

Bonds and Polarity electronegativity atom's attraction for electrons in a covalent bond (higher when atom more strongly pulls shares electron towards oneself) polarity <i>polar</i> when electrons are shared unequally because an atom is more electronegative	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	Isomers structural different covalent arrangements Cis-Trans same covalent bonds, differ in spatial arrangements enantiomers mirror images of each other	Carbohydrates (cont) - built from <i>monosaccharides</i> Lipids - does not form polymers - <i>hydrophobic</i> - mostly non-polar (hydrocarbons) - includes fats, phospholipids, steroids
hydrogen bonds form when H covalently bonds to electronegative atom is also attracted to another electronegative atom -- electronegative partners are usually O or N in living cells	polar covalent bonds in water - polar due to electronegativity of oxygen - uneven distribution of charge - polarity allows water molecules to form hydrogen bonds	microscopy light microscope most used in laboratories today scanning electron microscope useful for studying the topography of a specimen transmission electron microscope used to study internal structure of cells	Proteins - made from <i>amino acid chains</i> that are joined from <i>peptide bonds</i> (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)
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	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	Inheritance of Diseases (memorize) Autosomal Dominant: huntington disease, achondroplasia 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 CH ₂ O	Phospholipids - hydrophilic head - hydrophobic 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 nucleotides 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)

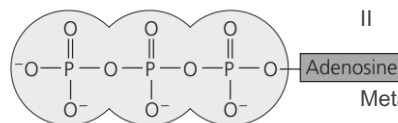
endoplasmic reticulum

smooth synthesis lipids, metabolize carbohydrates, detoxifies poisons, stores calcium ions

rough site for protein synthesis, produces transport vesicles 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

golgi 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)

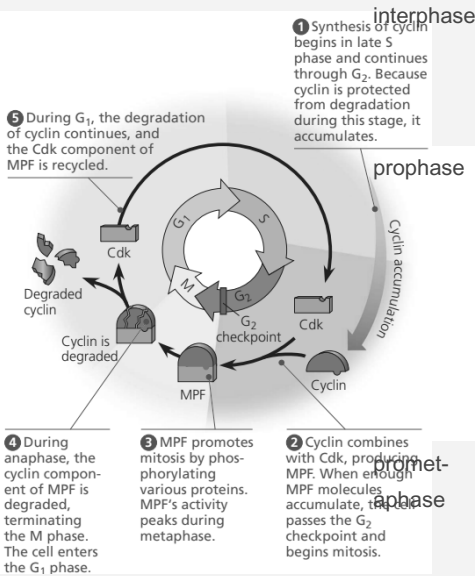
Aneuploidy of Sex Chromosomes

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



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 contents divide into 2

subphases of interphase (cont)

S phase duplication of DNA

G₁ final subphase, more growth and protein synthesis

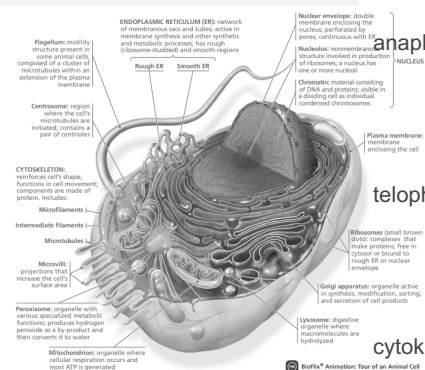
G₂ final subphase, more growth and protein synthesis

Maturation promoting factor (MPF) cyclin-Cdk complex that triggers cell passage past G₂ phase into M phase

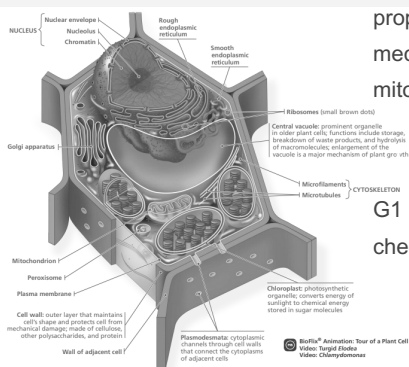
M checkpoint won't enter anaphase unless chromosomes are all attached to spindle microtubules at kinetochores, may delay anaphase to ensure daughter cells receive correct # of chromosomes

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

animal cell



plant cell



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

phases of interphase

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

Sources of genetic variation

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

Mutations

nondisjunction problem during meiosis that results into many or too few chromosomes:
down syndrome (trisomy)

deletion portion of chromosomes are lost, caused by viruses or chemicals

duplication gene sequence is repeated one or more times within one or more chromosomes

inversion certain gene segments become free and then are reversed

translocation part of the chromosome changes places with another part

DNA features

nucleotide phosphate group, 5 carbon sugar, nitrogenous base

nitrogenous base adenine, guanine, thymine, cytosine

DNA features (cont)

phosphate group between 5' and 3'

phosphodiester 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 complementary base (base pairs)

pyrimidines thymine and adenine, single ring structure

purines guanine and cytosine, double rings

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

nondisjunction

