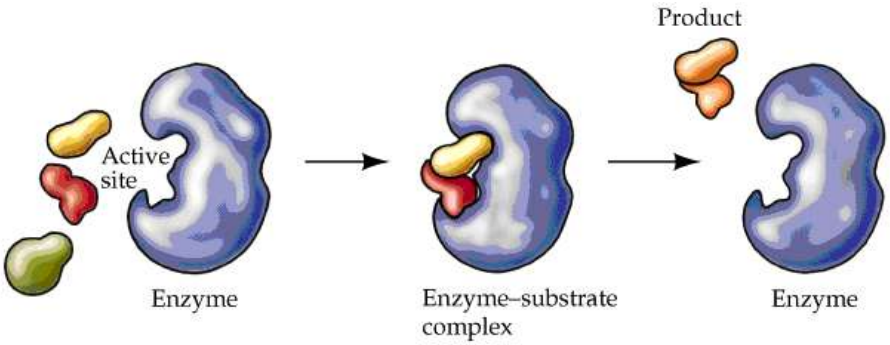
Biology EOCT Study Guide

SB1a Describe the jobs that the cell parts play in helping cells to survive and reproduce.

Structure	Function	Prokaryotic Cell	Typical Plant Eukaryotic Cell	Typical Animal Eukaryotic Cell
Cell Wall	Rigid outermost layer in plants	Yes	Yes	No
Centrioles	Aid in cell division	No	No	Yes
Chromosomes	Made of DNA; carry genes	One long DNA strand	Many	Many
Cilia or Flagella	Movement	Yes, simple	Some present	Yes, complex
Endoplasmic Reticulum	Protein processing	No	Yes	Yes
Golgi Complex	Distribute proteins	No	Yes	Yes
Lysosomes	Digest wastes	No	No	Common
Mitochondria	Make energy	No	Yes	Yes
Nucleus	Control center;contains chromosomes	No	Yes	Yes
Cell Membrane	Selectively permeable	Yes	Yes	Yes
Ribosomes	Make proteins	Yes	Yes	Yes

SB1b Explain how enzymes can make cell process proceed more quickly.
Substrates are proteins which a specific enzyme can chemically recognize and to which it can bind. Substrates undergo chemical changes to form new substances called products. Each substrate fits into an area of the enzyme called the *active site*. It is like a lock-and-key mechanism. Once the enzyme-substrate complex is together, the enzyme holds the substrate in a position where the reaction can occur. Once the reaction is complete, the enzyme *unlocks* the product and the enzyme is free to facilitate another reaction. Enzymes are not permanently altered or used up in reactions but help the reactions occur more quickly by decreasing the activation energy.



SB1c Describe each of the four major macromolecules structure and function in living things.

Macromolecule	Elements it is composed of.	Subunits	Used for in living things	Examples
Carbohydrate	Carbon hydrogen oxygen	monosaccharide	-short term energy storage, structure (cell walls) exoskeletons	mono-glucose (used for cell energy) di-sucrose lactose poly- starch (plant energy) cellulose glycogen (animals store energy)
Proteins	Carbon hydrogen oxygen nitrogen sulfur	amino acids	-digestion -hair, nails -carry oxygen in blood	hemaglobin enzymes keratin antibodies
Lipids	Carbon hydrogen oxygen	glycerol and fatty acids	-insulation -long term enegry storage -protects organs -immunity	waxes oils fats steroids (cholesterol, estrogen, testerone heroin)
Nucleic Acids	Carbon hydrogen oxygen nitrogen phosphorus	nucleotides	make proteins	DNA RNA

SB1d Describe the ways water can help move materials in and out of the cell.

Living cells maintain a balance between materials entering and exiting the cell. Their ability to maintain this balance is called **homeostasis**. It is important for a cell to control internal concentrations of water, glucose, and other nutrients, while eliminating cellular wastes.

Passive transport is the movement of materials across the plasma membrane without the use of the cell's energy.
Diffusion: the movement of substances across the plasma membrane from an area of high concentration to an area of lower concentration.
Osmosis: the diffusion of water molecules through a selectively permeable membrane from an area of high concentration to lower water concentration. Facilitated transport: occurs when a carrier molecule embedded in the plasma membrane transports a substance across the membrane by means of diffusion.

Active transport is the movement of materials across cell membranes that requires energy. Active transport is the process by which materials are moved against a concentration gradient, as in the sodium-potassium pump. Also, the movement of large particles into or out of the cell is done by the process of active transport.
Endocytosis: a process in which a cell surrounds and takes in material from its environment.
Exocytosis: a process by which materials leave the cell.

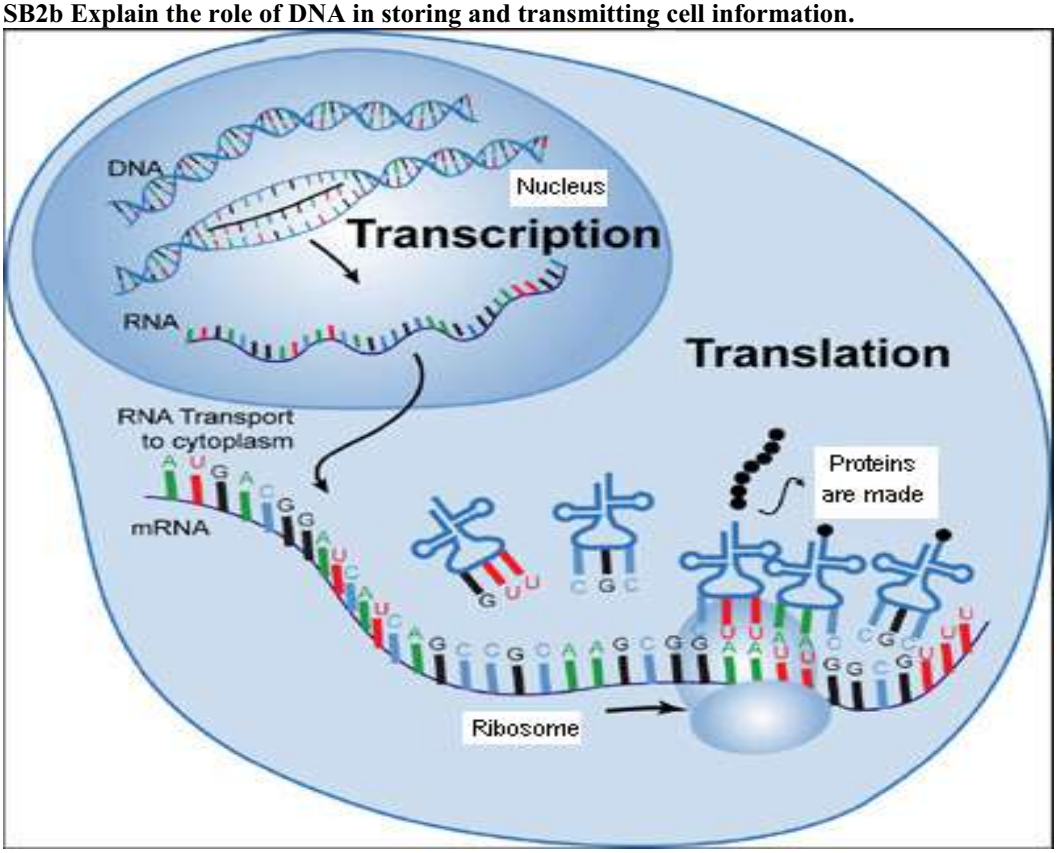
Example:

Water will move into the cell in the beaker because the solution in the beaker is hypotonic and the solution in the cell is hypertonic. Water always moves from hypotonic to hypertonic solutions by osmosis to maintain homeostasis.

SB2a How are DNA and RNA different? Similar?

	DNA	RNA
Bases & Sugars:	DNA is a long polymer with a deoxyribose and phosphate backbone and four different bases: adenine, guanine, cytosine and thymine	RNA is a polymer with a ribose and phosphate backbone and four different bases: adenine, guanine, cytosine, and uracil
Difference:	1.Found in nucleus 2. sugar is deoxyribose 3. Bases are A,T,C,G	1.Found in nucleus and cytoplasm 2.sugar is ribose. 3. Bases are A,U,C,G
Pairing of Bases:	A-T(Adenine-Thymine), G-C(Guanine-Cytosine)	A-U(Adenine-Uracil), G-C(Guanine-Cytosine)
Predominant Structure:	Typically a double- stranded molecule with a long chain of nucleotides	A single-stranded molecule in most of its biological roles and has a shorter chain of nucleotides
Stands for:	DeoxyriboNucleicAcid	RiboNucleicAcid

SB2b Explain the role of DNA in storing and transmitting cell information.



DNA is copied as RNA by transcription.

RNA is used to build proteins during translation.

SB2c How do Mendel's Laws explain how traits are inherited and meiosis increases genetic variability?
Two versions of a gene are called alleles. According to the Law of Segregation, the two versions of alleles segregate during gamete formation (meiosis). The Law of Independent Assortment also explains that different genes are sorted independently. For example hair color and eye color are inherited independently. In conclusion, more gene combinations may result because the two alleles for different pairs are all inherited separately and independently, thus resulting in more gene variability.

SB2d Describe how new traits (characteristics) result from mutations?
Mutations are changes in DNA's code. These mutations may be insertions, deletions, or substitutions. The result of these mutations is a change in the genes thus altering the phenotype (trait) of an organism. Mutations facilitate natural selection and increase genetic variability.

SB2e Describe the advantage of sexual reproduction over asexual reproduction.
Sexual reproduction is good for evolution because it creates genetic variability, which, in turn, is useful in adapting to constantly changing and challenging environments.

SB2f Examine the role of DNA technology in forensics, agriculture and medicine.

Advances in DNA technology have resulted in its increased use in medicine, forensics and agriculture. Police labs use DNA technology to identify people through a process known as DNA fingerprinting. Plant biologists have used DNA technology to produce plants with many desirable traits. These include increased disease resistance, herbicide resistance, and increased nutritional content. Today, researchers use recombinant DNA technology to analyze genetic changes. They cut, splice together, and insert the modified DNA molecules from different species into bacteria or another type of cell that rapidly replicates and divides. The cells copy the foreign DNA right along with their own DNA.

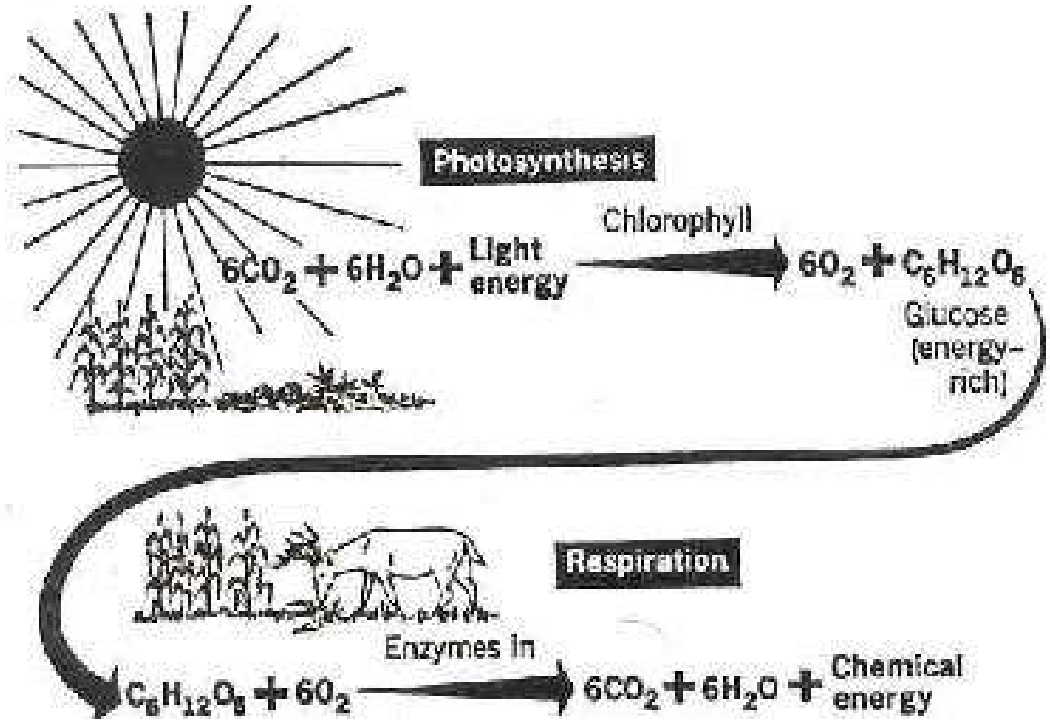
An example of this is the gene for human insulin. When the gene is transferred into a bacterium, the bacterium will use the "recombined" genetic code to produce human insulin. This is how human insulin is mass-produced. This insulin has saved the lives of many people with diabetes. Not only does genetic engineering have applications in medicine and the environment, it also has uses in industry and agriculture.
Sheep are used in the production of alpha-1 antitrypsin, which is used in the treatment of emphysema. Goats are also producing the CFTR protein used in the treatment of cystic fibrosis. In the plant world, the buds of cotton plants are vulnerable to worm attacks. The

buds of a modified cotton plant resist these worms, resulting in increased cotton production. These gene insertions are ecologically safer than pesticides. They affect only the targeted pest.

Scientists today have developed genetically altered bacteria. Among them are strains of bacteria that eat up oil spills, manufacture alcohol and other chemicals, and process minerals. There is, however, concern about possible risks to the environment and the general population as genetically engineered bacteria are introduced. It is important to remember that recombinant DNA technology and genetic engineering have a great potential for research and application in medicine, agriculture, and industry. As with any new technology, the potential risks must be taken into account, including social, ecological, and environmental risks

SB3a Explain how photosynthesis and respiration cycle energy.

Photosynthesis	Cellular Respiration
Photosynthesis is a process wherein plants utilize sunlight to make food.	Cellular respiration is a process that converts this food into energy which is used by plants and other living organisms.
It takes place inside the chloroplasts, organelles inside the plant cells that contain chlorophyll.	It takes place inside the mitochondria, organelles capable of breaking down glucose.
Photosynthesis requires energy to produce glucose.	Cellular respiration uses this glucose to create energy (ATP).
It takes carbon dioxide, water and sunlight from the atmosphere to create sugar and releases oxygen back into the air.	It combines sugars with oxygen, releases the energy as ATP and carbon dioxide and water as by products.
Photosynthesis occurs in plants and some bacteria.	Cellular respiration occurs in all living organisms.

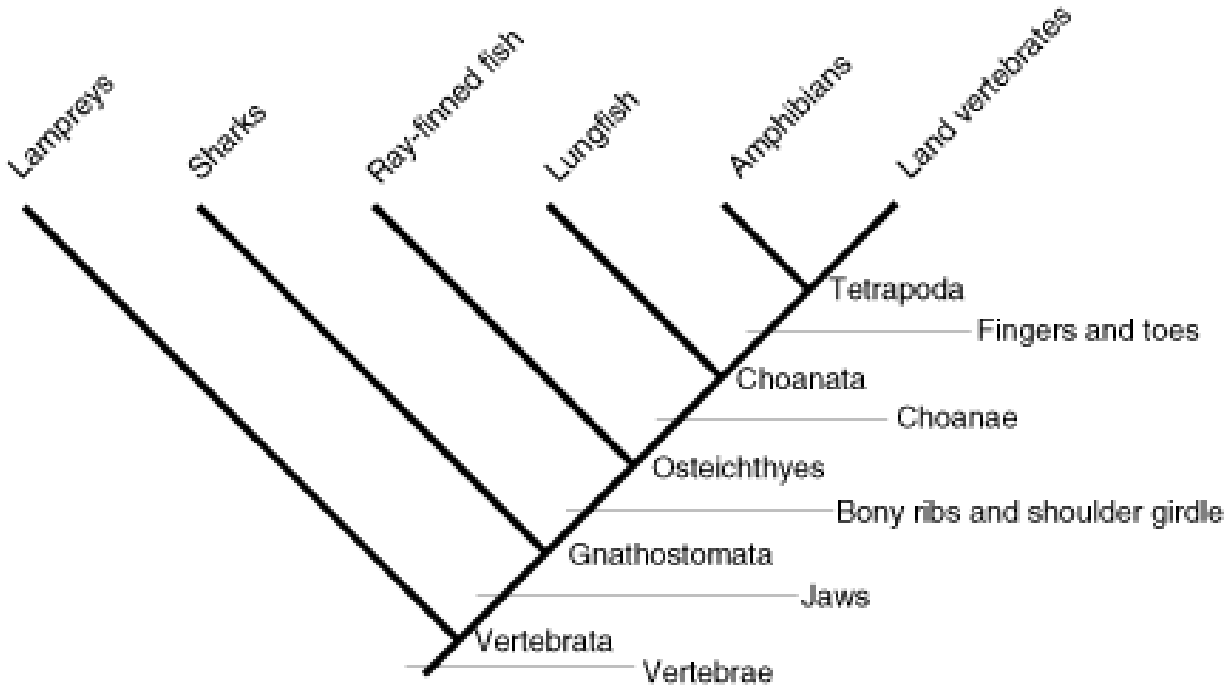


SB3b Compare the similarities and differences among the six kingdoms of life.

Six Kingdoms of Life

Kingdom	Cell type	Number of cells	Nutrition
Archaebacteria	prokaryotic	unicellular	autotrophy and heterotrophy
Eubacteria	prokaryotic	unicellular	autotrophy and heterotrophy
Protista	eukaryotic	unicellular and multicellular	autotrophy and heterotrophy
Fungi	eukaryotic	unicellular and multicellular	heterotrophy
Plantae	eukaryotic	multicellular	autotrophy and (rarely) heterotrophy
Animalia	eukaryotic	multicellular	heterotrophy

SB3c How has the modern classification system has changed and is now based on the evolution of those classified organisms?
Most of us are accustomed to the Linnaean system of classification that assigns every organism a kingdom, phylum, class, order, family, genus, and species. This system was created long before scientists understood that organisms evolved. Because the Linnaean system is not based on evolution, most biologists are switching to a classification system that reflects the organisms' evolutionary history. This phylogenetic classification system names only clades—groups of organisms that are all descended from a common ancestor. As an example, we can look more closely at reptiles and birds.



SB3d Compare and contrast viruses with living organisms.
Viruses are non-living microscopic particles that attack healthy cells within living things. They do not have the characteristics of living things and are not able to metabolize food. To metabolize means to change food energy into chemical energy that the body can use. Viruses are not alive, so they do not have a need for food like living organisms. Viruses do not have an organized cell structure. They are so light that they can float in the air or water, be passed on to other organisms if touched, and fit anywhere. The virus injects its own DNA structure into healthy cells where new virus cells grow.

SB4a How do different groups of living things affect one another?
Many organisms live together in extremely close relationships within an ecosystem. **Symbiosis** is the term for any biological relationship between organisms living in close association or direct contact with each other. These relationships play an important part of the community structure in ecosystems. There are three distinctly different types of symbiotic relationships depending on the nature of the benefits and costs to those organisms involved. **Mutualism** describes a case in which both organisms benefit from the association. **Commensalism** concerns an interaction that benefits one organism but does not harm the other. In **Parasitism**, one organism is dependent on another for its energy supply and usually harms its host or exists at its expense to some extent. The complex interplay of these relationships demonstrates the intricate nature of the interdependence of organisms within any environment. Abiotic factors also affect the different levels of life in an ecosystem as well. The climate is the biggest influence on the success of populations within communities of our biosphere.

SB4b Explain how energy and matter flow through an ecosystem

Energy flows from producers to consumers to decomposers. Decomposers recycle nutrients needed by plants to carry out photosynthesis. Producers make oxygen that is utilized for cell respiration in the breakdown of glucose. Energy flows from one trophic level to the next transferring only 10% of available energy to subsequent levels.

SB4c How do environmental conditions affect successional changes in ecosystems?
Ecological succession is the observed process of change or replacement in the frequency and distribution of species in an ecological community over time. Within any community some species may become less abundant over some time interval, or they may even vanish from the ecosystem altogether. Similarly, over some time interval, other species within the community may become more abundant, or new species may even invade into the community from adjacent ecosystems. Ecological succession may also occur when the conditions of an environment suddenly and drastically change. Forest fires, wind storms, and human activities like agriculture all greatly alter the conditions of an environment. These massive forces may also destroy species and thus alter the dynamics of the ecological community triggering competition for resources among the species still present.

SB4d List some human activities that pose threats to the environment.
CO_2 emissions from cars and industry
Overuse of pesticides and fertilizers
Deforestation
Depleting energy resources
Habitat Fragmentation

SB4e,f Relate plant and animal adaptations to survival in stressful environments.
Adaptations are the special characteristics that enable plants or animals to survive in a particular environment. An enhanced cuticle, which is a waxy covering, and needle like leaves prevent water loss. Spines and hairs will discourage predators (herbivores). Some very tall trees have developed ways of obtaining much needed additional support by forming buttressed roots, which grow out from the base of the trunk sometimes as high as 15 ft above the ground. These extended roots also increase the area over which nutrients can be absorbed from the soil. Animals adapt to abiotic (nonliving) and biotic (living) conditions in their environment. Camouflage is one common example of an adaptation. Animals' teeth (sharp or flat), feet (webbed, claws), bird's beaks (curved, short, long) are other features that have evolved over a long period of time, through the process of natural selection, and help the organism survive in its surroundings. Both plants and animals adapt constantly to changes in their environment.

SB5 Evaluate the role of natural selection in developing the Evolution Theory.
Natural Selection allows organisms best suited for an environment to survive and reproduce to increase those traits in the population. The rate of evolution depends on the rates of mutation, selection, and environmental change. Gradual changes that occur slowly over time allow a population to evolve. For example, If an agricultural plot is sprayed with a broad spectrum insecticide, a small percentage of the exposed insects may be immune to the spray and survive. Those survivors that were resistant to the spray can reproduce and increase that trait in the population.