Bonds and Polarity

electronegativity	atom's attraction for electrons in a covalent bond (higher when atom more strongly pulls shares electron towards oneself)
polarity	*polar* when electrons are shared unequally because an atom is more electronegative
hydrogen bonds	form when H covalentaly bounds to electronegative atom is also attracted to another electronegative atom -- electronegative partners are usually O or N in living cells

Mendel and the Gene

phenotype	outward appearance
genotypes	allele combination
progeny	descendant, offspring
Complete dominance	dominant allele masks recessive allele
incomplete dominance	blending of phenotypes ie pink flower from red and white

Mendel and the Gene (cont)

codominance	two dominant alleles affect the phenotype in distinct, separate ways
epistasis	traits determined by two or more genes, one gene can alter phenotypic expression of gene at separate locus

polar covalent bonds in water

- polar due to electronegativity of oxygen
- uneven distribution of charge
- polarity allows water molecules to form
hydrogen bonds

Properties of Water

Cohesive behaviour	bring water up roots of plants, surface tension
ability to moderate temperature	high specific heat capacity due to hydrogen bonds
expansion upon freezing	ice is less dense than water, floats
versatility as a solvent	polar dissolves polar

Isomers

structural	different covalent arrangements
Cis-Trans	same covalent bonds, differ in spatial arrangements
enantiomers	mirror images of each other

microscopy

light microscope	most used in laboratories today
scanning electron miscroscope	useful for studying the topography of a specimen
transmission electron microscope	used to study internal structure of cells

Inheritance of Diseases (memorize)

Autosomal Dominant: huntington disease, achrondoplasia

Autosomal Recessive: Cystic fibrosis, Tay-Sachs, Sickle cell anemia

X-Linked Recessive: colour blindness, Duchenne muscular dystrophy, Hemophilia

Carbohydrates

- sugars and polymers of sugars
- usually made from multiples of CH2O

Carbohydrates (cont)

- built from *monosaccharides*

Lipids

- does not form polymers
- *hydrophobic*
- mostly non-polar (hydrocarbons)
- includers fats, phospholipids, steroids

Proteins

- made from *amino acid chains* that are
joined from *peptide bonds* (carboxyl
group to amino groups)
- catalyze rxns, structure support,
transport, defense, movement

water molecule is released each time a peptide bond is formed (dehydration synthesis)

Phospholipids

- hydro**phil**ic head
- hydro**phob**ic tail
- amphipathic (having hydrophilic and phobic
parts
- spontaneously self-assemble into bilayer
when added to water

sickle cell anemia

- crescent shaped exterior
- abnormal interactions with other sickle-cells reducing capacity to carry oxygen

plants and some algae

sporophyte	diploid cell that makes haploid spores by meiosis
gameto-phyte	a haploid that spores grow into via mitosis

- haploid cells grow by mitosis into haploid multicellular organisms
- haploid adults produce gametes by mitosis

amino acid types

hydrop-hobic	carbon rich side chains(in many membrane bound proteins)
hydrop-hilic	hydrogen bonds
charged	work well with oppositely charged amino acids or other molecules

endosymbiont theory

modern eukaryotic cells evolved from prokaryotic cells that were engulfed by bigger prokaryotic cells. consistent with theory that all organisms arose from a single common ancestor

other cell structures

peroxisome	contain enzymes that remove hydrogen atoms from various substrates and transfer them to oxygen
centro-somes and centrioles	help organize microtubule assembly in animal cells

dna replication

SSB Proteins	keeps dna from coming apart (reannealing)
topois-omerase	prevent dna from uncoiling
helicase	breaks apart the hydrogen bonds to separate the DNA strands
DNA polymerase	replicates DNA to build a new one
Ligase	puts together the DNA strands
primase	builds primers (made of RNA) for polymerase to build on
okazaki fragments	sequences of DNA neucleotides on the lagging strand that will later be bonded together by ligase

the nucleus

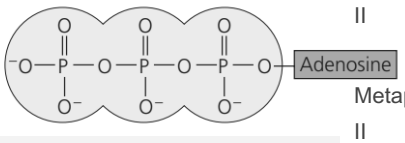
basic functions	contains most of cell's genes
nuclear envelope	double membrane, each membran consists of a lipid bilayer
nuclear pores	regulate entry and exit of molecules
nuclear lamina	maintains shape of nucleus (composed of protein filaments)

endoplasmic reticulum

smooth	synthesis lipids, metabolize carbohydr-ates, detoxifies poisons, stores calcium ions
rough	site for protein synthesis, produces transport vesiclres that distribute lipids and proteins to other components of the system

- accounts for half of total membrane in the cell
- continuous with nuclear envelope

ATP



golgi apparatus and lysosomes

gogli apparatus	processes and modifies proteins from ER to ship to target locations
lysosomes	compartment of enzymes, hydrolyzes proteins, fats, polysaccharides, nucleic acids, work best in acidic environments

meiosis cell cycle

prophase I	chromosomes condense, crossing over (synapsis) takes place
metaphase I	tetrads align in center of the cell
anaphase I	chromosome migrate to opposite sides, chromatids are still joined by centromeres
telophase I	cytokinesis occurs, two daughter haploid cells are formed
prophase II	chromosomes move towards center
Metaphase II	chromosomes aligned at center, centromeres facing opposite directions
anaphase II	chromatids separated, move towards poles

meiosis cell cycle (cont)

telophase II	cytokinesis divides into four nuclei, nuclear membrane develops, four daughter cells or gametes are produced

whole process ends with four haploid daughter cells

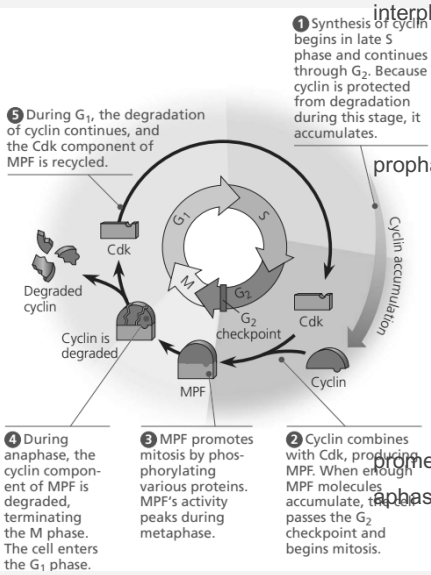
Abnormal Chromosome numbers

Aneuploidy	when nondisjunction occurs in the fertilization of gametes
monosomic zygote	zygote only has one copy of a particular chromosome
trisomic	zygote has three copies of a chromosome (down syndrome)

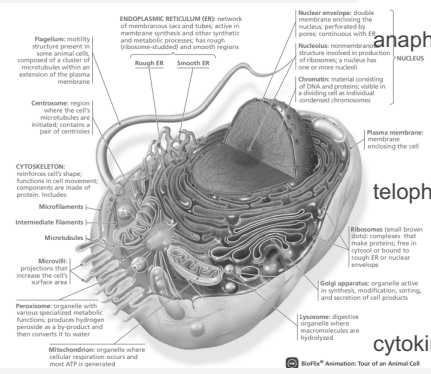
Aneuploidy of Sex Chromosomes

XXX	healthy, no unusual physical features
XXY (klinefelter syndrome)	extra X chromosome in males
Monosomy (turner syndrome)	produces XO females who are infertile

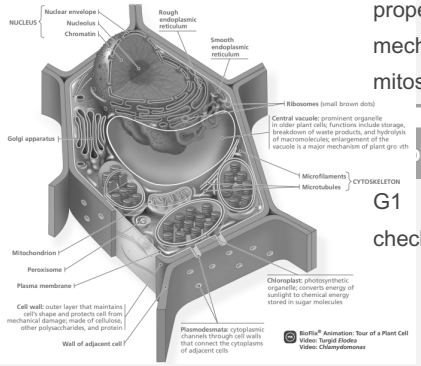
cell cycle clock



animal cell



plant cell



cell cycle in mitosis

interphase	centrosomes have formed, chromosomes aren't seen clearly
prophase	chromosomes condense, mitotic spindle starts to form, microtubules lengthen moving centrosomes away from each other
prometaphase	nuclear envelope fragments, kinetochore formed on centromeres
metaphase	chromosomes align in the center of the cell
anaphase	chromosomes are split and sister chromatids move to opposite poles
telophase	fibers disappear and membrane reforms around each set
cytokinesis	cleavage of cell and its contants divide into 2

cancer occurs when cells don't properly respond to control mechanisms (uncontrolled mitosis)

hases of interphase

G1 checkpoint	growth phase: can continue on to other phases once receives go ahead at this stage

subphases of interphase (cont)

S phase	duplication of DNA
cyclins and cyclin-dependent Kinases (Cdk)	always present but fluctuate during cell cycle based on concentrations of cyclin
G2	final subphase, more growth and protein synthesis
Maturation promoting factor (MPF)	cyclin-Cdk complex that triggers cell passage past G2 phase into M phase
M checkpoint	won't enter anaphase unless chromosomes are all attatched to spindle microtubules at kinetechores, may delay anaphase to ensure daughter cells receive correct # of chromosomes

cells grow in all three subphases of interphase but chromosomes are only duplicated during S phase

Sources of genetic variation

- crossing over during prophase I
- independent assortment of chromosomes
- Random fertilization

Mutations

nondis-junction	problem during meiosis that results intoo mayn or too few chromosomes: *down syndrome (trisomy)*
deletion	portion of chromo-somes are lost, caused by viruses or chemicals
duplic-ation	gene sequence is repeted one or more times within one or more chromosomes
inversion	certain gene segments become free and then are reversed
transl-ocation	part of the chromosome changes places with another part

DNA features

nucleotide	phosphate group, 5 carbon sugar, nitrogenous base
nitrog-enous base	adenine, guanine, thynine, cytosine

DNA features (cont)

phosphate group between 5' and 3'	deoxynucleotides
phosph-odiester bonds	phosphate group of one nucleotide bonds to the 3/ oxygen of another nucleotide
5' to 3'	on top (watson), runs 3' to 5' on bottom(crick)
bonds between the two strands	non covalent hydrogen bonds with compli-mentary base (base pairs)
pyrimi-dines	thynin and adenine, single ring structure
purines	guanin and cytosine, double rings

- 2 types of nucleic acids (DNA and RNA)
- DNA provides directions for its own replication
- DNA, RNA, protein

nondisjunction