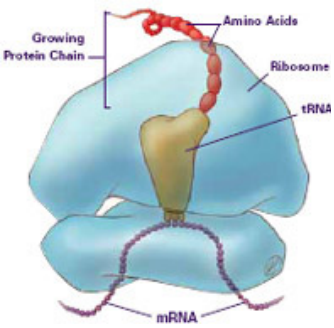
01: Introduction to Molecular Cell Biology

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.

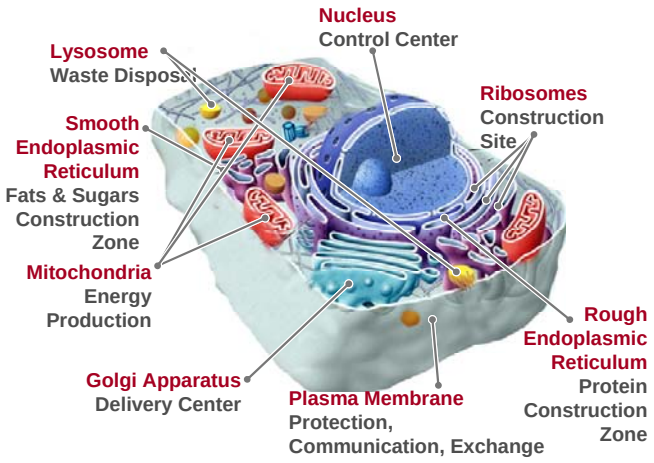
Transcription & Translation

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



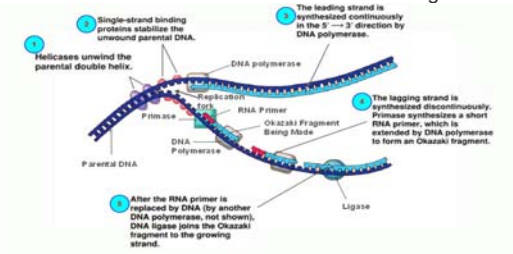
	U	C	G	A
U	UUU Phe UUC Phe UUG Leu UUA Leu	UCU Ser UCC Ser UCG Ser UCA Ser	UGU Cys UGC Cys UGG Trp UGA Stop	UAU Tyr UAC Tyr UAG Stop UAA Stop
C	CUU Leu CUC Leu CUG Leu CUA Leu	CCU Pro CCC Pro CCG Pro CCA Pro	CGU Arg CGC Arg CGG Arg CGA Arg	CAU His CAC His CAG Gln CAA Gln
G	GUU Val GUC Val GUG Val GUA 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

Organelles & Functions



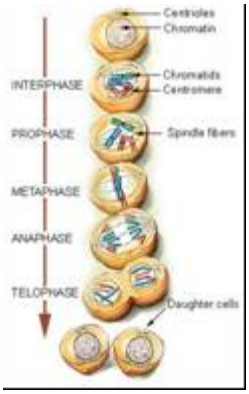
Important DNA Processes

DNA replication- is the process in which a strand of DNA makes an identical copy of itself.
DNA repair- a complex set of enzymes proofread DNA and repair brakes in the double helix.
DNA recombination- is the mixing of genetic material from two chromosomes as a result of crossing over.



Cell Division

Interphase– duplication of genetic material.
Prophase– condensation of chromatin into chromosomes.
Metaphase– binding of chromosomes to mitotic spindle.
Anaphase– separation of chromosomes into opposite sides of the cell.
Telophase– reformation of cell and nuclear membranes.



Cytoskeleton Components

The cytoskeleton gives cells structure and is composed of three types fibers:
Actin– composed of actin polymes, important for cellular locomotion and contraction of muscle cells.
Microtubules– composed of tubulin poymers, important for vesicle motilty and separation of chromosones 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.