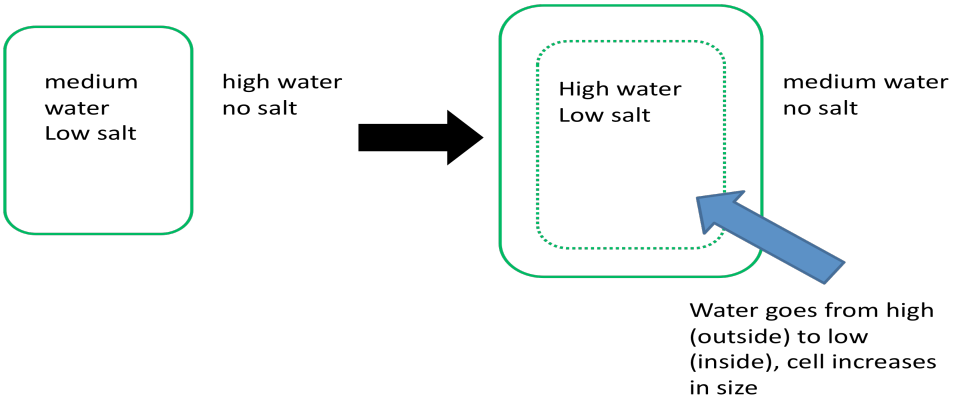
Example: a plant cell in salt water. Water can move through the membrane, the salt cannot.



Because there is more water in the cell than outside, the water moves from high to low, and leaves the cell. The cell shrivels up. The salt doesn't move because it cannot get into the cell even though the concentrations are different.

If we put a cell in pure water, the cell will gain water and expand.

Plant cells have a cell wall and can survive this, animals cells don't have cell walls and could burst like an overfull water balloon



Extra vocabulary:

Hyp**er**tonic:	the concentration of dissolved stuff more than cell	
(high)	the concentration of water less than cell	e.g. salt water
Isotonic:	the concentration of dissolved stuff same as cell	
	the concentration of water same as cell	e.g. Gatorade, blood
Hyp**o**tonic:	the concentration of dissolved stuff less than cell	
(low)	the concentration of water more than cell	e.g. pure water

In the above example with plant cell in salt water, the salt water is Hypertonic

7. **Explain how water is important to cells (buffer for body temperature, provides soluble environment for chemical reactions, provides hydration and maintains cell turgidity, maintains protein shape)**

Water has a high specific heat capacity, which means it has to gain a lot of energy in order to make it warmer, and it has to lose a lot of energy to cool it down. This has the effect of protecting cells (and all organisms, who are made of cells) from big temperature changes. If an organism ends up in a cold environment, it takes a long time to cool down. Likewise, in a hot environment it takes a long time to warm up. This also means that when you sweat and the sweat evaporates, it takes away a lot of heat so cooling you down

Water is good at dissolving things (a good solvent). This is why the cytoplasm is mostly made of water, as it can contain dissolved chemicals for the cell. Water also takes part in some chemical reactions, most notably photosynthesis and cellular respiration) H_2O !

Because the cell's cytoplasm is mostly made of water, it helps give the cell shape- like the water in a water balloon. This pressure of water is called "turgidity", the property of being "turgid". This is why plants that don't get enough water wilt as they don't have enough water in their cells to keep their structure solid.

8. **Explain physical and chemical interactions that occur between organelles (e.g. nucleus, cell membrane, chloroplast, mitochondria, ribosome) as they carry out life processes**

DNA in nucleus > ribosomes in ER make protein	> golgi bodies transport proteins to other organelles, or to membrane
Cell membrane takes in food particles	> lyzosomes break down particles
Endoplasmic reticulum makes lipids	> cell membrane is made of lipids
Chloroplast (plants) uses sun energy to make glucose	> mitochondria breaks down glucose to release energy
Cell membrane takes in glucose (animals, bacteria)	>mitochondria breaks down glucose to release energy

9. **Explain the relationship between the processes of photosynthesis and cellular respiration (i.e. recycling of carbon dioxide and oxygen), comparing and contrasting reactions**

Photosynthesis takes place in the chloroplasts in producers (like plants). Energy is absorbed by the pigment chlorophyll, and the energy is used to make the energy rich glucose.

Photosynthesis: **carbon dioxide + water ⟹ glucose + oxygen**

$$\mathbf{CO_2 + H_2O \Longrightarrow C_6H_{12}O_6 + O_2}$$

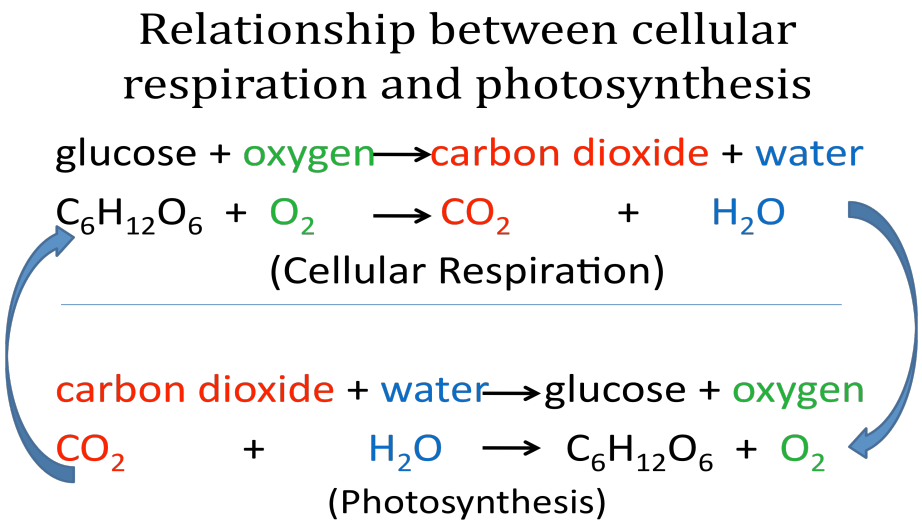
Cellular Respiration: **glucose + oxygen ⟹ carbon dioxide + water**

$$\mathbf{C_6H_{12}O_6 + O_2 \Longrightarrow CO_2 + H_2O}$$

Note that plants do BOTH photosynthesis and respiration: they still need to break down the glucose they make. Animals ONLY do respiration

Carbon dioxide taken in by plants (for photosynthesis) is given out by organisms (doing respiration).

Oxygen taken in by organisms (doing respiration) is given out by plants (doing photosynthesis).



10. **Determine what factors affect the processes of photosynthesis and cellular respiration (i.e. light intensity, availability of reactants, temperature)**

The more light there is, the more the plant can do photosynthesis

The more reactants (ingredients) there are, the more the reaction can happen.

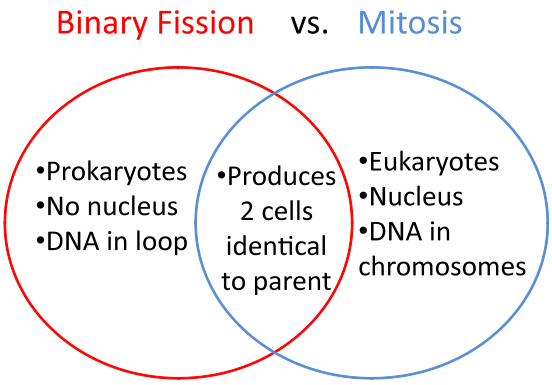
More CO_2 or H_2O, more photosynthesis
Less CO_2 or H_2O, less photosynthesis

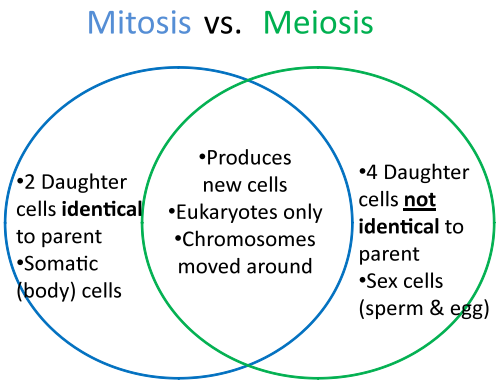
More O_2 or glucose, more respiration
Less O_2 or glucose, less respiration

The chemical reactions work best at specific temperatures- this is why mammals heat their body to 98.6F. In general, the higher the temperature is, the faster the reactions are. If cooler, then slower.

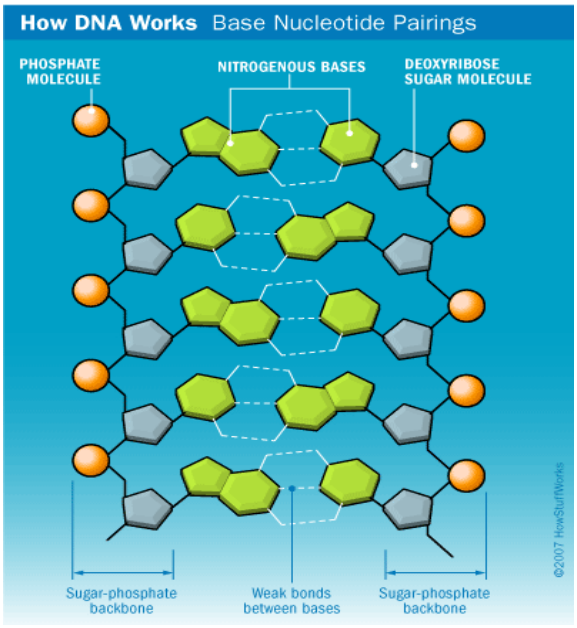
11. **Distinguish between asexual (i.e. binary fission, budding, cloning) and sexual reproduction**

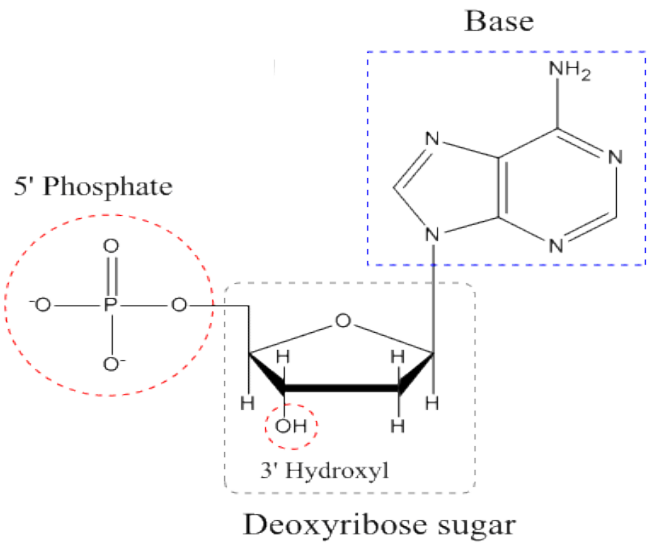
Asexual	Sexual
Offspring identical to parent and each other	Offspring non-identical to parent or each other
Fast	Slower
Bacteria, animal/plant somatic (body) cells	Sex cells only: Fuses sperm + egg cells together
Binary fission, mitosis	meiosis
Eukaryotes: growth of organism, healing	Eukaryotes: make new organism





12. Describe the chemical an structural properties of DNA (e.g. DNA is large polymer formed from linked subunits of 4 kinds of nitrogen bases; genetic information is encoded in genes based on the sequence of subunits; each DNA molecule in a cell forms a single chromosome)

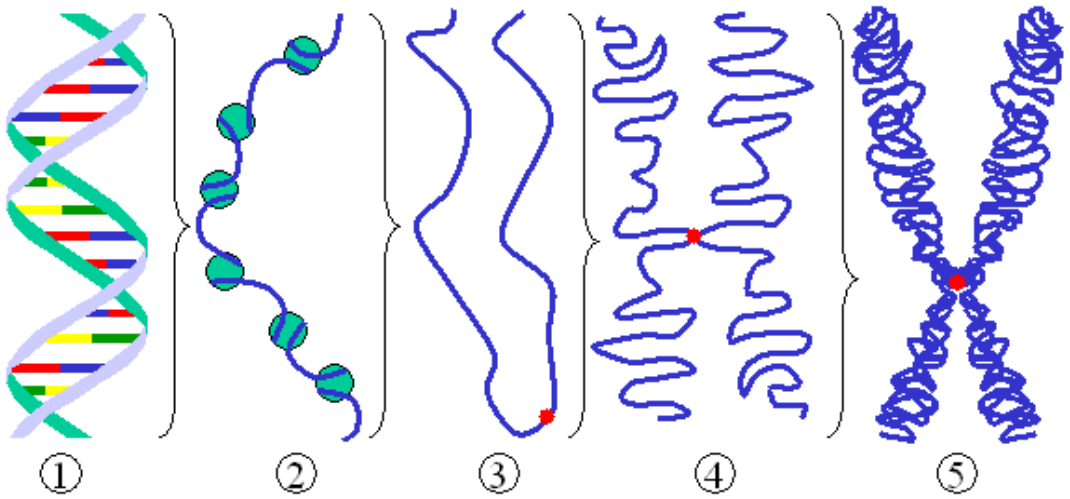




The four bases are Adenine, Thymine, Cytosine and Guanine.
They link the 2 strands of DNA: A=T
C=G

If you have the sequence for one strand of DNA, you can calculate the other
ATCGCTATGCA ⟹ ATCGCTATGCA
TAGCGATACGT

The specific sequence of the bases codes for the traits/characteristics of an organism.
A specific sequence will code for ONE trait, this is known as a GENE. A DNA strand consists of lots of gene sequences in a row, each one coding for a specific trait.
A single strand of DNA may contain thousands of genes- and is very tightly packaged. This is packaged DNA is called a CHROMOSOME.



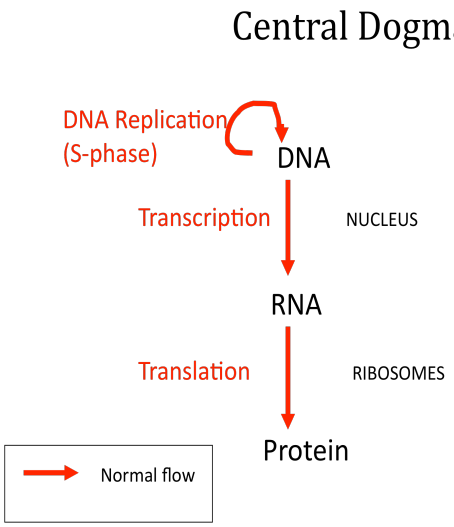
Humans have 23 pairs of chromosomes, you inherit one set of chromosomes from each parent (23 from mom, 23 from dad) making a total of 46 individual chromosomes, or 23 pairs. Don't get these numbers mixed up!

There is another nucleic acid, called RNA. This is used to carry gene information from the nucleus to the ribosome.

DNA	RNA
Double (2) stranded	Single (1) stranded
Bases: ATCG	Bases: AUCG
Nucleus only	Made in nucleus, moves to ER/ribosomes
Sugar: deoxyribose	Sugar: ribose

13. Recognize that DNA codes for proteins, which are expressed as the heritable characteristics of an organism

An organism might have the genes for blonde hair, or brown eyes, or having tentacles. What actually makes the characteristic/trait *happen* are specific proteins.
Each gene codes for a specific protein. The DNA codes instructions on how to make the protein. Remember that DNA is just the library of instructions, and doesn't make the protein itself. Instead, a copy of the specific gene DNA is made (mRNA) and sent from the nucleus to the ribosome (in the E.R.), which does the work of making the protein.
So: the DNA stays in the nucleus, mRNA carries the information from the nucleus to the ribosome, and the ribosome makes the protein.



DNA replication: when the cell copies ALL of its DNA, e.g. during cell replication

Transcription: copying one genes information from DNA onto mRNA

Translation: the ribosome decoding the mRNA information and using it to make proteins

The ribosome itself reads 3 RNA letters at a time (triplet codon). Each triplet codes for a specific amino acid, which are the building blocks of proteins. This means that proteins are built out of specific amino acids in a specific order, which makes them have a specific shape. The shape allows it to have a specific function. Example: a key has a specific shape which allows it to have a specific function, opening a specific lock.

14. **Recognize that degree of relatedness can be determined by comparing DNA sequences**

We know that all humans have DNA in common- after all, we all have 2 arms, 2 legs, lungs, blood, mitochondria etc. But we don't look exactly the same, so there must be some slight differences in our DNA. It also follows that you have more DNA in common with your parents than with a random human; after all you inherited your DNA from your parents. However, you have less DNA in common with your cousins, because even though you share some of the same grandparents, you don't share all of them. So, the more DNA in common you have with someone, the more related you are to them. This is how DNA paternity testing works.

We can use this to show how related 2 species are- for example a human and a chimpanzee share 98.5% of their DNA, as they had a common ancestor only 6 million years ago. However, to find a common ancestor between humans and mice you have to go back a lot further (75-80 million years ago) as we only have 85% of DNA in common. We are of course both mammals so there is still a lot in common (warm blooded, 4 limbs, lungs, heart, hair/fur etc). Between humans and bananas there is still 50% of DNA in common, mostly because of all the proteins that are involved with running a eukaryotic cell are pretty much the same in all eukaryotes regardless of how cells are put together to make an organism.

15. **Explain how an error in the DNA molecule (mutation) can be transferred during replication**

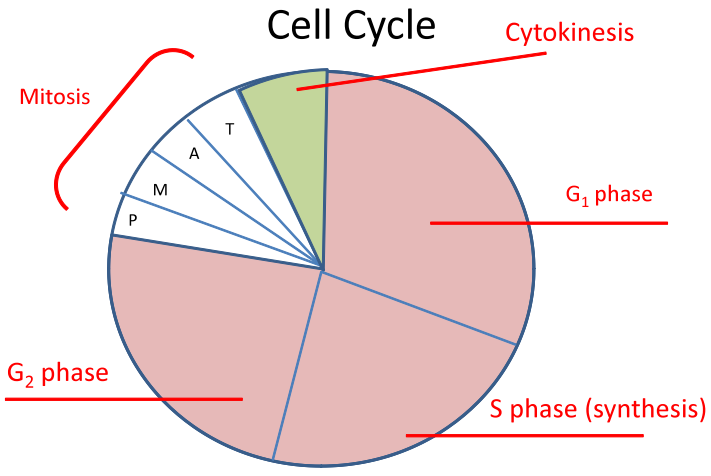
When a cell copies its DNA, it might make a mistake and add, delete or change letters. As DNA codes for specific genes, this means that the gene could be altered- which might have no effect, a really bad effect (even deadly if it was an essential gene) or very rarely a good effect *(note- this is how variation can increase in a population)* .
This change in the DNA is called a MUTATION.
This can cause cancer.

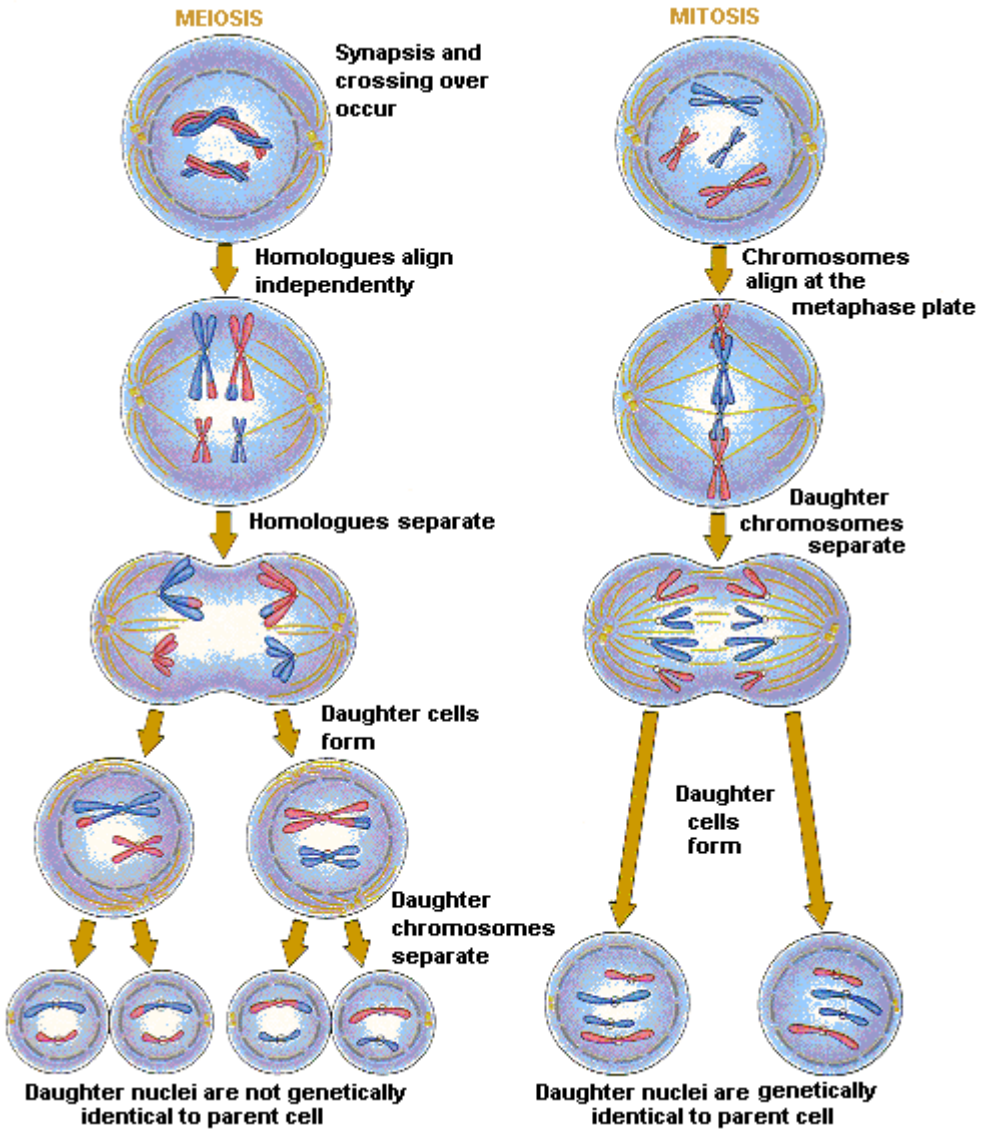
16. **Identify possible external causes (heat, radiation and certain chemicals) and effects of DNA mutations (altered proteins which may affect chemical reactions and structural development).**
As we said above, the function of a protein is determined by its shape. The shape of a protein is determined by the sequence of DNA. If the DNA mutates, the shape of the protein it codes for can be changed, and so can its function. This will generally cause problems with whatever the protein was supposed to be doing- just like bending a key or changing its shape will cause problems in trying to fit it in a lock.
Radiation- both nuclear, X-rays and Ultraviolet rays can damage the DNA.
Chemicals can also damage the DNA- these are called mutagens.
Certain chemicals can cause specific DNA damage that turns the cell cancerous. These are known as carcinogens. A really good example is tobacco smoke

Just remember- in real life radiation and mutagens don't cause superpowers- they cause cancer, sickness and death.

17. **Recognize the chromosomes of daughter cells, formed through the processes of asexual reproduction and mitosis, the formation of somatic (body) cells in multicellular organisms, are identical to the chromosomes of the parent cell**
See 18. below
These are all DIPLOID cells- i.e. two sets of chromosomes.
Big note: mitosis produces 2 identical cells

18. **Recognize that during meiosis, the formation of sex cells, chromosomes are reduced to half the number present in the parent cell**
See diagram.
Remember that meiosis leads to FOUR cells that are not exactly the same as the parent cell, and have half the chromosomes.
Having half the usual number of chromosomes is called HAPLOID





19. Explain how fertilization restores the diploid number of chromosomes

If haploid sperm (1 set of chromosomes) fertilizes an egg (also haploid with 1 set of chromosomes), the new zygote (fertilized egg) will have 2 sets of chromosomes.

Remember that sex cells (eggs and sperm) are made using MEIOSIS. If this wasn't the case, and sex cells were made using mitosis instead of meiosis, then all offspring would have double the chromosomes of their parents. Then the next generation would have double that, and the generation after having 16 times the DNA of their great-grandparents…obviously this is NOT the case!

20. Describe the advantages and disadvantages of asexual and sexual reproduction with regard to variation within a population

Asexual reproduction:	
Advantage:	Fast replication
	All cells are identical (so already adapted to environment)
	All cells have same DNA as original.
Disadvantage:	less variation, so less likely to survive if environment changes

Sexual reproduction:	
Advantage:	All cells not the same, so if environment changes there is increased chance that some might have a variation that is adapted to new environment
Disadvantage:	Slower replication
	Some cells might not be have the right variations to survive in the current environment
	All cells do not have all of parental DNA so could be considered competitors with parent cell.

21. Describe how genes can be altered and combined to create genetic variation within a species (e.g., mutation, recombination of genes)

- During prophase in meiosis, chromosomes "cross-over". This may mix up the genes that are on specific chromosomes.
- During anaphase in meiosis, independent assortment pulls the chromotid pairs apart-completely random which ends up in each egg or sperm.
- During fertilization sperm and egg from different individuals with different genes will fuse to make a new individual with different mix of genes compared to either parent.
- Mutation is described earlier.

22. Explain how genotypes (heterozygous and homozygous) contribute to phenotypic variation within a species

Alleles different forms of the same gene
Homozygous: 2 alleles of the same type e.g. BB or bb. Also known as true bred
Heterozygous: 2 alleles of different type e.g. Bb. Also known as hybrid
Dominant: an allele that overrides the other. Always capitalized e.g. B, Z. P. L
The letter chosen to represent the gene is always the dominant e.g. Red flower color is dominant over white, then the gene is R not w
As long as there is one copy it will express e.g. RR and Rr will both show red
Recessive: an allele that is overridden by a dominant allele. Will only be expressed if there are 2 copies of it e.g. rr, bb,tt
Phenotype: How the alleles are expressed, what they look like. e.g. Rr will look red, rr will look white
Genotype: What the genes are e.g. RR, Rr, rr.

23. Predict the probability of the occurrence of specific traits, including sex-linked traits, in an offspring by using a monohybrid cross

Usually you cannot tell whether an organism is homozygous dominant RR or heterozygous dominant Rr just by looking at it- they both look red; and you can't "see" the genes to see what they are.

Punnett squares!

Example: Red flower (RR) mated with a white flower (rr)

	R	R
r	Rr	Rr
r	Rr	Rr

All offspring are Rr and will look red

Example 2: Crossing two hybrids/heterozygotes Rr x Rr

	R	r
R	RR	Rr
r	Rr	rr

3 of 4 offspring will be red (1 homozygous dominant, 2 heterozygous dominant)

1 of 4 offspring will be white (homozygous recessive)

Look out for the 3:1 ratio: it means the parents were both heterozygotes

Example 3: crossing two white flowers rr (both homozygous recessive)

	r	r
r	rr	rr
r	rr	rr

41 of 4 offspring will be white (homozygous recessive)

The ONLY way you can get all completely recessive is to breed together 2 recessive.

There are some exceptions to these general rules.
You still use Punnett squares the same way to work out questions.

Incomplete dominance: The dominant does not completely over ride the recessive. Heterozygous phenotype is a blend of dominant and recessive

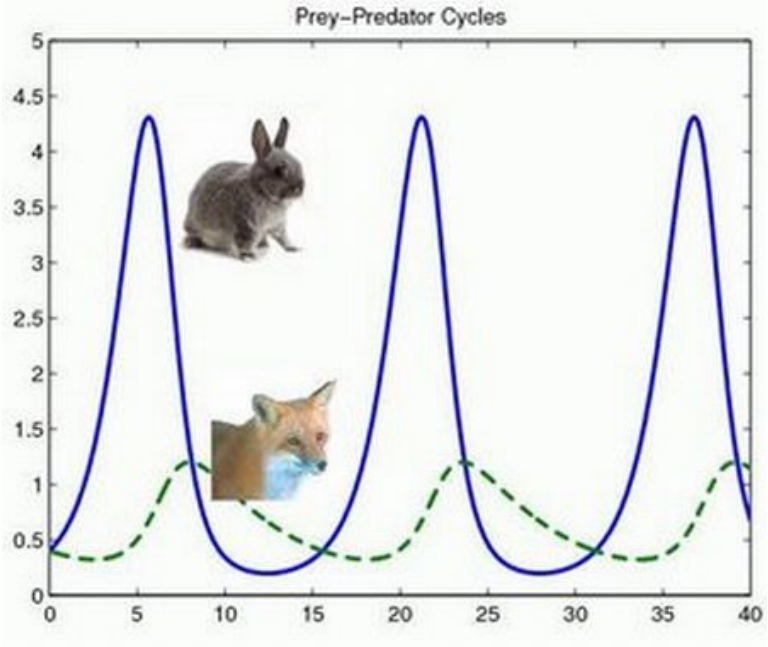
Example: RR =red flowers
rr =white flowers
Rr =pink flowers

Codominant: There are multiple dominant variants of the same allele. The best known example is the human blood type system

Phenotype	Genotype (proper usage)	Genotype (you might see it this way)
A	I^AI^A or I^Ai	AA or Ao
B	I^BI^B or I^Bi	BB or Bo
AB	I^AI^B	AB
O	ii	oo

24. Explain the nature of interactions between organisms in predator/prey relationships and different symbiotic relationships (i.e., mutualism, commensalisms, parasitism)

Predation	Benefits 	Killed 	Lion/antelope
Parasitism	Benefits 	Harmed 	Dog/tapeworm
Commensalism	Benefits 	Not harmed Not benefit 	Whale/barnacle
Mutualism	Benefits 	Benefits 	Bees/flowers



There will always be more prey than predators.

1. If the prey numbers increase, there will be more food for the predators, so they increase
2. But when predators increase, more prey are eaten, so their numbers drop
3. When there are less prey, there is not as many prey, there is less food for predators, so they decrease
4. When there are less predators, prey numbers increase
5. Go to 1. (causes a cycle)

25. Explain how cooperative (e.g., symbiotic) and competitive (e.g., predator/prey) relationships help maintain balance within an ecosystem

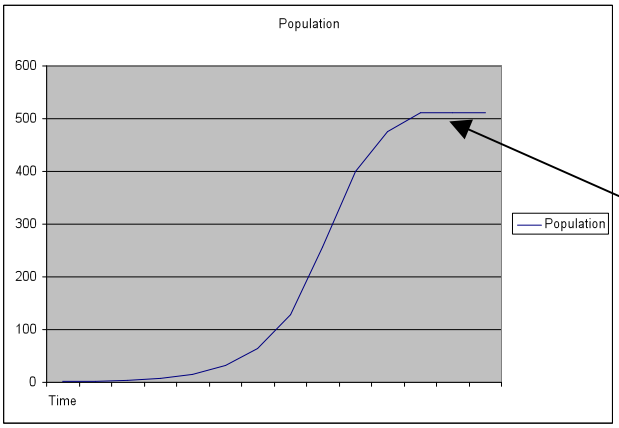
Ecology Vocabulary**:**

Population:	One species living in a place
Community:	Many species living together in a place
Habitat:	The place they live
Ecosystem:	Collection of living (biotic) and non-living (abiotic) things in a habitat
Niche:	The role of an organism in a habitat: what it eats, how it lives etc.

26. Identify and explain the limiting factors (biotic and abiotic) that may affect the carrying capacity of a population within an ecosystem

Biotic:	living things	e.g. animals, plants, bacteria
Abiotic:	non-living things	e.g. soil, CO_2, rainfall, nesting sites, temperature

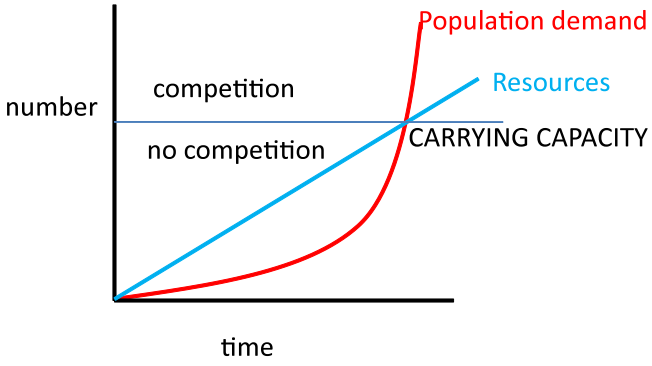
Populations will keep growing until something limits their numbers.
This could be biotic or abiotic; and there is often more than one limiting factor.
Examples: availability of food or water, overcrowding, number of available nesting sites, predators, access to mates etc.
At this point, their numbers stabilize. Note that new organisms are still being made, but total population numbers are balanced by the number of deaths. This will almost always lead to competition within a population for those resources: those that do not compete as effectively are less likely to survive (and pass on their genes)



Carrying capacity of environment = maximum population

Know this graph!

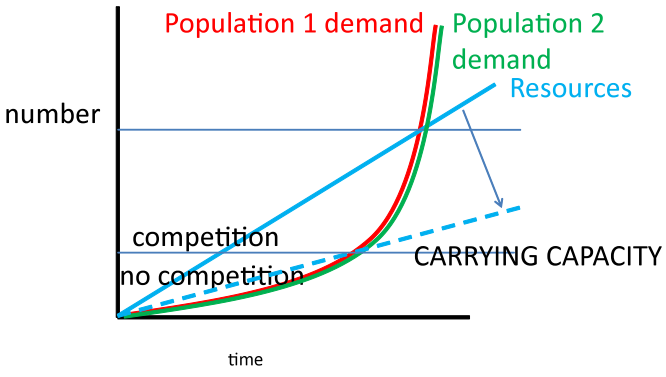
Competition: supply vs. demand



Know this graph!

Also usable in evolution

Competition: supply vs. demand (2 species in same niche)



You can only have 1 species in a niche

If there are two species in the same niche, they will compete for resources and the carrying capacity will be less as more resources get used up

Eventually there will only be one species- the other gets outcompeted

27. Predict how populations within an ecosystem may change in number and/or structure in response to hypothesized changes in biotic and/or abiotic factors

If available resources increase, population increases.

Example:	More prey	= more food.
	More nesting sites	= more offspring

If available resources decrease, population decreases

Example:	less vegetation	=less cover (so harder to hide from predators)
	Lower temperatures	= less available energy

28. Predict the impact (beneficial or harmful) a natural or human caused environmental event (e.g., forest fire, flood, volcanic eruption, avalanche, acid rain, global warming, pollution, deforestation, introduction of an exotic species) may have on the diversity of different species (community) in an ecosystem.

Acid rain is caused by burning fossil fuels- the fumes go into the atmosphere and make acid. The acid falls down as precipitation and damages plants (producers) – which means that organisms that depend on those plants are going to be affected.

Global warming is caused by burning fossil fuels; this increases the amount of CO_2 in the atmosphere. This traps more of the sun's rays, raining the global temperature, melting polar ice, causing worse storms and flooding. However, plants like it as they have increased CO_2 for photosynthesis and they grow better when it is warmer- as long as there is enough water and it doesn't get *too* warm!

29. Explain why there are generally more producers than consumers in an energy pyramid

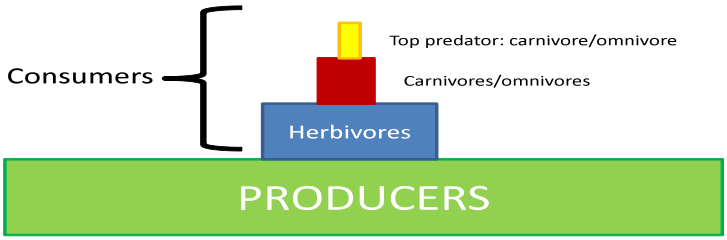
Autotroph:	makes own food
Photoautotroph:	makes own food using light e.g. plants. (Sometimes called Phototrophs)
Heterotroph:	eats other organisms for food to get *their* energy
Producer:	Plants. Uses suns energy to make own food (level 1)
Consumer:	Animals. Heterotrophs
Herbivore:	eats plants (level 2)
Carnivore:	eats animals (level 3)
Decomposer:	breaks down dead stuff for food. Not part of traditional pyramid
Detritivore:	special term for a decomposer that eats dead plant material

Sun > producers (plants) > primary consumers (herbivores) > carnivores/omnivores (consumers)

Only 10% of energy is transferred at each stage (i.e. 90% is used or lost) so carnivores only get 1% (10% of 10%) of the energy that the plants had!

This means that a given number of producers can support a small number of herbivores and a much smaller population of carnivores. Top predators are understandably rare.

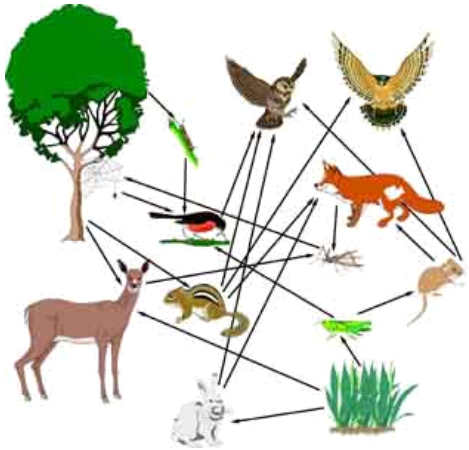
Trophic levels



30. Predict how the use and flow of energy will be altered due to changes in a food web

Food chain: a chain of organisms feeding on other organisms
e.g. tree > caterpillar > robin > owl

Food web: many chains together



HINT: don't over think food web questions.

The examiners are usually just looking for the most direct consequences.

If a species in a food chain/web changes, then this will have an impact on everything that

1. It feeds on e.g. if the rabbits leave, then grass will increase
2. Feeds on it e.g. if the rabbits leave, then the owls and foxes will decrease

31. Explain the importance of the recycling of nitrogen, oxygen, and carbon within an ecosystem

Remember that plants take in carbon dioxide and water for photosynthesis, while animals (and plants) give out carbon dioxide and water when doing cellular respiration. =Recycling of carbon and oxygen.

Also- plants give out oxygen in photosynthesis, while cellular respiration by animals (and plants) takes in oxygen. =Recycling of oxygen.

When organisms die, the carbon in their bodies is broken down by decomposers eating them, the carbon is breathed out as CO_2 that plants can use. Plants are then eaten by other organisms.

Nitrogen based compounds are used in proteins, when those organisms die and are decomposed, plants can take the nitrogen compounds from the soil and use it themselves. Plants are again eaten by other organisms.

32. Explain the importance of reproduction to the survival of a species (i.e., the failure of a species to reproduce will lead to extinction of that species)

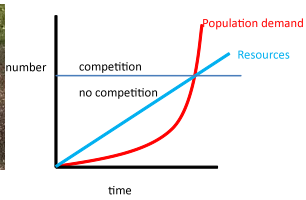
Four main points to Darwin's Theory of Evolution, by means of natural selection

Evolution

1. All organisms of the same species have variation between them

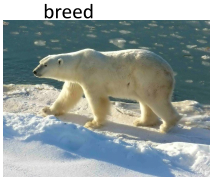

Evolution

2. Organisms will reproduce above the level of resources available

Evolution

3. Those individuals with the variations that best fit the environment will survive and breed




Those that *don't* have the best traits are less likely to survive and breed

Evolution

4. The organisms that survive will pass on their variations to the next generation. Eventually, all the organisms will have that variation

This can eventually cause a new species


Natural Selection is selection by the environment.
Basically, if a variation allows an organism to:

- Survive to breeding age
- Attract a mate better (sexual selection)
- Have offspring

Then the organism will be considered "more fit" i.e. survival of the fittest (the better adapted to the environment they are in.

IMPORTANT POINTS:

- *Individuals* do not evolve. The smallest unit of evolution is a population
- Organisms do not choose to evolve or adapt. They are either born with the variation or not.
- Nothing is evolving towards a "specific goal". They are just adapting to the environment that they are in *right now*

33. **Identify examples of adaptations that may have resulted from variations favored by natural selection (e.g., long-necked giraffes, long-eared jack rabbits) and describe how that variation may have provided populations an advantage for survival**

Giraffes have long necks because they use them to attract mates. They also use them to get food from tall trees, but that is not the main purpose)
Long eared jackrabbits (actually a hare) use their ears to shed heat, and focus sounds (so they might hear a predator approaching. Not being eaten is a good survival trait… if you are eaten you don't get to breed and pass on your traits!
Polar bears have developed thick fat and warm white fur compared to the black bears they evolved from, these are traits well suited to living in colder environments
Humans adapted walking upright as an advantage as it helped them see prey and predators over the long grass in the African savanna. Our chimpanzee cousins evolved from the same ancestor as us, but their environment was more heavily forested so there was less of an advantage to walking upright, and more of an advantage having strong arms.

34. **Explain how genetic homogeneity may cause a population to be more susceptible to extinction (e.g., succumbing to a disease for which there is no natural resistance).**
Homogeneity: being all the same (homogenous)
If all the organisms are genetically all the same in an environment, there will not be variations. If the environment changes, then there will be fewer variations that could be useful in the new environment. This means that fewer organisms will survive the environmental change.
Examples:
If you take antibiotics to kill bacteria, you are changing the environment the bacteria live in (basically adding chemicals the bacteria can't deal with). But there might be some bacteria that have the right variations to survive the antibiotics- these bacteria will survive and their offspring will also have the resistance genes.
Cheetahs are genetically virtually identical- very little variation. Their numbers are dropping because they cannot (as a species) adapt to the changing African environment.

35. **Explain how environmental factors (e.g., habitat loss, climate change, pollution, introduction of non-native species) can be agents of natural selection.**
If the environment changes (e.g. global warming, deforestation) then the organisms that live there might not have the best variations for the new environment. This means that they are less likely to pass on their genes to the next generation.
There might be some individuals in that population that have suitable variations that provide an advantage compared to the majority of the population that don't have them. So they are more likely to survive and breed and pass on their genes. Gradually over many, many generations, those variations will spread through the population and eventually be found in everyone; the population with the variation could now be considered a new species.

36. **Given a scenario describing an environmental change, hypothesize why a given species was unable to survive.**
- Evolution- not having the right variations to survive
- Food chain or web: other organisms are affected changing availability of food, or of *being* food.
- New predators may be introduced
- Habitat changes- different abiotic factors (temperature, less sunlight, less water etc)