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About The Book

This is the Keystone Kramming Biology Book! This book is to be used as a resource to help you study effectively for the biology keystone. This is a book that's for students and written by students using resources provided by teachers and educators everywhere. In this book you will find all the information you need to be score advanced n the Keystone Exam. To use this book most effectively read everything word for word and highlight key terms as well as answering questions. Also, you will find some games related to topics. Good luck using this book and Good Luck on the exam!

Chapter 1

Cells and Cell Processes

Basic Biological Principles

Biology is the basic study of the science of life. Biology has four principles that unify and become the understanding of the subject.[1]

The four principles of biology are:

Cell Theory
Gene theory
Homeostasis
Evolution

You're Next Question that you probably have is… What does this even mean?

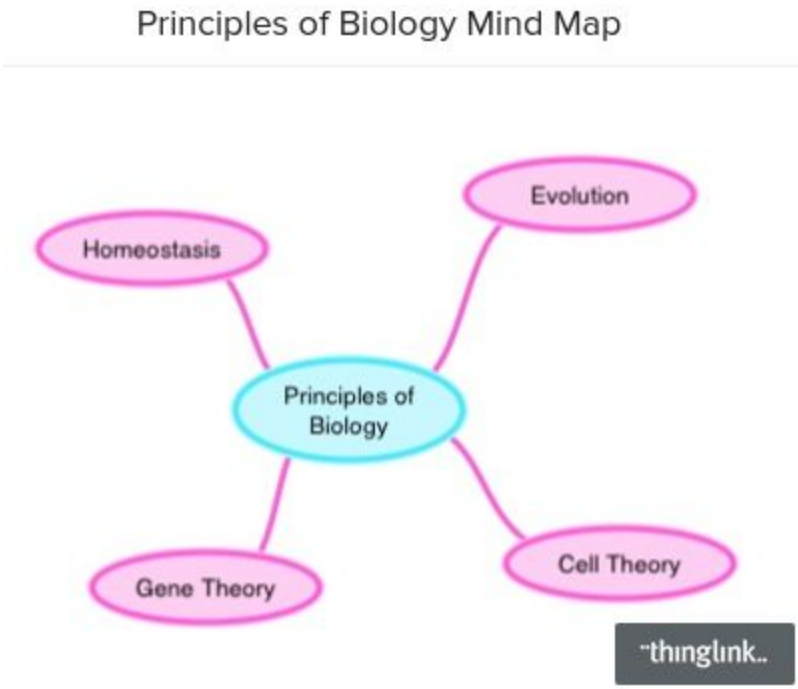


Figure 1- Mind Map produced by ck12.

What is cell theory? Cell Theory is the theory that the cell is the basic unit of life, all living things are composed of cells, all living things start single celled, and all cells arise from pre-existing cells.[2]
*Question: Which is **not** a living organism?*

A- humans
B- fossils
C- animals
D- bacteria
Answer: A, C, and D are all living organisms because they are constantly growing. Answer D is a fossil meaning it was once living but is no longer living.
What is gene theory? Gene Theory states that all characteristics of an organism come from a gene which is passed through parents to their offspring. Genes are a segment of the DNA (**deoxyribonucleic acid**) that carry codes to form proteins. A gene is located on chromosomes which are found in a cell in a chromosome DNA will be found. In the DNA instructions are held that tell the cell what to do.[1]
Question: What is a gene you notice that you've inherited from your parents?

_____

_____

What is Homeostasis? Homeostasis is the balancing act where internal conditions that includes temperature, water, glucose,and oxygen will be regulated and maintained within specific ranges.[3]
Question: Where have you seen homeostasis in your environment?

_____

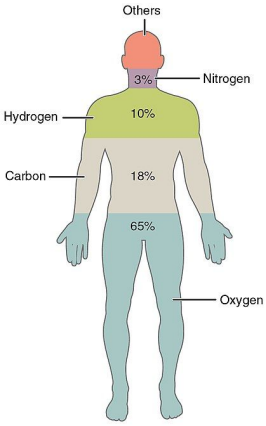
_____

What is Evolution? Evolution is the change in characteristics of species over time. Evolution is a result of **natural selection** which states that some living things are capable of producing mor offspring than others are allowing more genes to be passed over time which also changes characteristics gradually over time.[1]
*Question: If all living things evolve which of the following will **never** evolve?*
A-rocks
B-hair
C-dolphins
D-seaweed
Answer:B,C, and D are evolving aspects of life because they have been evolving since the beginning of time. Answer A is correct because although rocks can break down they never grow.
Summarize each of the principles

In this chapter you just learned the four biological principles. These are the four topic law that are the basic principles of life.

Chemical basis of life 01:

Atoms, Molecules, and water



Element	Symbol	Percentage in Body
Oxygen	O	65.0
Carbon	C	18.5
Hydrogen	H	9.5
Nitrogen	N	3.2
Calcium	Ca	1.5
Phosphorus	P	1.0
Potassium	K	0.4
Sulfur	S	0.3
Sodium	Na	0.2
Chlorine	Cl	0.2
Magnesium	Mg	0.1
Trace elements include boron (B), chromium (Cr), cobalt (Co), copper (Cu), fluorine (F), iodine (I), iron (Fe), manganese (Mn), molybdenum (Mo), selenium (Se), silicon (Si), tin (Sn), vanadium (V), and zinc (Zn).		less than 1.0

99% of the body mass is made of six elements:

- Oxygen
- Carbon
- Hydrogen
- Nitrogen
- Calcium
- Phosphorus

0.85% of the body is made up of five other elements:

- Potassium
- Sulfur
- Sodium
- Chlorine
- Magnesium

All 11 elements are necessary for life

Properties of water

Cohesion, Adhesion, Polarity, Heat of Vaporization, Freezing Point.

Cohesion – the attraction between molecules of the same substance, (water bonds to water)

Adhesion – the attraction between molecules of different substances, (water bonds to another molecule)

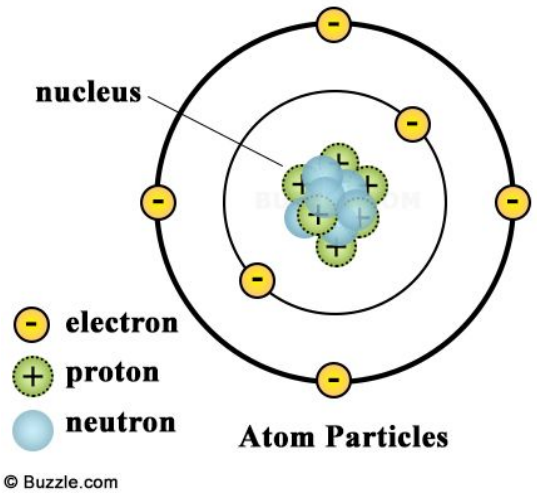
Cohesion and ***adhesion*** help life in a variety of ways: they contribute in the transport of liquids in plants, provide surface tension for aquatic organisms, etc.

Polarity – Polar molecules have ends with opposite charges. Giving the oxygen a slight negative charge and the hydrogen a
slight positive charge. The polar nature of water makes it the universal solvent.

Heat of vaporization – it takes a large amount of energy to change the state of water. This benefits aquatic organisms, as bodies of water maintain fairly stable temperature conditions.

Everything is made of matter - Matter is made of atoms

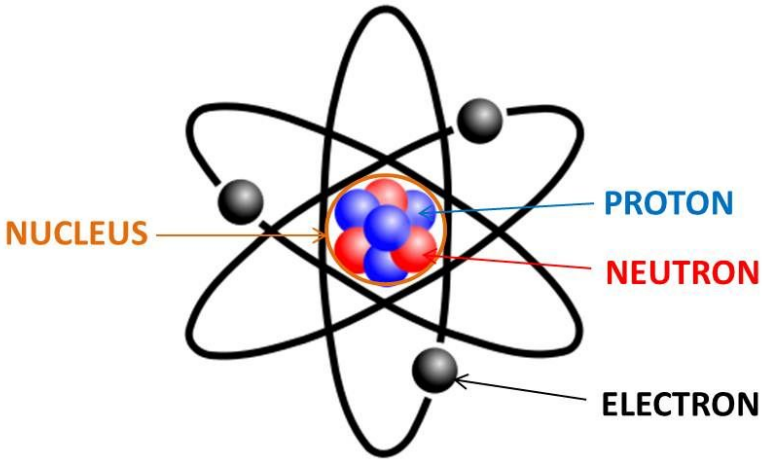
Atoms - protons neutrons electrons



*Atoms are the basic units of matter defining structure elements.*All atoms are made up of three particles as demonstrated above: protons, neutrons, and electrons. Those three things, are composed of even smaller things- such as *quarks*.Protons have a positive electric charge, electrons have a negative electric charge, and neutrons have no charge. An atom is the smallest unit of matter. Everyone, solid, liquid, and gas, is made up of atoms. More than 99.4% of an atom is made of a nucleus.

Why does this chapter matter?

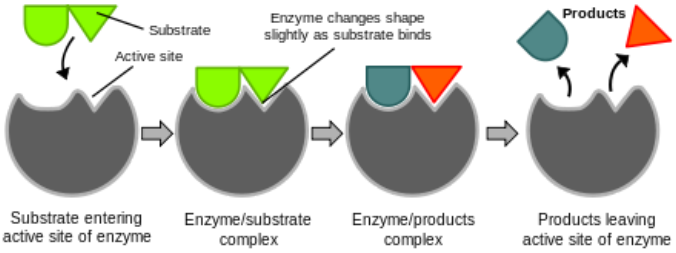
In this chapter, you learned the basic chemicals to your life. You learned about the human body, and how certain functions and reactions happen. The most general way in which you can understand the term would be to know that, the chemical basis include, atom and molecular structure. There is some type of reaction that occurs in the body, it gets sped up, lets out products, and repeats. All of this having to do with atoms, and atoms having to do with biological catalyst. If you can understand the key concepts listed above, I promise you'll have nothing but success in the future! HAPPY STUDYING!



Enzymes

EQ: What occurs during chemical reactions?

Enzymes are biological molecules that speed up the rate of a chemical reaction. Enzymes are an essential part of the human life, and they serve important factors in the functioning of the human body. For example, the digestion of food in the body, and metabolism speeding up or slowing down.



In order for your body to properly function and generate, it requires energy. Substrates-the molecules that an enzyme works with, bind to specific regions of the enzyme, called the *active site.* Whatever the case may be, whether saliva, or something else, the reactions generate in a continuous speed, allowing the process to generate quickly, and properly. Once substrates bind to active site, the chemical reaction make new product/molecule and the process is complete, and the substrate catalyzes, to go on and create new molecules.

REMEMBER!

Don't overthink! Take information one step at a time! You will be okay. Remember, everything listed above is important. Take your time, reread, and TAKE NOTES! HAPPY STUDYING!

Now.. Let's test your knowledge, don't be nervous!! All of your information is right above!

1. ***What are atoms?***

_____

_____

_____

3. ***How is polarity related to cohesion and adhesion?***

_____

_____

4. ***What happens during a chemical reaction?***

_____

_____

_____

5. What is the role of an enzyme in human bodies?

_____

_____

_____

6. Describe the cycle of an enzyme's performance.

_____

_____

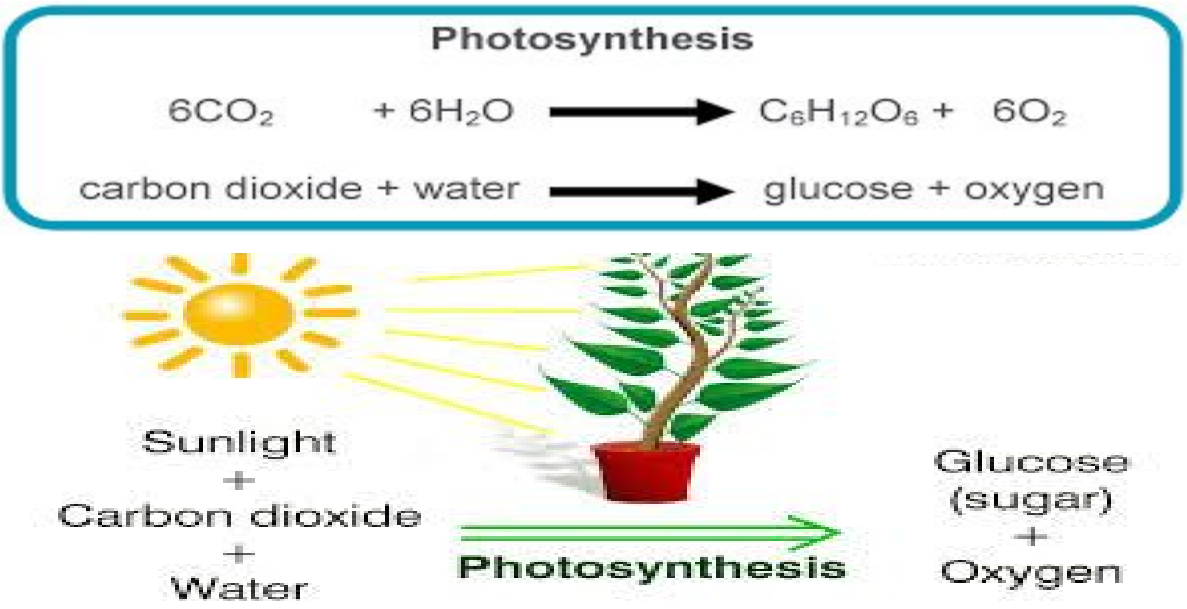
_____

Bioenergetics: Photosynthesis and Cellular Respiration

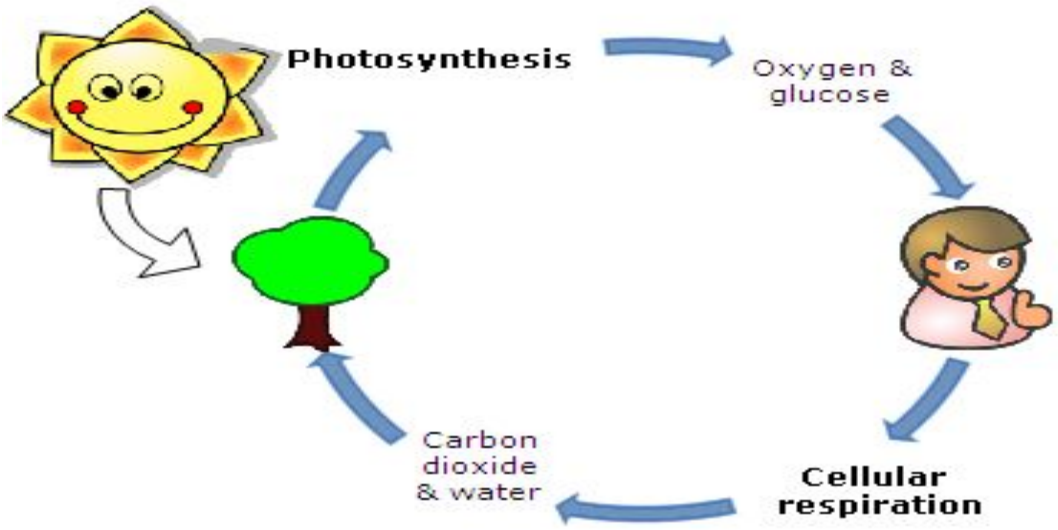
Photosynthesis is the process in which it uses water, carbon dioxide, and light energy to produce **glucose** and oxygen. This process is important because without photosynthesis living organisms would have a hard time living and will begin to die due to the little of food or organic matter on Earth. With the product of glucose, it helps with the next stage cellular respiration by helping with growth and reproduction. **Cellular respiration** helps within providing energy from **ATP** for living organisms to function in life.

Photosynthesis Process:

All plants contain tiny cells which have chloroplast that are tiny structures containing a green chemical called chlorophyll which obviously gives plants their color. The energy is absorbed from this pigment and began to split water into two molecules called hydrogen and water. Oxygen is released, carbon dioxide and hydrogen are used to form glucose.



Cellular Respiration has four main stages that happen in the Mitochondria …… (with each stage organisms breaks down nutrients to produce energy of ATP, which stands for **A**denosine **Triphosphate**)



First Stage: **Glycolysis** occurs in the cytoplasm.. In this process enzymes breaks down the glucose sent from photosynthesis helping produce ATP. Why is glucose being broken down? Glucose is broken down into two molecules of pyrukets which produces 2 ATPs and NADH which is used later on during the process.

Second Stage**:** **Prepotry Reaction** in which the pyrukets that had came from the first stage moved into the Mitochondria.. They begin to convert into molecules that participate in reactions that involve proteins, carbohydrates, and lipid metabolism. Also, in this stage they produce more NADH but release carbon dioxide.

Third Stage: **Citric Acid Cycle** it takes any remaining carbons from the glucose are oxidized releasing carbon dioxide and more NADH and new $FADH^2$ helping make 2 more ATPs.

Last Stage; **Electron Transport Chain** takes the NADH and $FADH^2$ help giving up electrons to the chains to help release energy. In this stage ATP is mostly

focused on because the energy helps with the production of ATP. Oxygen combines with hydrogen ions to produce water.

Photosynthesis: Plants and organisms use sunlight to synthesize foods from carbon dioxide and water. Photosynthesis in plants generally involves the green pigment chlorophyll and releases oxygen and forms glucose.
Cellular Respiration: Process of breaking sugar into a form that the cell can use as energy. This happens in all forms of life. It takes in food and uses it to create ATP.
Glucose: sugar that is an important energy source in living organisms and is a component of many carbohydrates
Chlorophyll:a green pigment, present in all green plants and in cyanobacteria, responsible for the absorption of light to provide energy for photosynthesis

Key Words!

In this chapter you learned and reviewed the roles of photosynthesis and cellular respiration. This chapter will help you know what we intake in our body and give back. You will also learn where we get our oxygen from and the steps of what we're doing when we are inhaling and exhaling. You will be able to take part in what you do for Earth in order to make it healthy all living organisms to live in. This is why it is very important on picking up trash and recycling it helps keep plants give off the oxygen that humans need. Photosynthesis is very important because it helps us get oxygen and energy based of plants or trees. The process of cellular respiration is also important because it helps us function in life with the help of receiving energy. Both photosynthesis and cellular respiration take a big part in keeping humans and plants healthy. We need oxygen to breathe and to stay alive. Plants need carbon dioxide, water, and sunlight to make sure they keep their pigment and produce products such as glucose and oxygen.

Now let's test your knowledge!

1. *Why is glucose broken down? What 2 molecules does it form?*

2. *What is the purpose of cellular respiration and photosynthesis?*

3. How many ATPS are produced in the cellular respiration?
(a): 35
(b. 38
(c) 40
(d) 1009

4. What's the equation of photosynthesis?
(a) glucose + water
(b) carbon dioxide + water ⟶ glucose + oxygen
(c) glucose + sugar
(d) oxygen + glucose ⟶ carbon dioxide + water

5. What does photosynthesis contain?
(a) Sunlight, carbon dioxide, & water
(b) glucose & water
(c) energy
(d) humans

Homeostasis and Transport

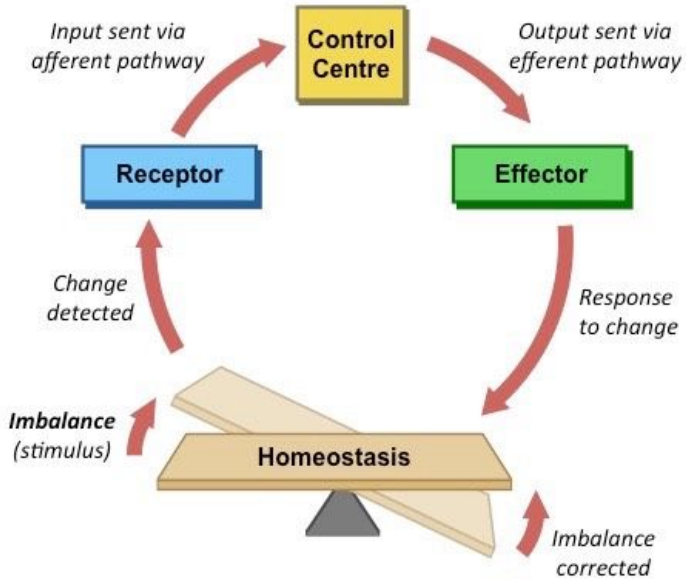
Homeostasis

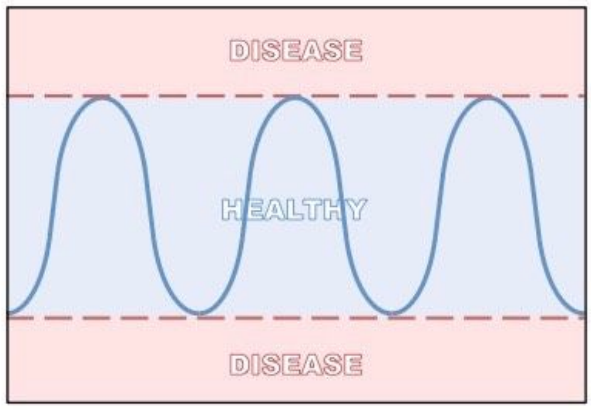
All living things work to maintain consistent internal states. Any changes in temperature or pH can affect an organism's ability to function correctly. Temperature, water, glucose, and oxygen, and blood levels are regulated. This is called **Homeostasis.**

There are different types of homeostasis and the ones we will be talking about today are:

- Temperature Homeostasis (thermoregulation)
- Blood Glucose Homeostasis
- Blood Water Homeostasis (Osmoregulation)

The body relies on a **negative feedback loop** which regulates the body's internal states. Any change to a system causes it to return to its original state. In contrast, a **positive feedback loop** enhances or amplifies changes. It tends to move a system away from its state of equilibrium, and make it more unstable.





Homeostasis does **not** involve keeping conditions static
It involves keeping conditions within tightly regulated *physiological tolerance limits*

1. During labor, contractions of the uterus grow stronger until the baby is born. What is this an example of?

a. Negative feedback loop
b. Positive feedback loop
c. None of the above

Thermoregulation

When the normal human body temperature (37.0°C) is altered, then changes will take place through the body to bring it back to it's normal temperature. Muscles in the skin can make hairs stand up to reduce heat loss (trap heat), or lay flat to increase heat loss (release heat). The **hypothalamus** is an area in the brain that senses and regulates any changes in the body. It acts like the body's thermostat.

When we are too hot, blood vessels that supply blood to the skin can swell or dilate. This allows warm blood to flow near the surface of the skin. This is why some people will turn red when they are hot. On the other hand, when we are too cold, the blood vessels that supply blood will become narrow which will reduce the flow of warm blood to the surface of the skin. This is why some people will turn pale, or blue when they are cold.

2. Why do some people turn red when they are hot?

a. They are embarrassed
b. The heat scorches their skin
c. Blood flows near the surface of the skin

If you are too hot or too cold the following things will happen:

Too cold	Too hot
● Hair muscles pull hairs on end ● Erect hairs trap heat ● Blood flow in capillaries decrease ● Hypothermia	● Hair lays flat so that heat can escape ● Sweat is released by glands in the skin. It cools the skin by evaporation. ● Blood flow in capillaries increase. ● Heat stroke

3. How does sweating cool you off?
   a. The sweat will cool the skin by evaporating
   b. Sweating doesn't cool you off
   c. It allows more blood flow

Osmoregulation

Organisms regulate the balance of water and solutes in their bodies. Fresh water in lakes and rivers is **hypotonic** to the water in the cells of organisms. Living things that live in freshwater have to regulate their balance of water since, excess water enters the body and they lose solutes. Organisms that live in saltwater are **isotonic**

4. Describe how hypotonic and hypertonic are different from each other:

Passive Transport

Passive transport moves chemicals from areas of high concentration to low concentration, and it does not require energy. It is dependent on the permeability of the cell membrane. There are three main kinds of passive transport: Diffusion, Osmosis and Facilitated Diffusion.

In diffusion, the movement of molecules from higher to lower concentration occurs. It moves particles through a permeable membrane down a concentration gradient until they are both equal. In facilitated diffusion, it is helped by a membrane transport channel. Osmosis is the diffusion of water molecules across a selectively permeable membrane.

Active Transport

Active transport requires energy because it is the movement of chemicals from areas of lower concentration to areas of higher concentration. It makes molecules move through the cell membrane against the concentration gradient so more of the substance is inside the cell or outside the cell than normal. Active transport uses membrane proteins that are called ion pumps and molecular pumps. Ion pumps move ions, or charged atoms while molecular pumps move uncharged molecules.

5. How are active transport and passive transport different from each other?

_____

_____

_____

Short Summary:

In this section we have reviewed homeostasis, passive transport, and active transport. You have learned what they each function as and why they exist. You have learned about the consequences of our body getting too cold or too hot. Homeostasis is a set of automatic control systems that maintain temperature and water at steady levels throughout the body. It is important for the body to have

homeostasis because without we wouldn't have a stable environment for cells to function correctly, and certain processes such as osmosis, proteins, and enzymes wouldn't function correctly either. In homeostasis there is a negative feedback loop and a positive feedback loop which regulate the body's internal states. Passive transport and active transport are what move ions and other atomic or molecular substances across cell membranes with or without energy. Passive transport does not need energy while active transport does require it. It is necessary for both passive transport and active transport to occur in the role of photosynthesis. Light molecules need ATP or Active Transport to make glucose in the cells of the plant, also It needs Passive Transport so the light molecules can pass through the cell membrane.

Chapter 2

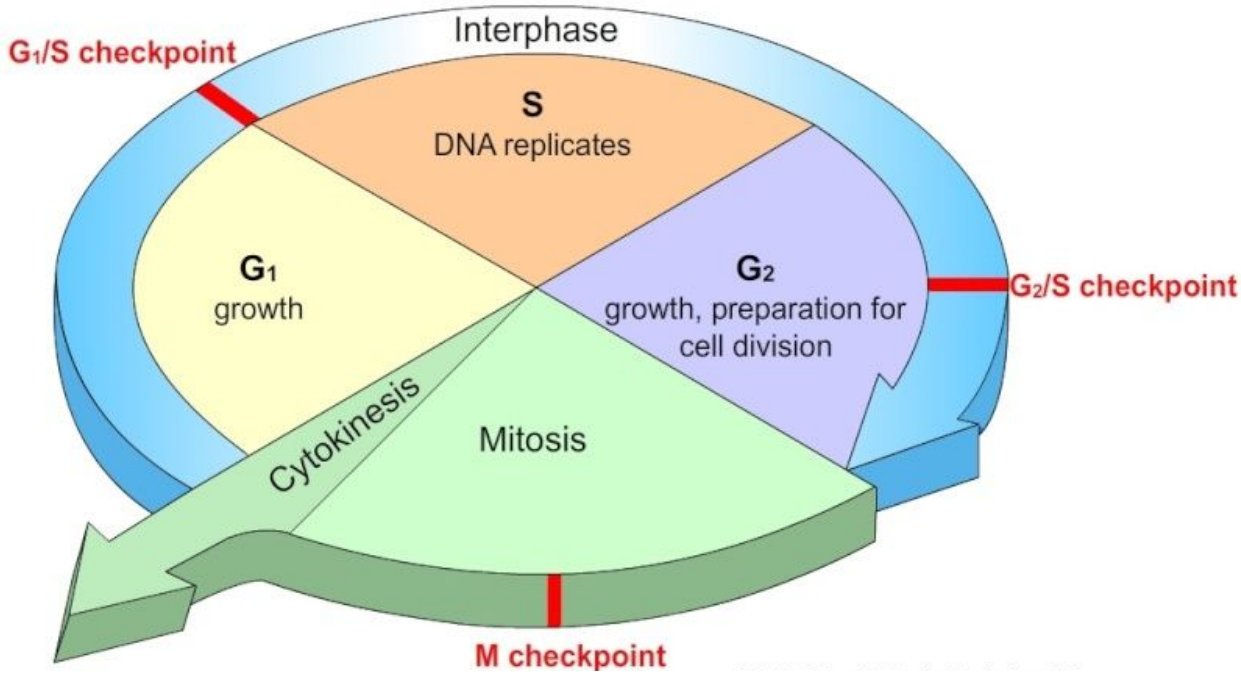
Continuity and Unity of Life

Cell Growth and Reproduction

Cell division continues throughout life, helping to repair tissues and replace damaged cells. **Mitosis** is the process in which the body grows and repairs itself. It helps produce twin cells with the same number of chromosomes. Second division is, **Meiosis** which occurs in organisms that reproduce sexually. It produces gametes, sperm, and egg cells.

The Cell Cycle

A cell goes through stages such as interphase, (Mitosis) nuclear division, and cytokinesis. The **interphase** (G1 phase), the cell grows, prepares for nuclear division, and replicates DNA, Next The Syn. Phase the cell replicates DNA, Last the G2 phases produces proteins needed for Mitosis. The cell will then travel to **Mitosis** where it is divided into 5 stages known as the prophase, prometaphase, metaphase, anaphase, and telophase. In the prophase DNA condense and organize. Prometaphase, where microtubules attach and nuclear membranes are broken down. Metaphase spindles aline center of the cell when they go to anaphase to be shorten while they pull the sister chromatids apart. In the last phase of Mitosis (Telophase), nuclear membranes form newly separated chromosomes, They become longer and thinner producing two new nuclei. **Cytokinesis** is the process where the cytoplasm, organelles, and plasma membrane of a cell divide the nuclei to form two daughter cells.



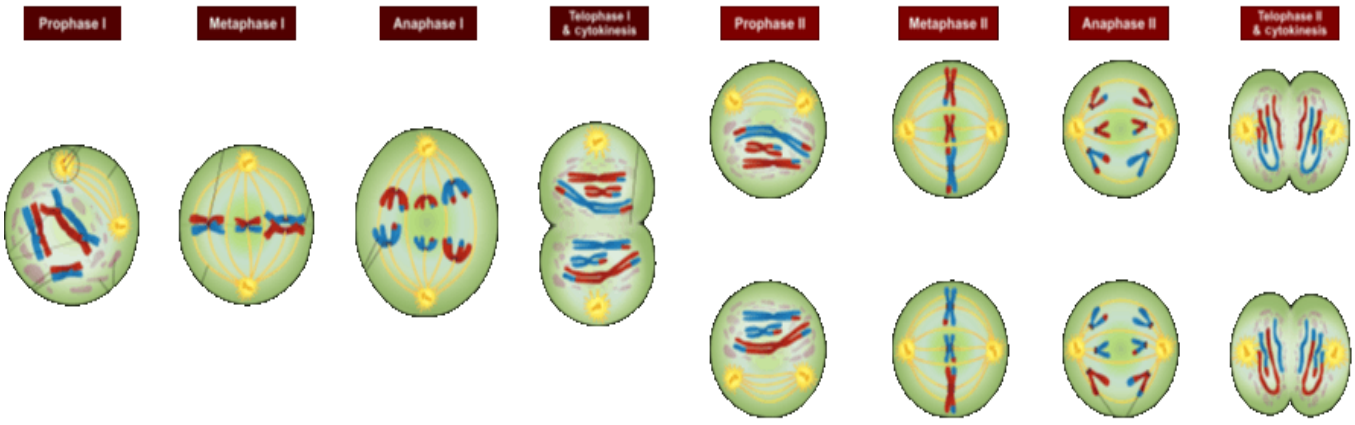
Meiosis

Similar to Mitosis and they have the same phases but different actions with a sequence.

For every organisms that have a characteristic **chromosomes** number. This helps know that if one specie has that number of chromosomes, they all do. Each chromosomes are found in pairs of homologous or homologs, they have the same structure and same DNA. For chromosomes that may have the same genes but all their alleles could be totally different.
Allele is a version of a gene. For example, redheads may have one version of a gene but people with blonde hair will have different versions. Each homologous pairs holds 2 alleles of each gene.
Sperm and eggs cell contain half the normal number of chromosomes. **Gametes** holds on chromosome from each pair with allele of each gene. Gametes are produced by meiosis so this is only for sexually reproducing organisms.

Phases of Meiosis Sequence

In the interphase, you will start with 2 chromosomes from each parent. During this process the DNA is copied which is like mitosis but then changes in the second stage. Prophase 1 each chromosomes from mom and dad come together to swap parts of their chromosomes becoming identical basically crossing over. ThIs process is called Synapsis and if we didn't have this the chromosomes we have will be sent to our children. This step allows us to get brand new chromosomes. The next step is metaphase, where they align up in the middle of the cell. When the chromosomes are in the middle of the cell is that the spindles would join which would help with the process in anaphase by pulling the chromosomes apart. In the telophase, reforming a nuclei and dividing it. In the end results of Meiosis 1 once we have divided the rest of the cell where are in the cytokinesis. The next step is starting over but a second sequence of each phase. Since we have 2 new cells, the chromosomes line up and the spindles begin to join and pull apart in each cell. Repeating the prophase, metaphase, and anaphase in each cell. In telophase and cytokinesis, we have created 4 cells that contain two chromosomes.



In this section we have reviewed the process of mitosis and meiosis and how it helps with living organism. We also went by the steps taking place during the cell cycle. In the past reading you have understood how a cell grows and reproduce with the help of mitosis and meiosis. The cell cycle allows us to understand the process it takes to make a cell grow and reproduce with the steps of the interphase regarding to G1, S Phase, G2 then continuing onto mitosis and cytokinesis. These phases are taking place where there are missing cells, damaged cells, or the living organisms needing more cells. The cell cycle helps us know the cell process in our body and the steps that a cell goes through in order for us to create new cells everyday. We need to know the cell cycle because it plays an important part in our body. The Mitosis stage allows us to fix the cell we have and to get new ones without having this process in our body we will mostly get sick. If we didn't have the mitosis or cytokinesis we wouldn't be able to copy DNA and our cells will be too big to function. Without having the Meiosis stage we wouldn't be able to reproduce. WIth knowing the meaning of mitosis and meiosis your able to know how important it is to take care of your body and to know how it works.

Test Yourself

What is the difference between Mitosis and Meiosis?

What are the 5 phases in Mitosis and what do they do?

What's the first step of the cell cycle?

A: cytokinesis
B: G1 (growth)
C: Mitosis
D: G2 (growth and prepare for cell division)

If a cell is not ready for the next step or something is missing what will happen to that cell?

A: If a cell doesn't exceed a checkpoint it will be sent back.
B: It will move forward but will cause problems with the human.
C: It will die.
D: It will stay in that step and never move forward.

What is the last step of the cell cycle and what does it do?

A: Cytokinesis
B: Mitosis, and the 5 phases take place.
C: The final stage, cytokinesis takes the cytoplasm and divides it into two.
D: The final stage Meiosis, produces.

Glossary

Active Transport - the movement of particles from an area of low concentration to an area of high concentrations while using energy.
Diffusion - the movement of ions or molecules down a concentration gradient.
Facilitated DIffusion - it relies on membrane proteins to help molecules across a cell membrane.
Homeostasis - the maintenance of a constant internal state.
Hypertonic - any solution that has a higher osmotic pressure than another solution
Hypothalamus - an area in the brain that senses and regulates any changes in the body.
Hypotonic - any solution that has a lower osmotic pressure than another solution.
Isotonic - a solution having the same osmotic pressure as some other solution
Negative feedback loop - any change to a system causes it to return to its original state.
Osmoregulation - The process of maintaining salt and water balance across membranes within the body.
Osmosis - the movement of water from an area of high water concentration to an area of low water concentration.
Passive Transport - the movement of a substance across the plasma membrane without any energy
Positive feedback loop - amplifies a change to the system which causes it to move farther from the original state.
Thermoregulation - the regulation of body temperature
Photosynthesis: Plants and organisms use sunlight to synthesize foods from carbon dioxide and water. Photosynthesis in plants generally involves the green pigment chlorophyll and releases oxygen and forms glucose.
Cellular Respiration: Process of breaking sugar into a form that the cell can use as energy. This happens in all forms of life. It takes in food and uses it to create ATP.
Glucose: sugar that is an important energy source in living organisms and is a component of many carbohydrates
Chlorophyll:a green pigment, present in all green plants and in cyanobacteria,

responsible for the absorption of light to provide energy for photosynthesis
Cohesion – the attraction between molecules of the same substance, (water bonds to water)
Adhesion – the attraction between molecules of different substances, (water bonds to another molecule)
Polarity – Polar molecules have ends with opposite charges. Giving the oxygen a slight negative charge and the hydrogen a slight positive charge. The polar nature of water makes it the universal solvent.
Heat of vaporization – it takes a large amount of energy to change the state of water. This benefits aquatic organisms, as bodies of water maintain fairly stable temperature conditions.

Answer Key

Homeostasis and Transport

1. *The answer would be B. In positive feedback, it is amplifying the change until everything goes back to normal. During the labor the contractions of the uterus are the change that is being amplified. They continue to keep growing until the baby is pushed out and everything goes back to normal.*
2. *The answer is C. Blood vessels that supply blood to the skin will dilate and blood rushes up and into them – and that blood is being pumped to the surface of your skin.*
3. *The answer would be A. Sweat is evaporated into the air and cools the skin*
4. *A hypotonic solution has a lower osmotic pressure than another solution while, a hypertonic solution requires a higher osmotic pressure than another solution.*
5. *Active transport requires energy and moves ions from low concentration to high while, passive transport does not require energy and moves ions from high concentration to low.*

Photosynthesis & Cellular Respiration

1. Answer : Glucose is broken down so it will be able to travel as 2 molecules called purkets which is included in the cellular respiration which will help produce energy as in ATP.
2. Answer: The purpose of photosynthesis is that plants help produce oxygen, and gives us clean air to breathe. The purpose of cellular respiration allows us to get energy, break down food, and give off carbon dioxide.
3. Answer: The answer is 38 because adding up all the ATP being made during the cellular respiration will equal to 38.
4. Answer; (b) carbon dioxide + water ⟶ glucose + oxygen because with the process of photosynthesis it starts off with carbon dioxide and ends in the results of glucose and oxygen for cellular respiration.
5. Answer: The answer is (a) Sunlight, carbon dioxide, & water because in order for the process to begin it needs these factors to make glucose and oxygen for cellular respiration.

Cell Growth And Reproduction

1. The difference between Mitosis and Meiosis is that each process contain the same phases but uses it different. Mitosis focuses on fixing old damaged cells and creating new ones while meiosis reproduces with the help of sperm and egg cells.
2. The five stages are prophase, prometaphase, metaphase, anaphase, and telophase. Prophase DNA condense and organize. Prometaphase, where microtubules attach and nuclear membranes are broken down. Metaphase spindles aline center of the cell when they go to anaphase to be shorten while they pull the sister chromatids apart. In the last phase of Mitosis (Telophase), nuclear membranes form newly separated chromosomes, They become longer and thinner producing two new nuclei.
3. The answer is G1 growth because in order for the cell to reach any other step it would be examined in each step making sure it exceeded its job to move on to the next step.
4. The answer is If the cell doesn't exceed a checkpoint it will be sent back because each cell takes it time in each step of the cell cycle. The cell is growing and being fixed not being rushed.
5. The answer is The final stage, cytokinesis takes the cytoplasm and divides it into two. This is the answer because it the cell has certain steps for it to go by to each the last stage of cytokinesis. And in each step the cell has a job to do.

Chemical Basis of Life 01

1. What are atoms?

Atoms are small biological

3. How is polarity related to cohesion and adhesion?

The attraction that occurs between cohesion and adhesion is the result of polarity.

4. ***What happens during a chemical reaction?***

During a chemical reaction, atoms arrange to form bonds and create products.

5. What is the role of an enzyme in human bodies?

Enzymes act as biological catalyst, that speed up chemical reactions.

6. Describe the cycle of an enzyme's performance.

Substrates bind to the active site of an enzyme. The reaction speeds up and occurs, creating a product. The product is then released, causing the site to go uncharged. The process then repeats itself.

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