

01: Introduction to Molecular Cell Biology

Key Terms

Molecular Biology is the study of the replication, transcription, & translation of genetic material within a cell. Manipulation of these processes is also known as molecular biology or recombinant DNA techniques.

Macromolecules- there are four main classes of macromolecules: lipids, proteins, carbohydrates, and nucleic acids.

Deoxyribonucleic acid (DNA)- double helix chains of paired bases containing thymine, cytosine, guanine, and adenine.

Ribonucleic acid (RNA)- the intermediate between DNA and proteins.

Proteins- chains of amino acids coded for by genes in the DNA.

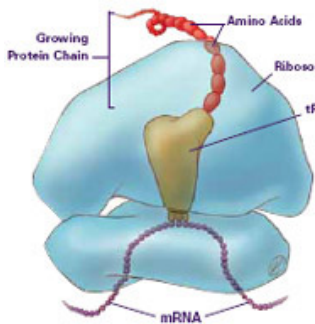
Carbohydrate: consist of hydrogen, oxygen and carbon. Glucose is the most important carbohydrate in biology.

Proteins: linear polymer the alpha carboxyl group of one amino acid links via a peptide bond to the alpha amino group of another amino acid.

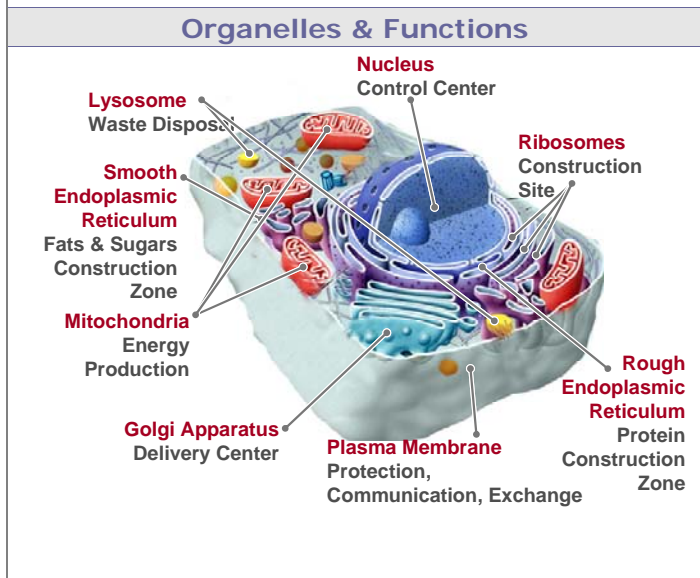
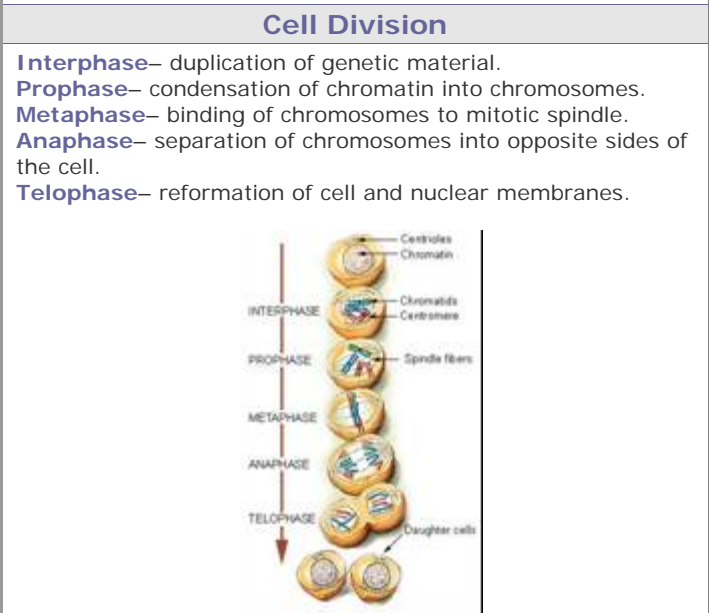
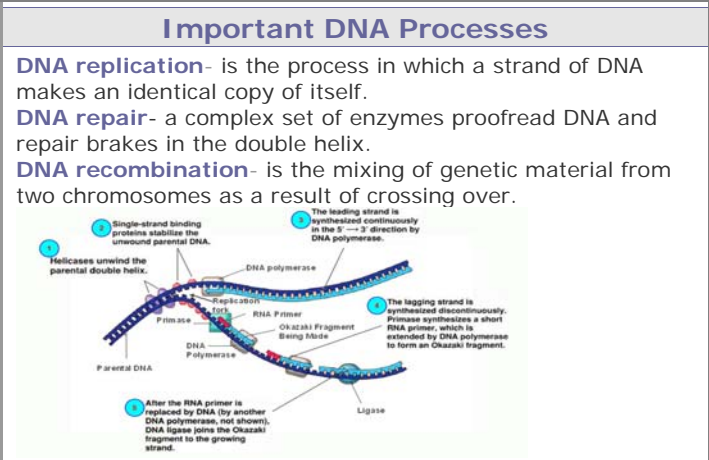
Lipid: amphiphilic having a large organic cation or anion and a long unbranched hydrocarbon chain.

Transcription & Translation

DNA is transcribed into mRNA. mRNA is translated via the ribosome, complexed with rRNA and tRNA, into a protein. A codon consists of three nucleotides that code for an amino acid in a protein.



| | U | C | G | A |
|---|--|--|---|--|
| U | UUU Phe UUC Phe UUG Leu UUA Leu | UCU Ser UCC Ser UCG Ser UCA Ser | UGU Cys UGC Cys UGG Trp UGA Stop | UAU Tyr UAC Tyr UAG Stop UAA Stop |
| C | CUU Leu CUC Leu CUG Leu CUA Leu | CCU Pro CCC Pro CCG Pro CCA Pro | CGU Arg CGC Arg CGG Arg CGA Arg | CAU His CAC His CAG Gln CAA Gln |
| G | GUU Val GUC Val GUG Val GUA Val | GCU Ala GCC Ala GCG Ala GCA Ala | GGU Gly GGC Gly GGG Gly GGA Gly | GAU Asp GAC Asp GAG Glu GAA Glu |
| A | AUU Ile AUC Ile AUG Met AUA Ile | ACU Thr ACC Thr ACA Thr ACG Thr | AGU Ser AGC Ser AGG Arg AGA Arg | AAU Asn AAC Asn AAG Lys AAG Lys |



Cytoskeleton Components

The cytoskeleton gives cells structure and is composed of three types fibers:

Actin- composed of actin polymers, important for cellular locomotion and contraction of muscle cells.

Microtubules- composed of tubulin polymers, important for vesicle motility and separation of chromosomes during cell division.

Intermediate filaments- composed of proteins such as keratin and lamin, important for cell adhesion and signaling.

Membrane Transport

Simple diffusion- passive transport down with rate determined by a molecules permeability, size, and concentration gradient

Facilitated diffusion- carrier protein mediated but does not use energy

Active transport- uses both carrier proteins and metabolic energy, can move molecules against an electrochemical gradient (i.e. uphill)

Cotransport - uses a carrier protein to move two molecules the same direction across a membrane without metabolic energy. One molecule (usually sodium) move "downhill" and the other "uphill"

Countertransport - uses a carrier protein to move two molecules the opposite direction across a membrane without metabolic energy

How to Use This Cheat Sheet: These are the keys related this topic. Try to read through it carefully twice then recite it out on a blank sheet of paper. Review it again before the exams.