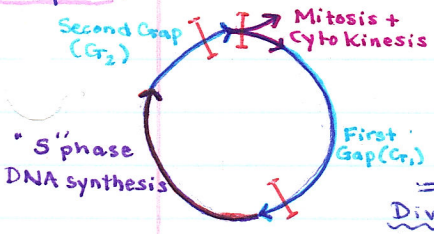
Biology 121: Midterm #1

Chromosomes: Holds DNA to encode for hereditary traits. A gene is a subunit of DNA.
"Unreplicated": single long DNA wrapped around proteins (double helix) "Replicated" two copies of same chromosome → sister chromatids.

Cell cycle:



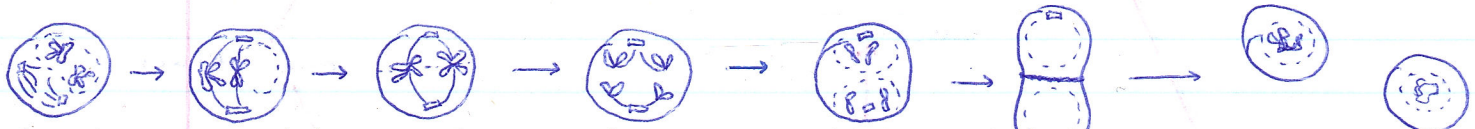
Interphase - DNA found within the nucleus associated with proteins called histone. Material is called chromatin (uncondensed) cell is either growing and preparing to divide or is fulfilling cell function.
- G_1 → organelles replicate, cytoplasm increased.
- S phase → DNA is replicated
- G_2 → grows more, prepares for mitosis.

= **Division** - Mitosis and cytokinesis to form two new cells.

Monohybrid = between heterozygous alleles 3:1 phenotypic
Dihybrid = between two heterozygous alleles. 9:3:3:1 phenotypic

*Proteins needed for mitosis: cohesins is large ring of proteins to hold sister chromatids together. Codeasin is used to condense chromosomes.

Mitosis: 5(4) subphases; prophase → prometaphase, metaphase, anaphase, telophase.



prophase: chromosomes condense, spindle apparatus begin to form.
prometaphase: Nuclear envelops break down Microtubules contact chrome.
metaphase: line up in the middle.
Anaphase: Sister chromatids seperate to poles
telophase Nuclear env. reforms. Spindle apparatus disintergrate.
CytoKinesis: Actin myosin causes plasma membrane to pinch. Cell division is complete. ($2n \rightarrow 2n$)

Definitions: Kinetochores = where microtubules attach to sister chromatids. Centrioles: Bundle of microtubules. Mitosis-promoting factor (MPF) = induces mitosis in all eukaryotes - Cyclins - trigger. Cdk - catalyses. Builds up during interphase. Negative feedback. Shuts down by complex activated by mitosis.
G_1 check point: Check size, enough cytoplasm, organelles. Nutrients must be sufficient, social signals are present. DNA must be undamaged. p53 = tumour suppressor.
G_2 check point: Chromosome have replicated successfully, DNA is undamaged, activated MPF is present.
Metaphase checkpoint: chromosomes are attached to spindle fibers.
*Oncogene → stimulates cell division because it codes for a protein.
Cancer: caused by cells that divide uncontrollably, invade neighboring tissues, spread. cell-cycle checkpoint fails. proteins required for cell growth is active when it should not be, or a defect that prevents tumor suppressors.
• Benign → mass of cells, noncancerous, non-invasive, grows slow or fast • Malignent → cancerous, invasive.
Cells become cancerous when social controls fail. Cells can't die without the go-ahead. Not in best interest of organism.

Meiosis: At the start same state as mitosis. Chromosomes replicate = two identical sisters!!!
Homologous chromosomes (Not identical) Tetrad = homologous chromosomes that are joined together.
*Replicated or unreplicated = both consist of single chromosome.

Steps
1. **Interphase**: Chromosomes replicate / sister chromatids.

1. **Early Prophase I**: condense, synapse homologs
2. **Late Prophase I**: crossing over.
3. **Metaphase I**: migrate to middle
4. **Anaphase I**: Homologs seperate
5. **Telophase I + CytoKenisis**: cell divides.
6. **Prophase II**: Spindle apparatus forms
7. / 8. **Metaphase II**: Meet in middle
Anaphase II: Sister chromatids seperate.

*Homologous chromosome pair in meiosis not mitosis.
Crossing over: complex of proteins cut and reattach pieces of chromosomes to adjacent homologs. Some proteins are required for holding, cutting and glueing.
Independant Assortment: Homologous chromosomes (paternal + maternal) seperate randomly and independantly of each other during meiosis. Variety of combinations.
Crossing over → results in genetic recombination, new combinations of alleles within a chromosome that did not exist in either parent.
Nondisjunction: Both homologs or both sister chromatids move to the same pole. product is abnormal (trisomy, monosomy).

Mendel and The Gene
1. **Principle of segregation**: two members of each gene pair must seperate into different gamete cells during the formation of egg and sperm. One allele of each gene.
2. **Principle of independent assortment**: alleles of different genes are transmitted independently of one another. *on non-homologous chromosomes.

Linked Gene: Do not assort independently: inherited together but crossing over violates that
Non-Mendelian Ratios: • incomplete dominance → blending in heterozygotes (mixed)
• codominance → see product of both alleles in heterozygote (black + white)
*Phenotypes depend on (1) the individual's genotype and (2) physical surroundings.
Definitions: Multiple allelism → more than two allele located on a locus
Polymorphism → two or more phenotypes associated with a single gene are present. Pleiotrophy → A single allele affects many traits. Gene-by-Gene interaction → In discrete traits, phenotype associated with an allele depends on which alleles are present at another gene. Gene-by-environment interaction → Phenotype influenced by environment (Same genotypes can be associated with different phenotypes) Polygenic inheritance of quantitative traits → Many genes are involved in specifying traits that exhibit continuous variation.
Pedigrees (if males are much more likely to have a trait in question than females are, than the allele responsible is likely to be x-linked recessive. y-linked genes inheritance is rare because so few genes occur on Y chromosome. Apperance of X-linked recessive traits skip a generation in pedigrees. More affected females that males is a good indication of a x-linked dominant

Result

haploid!!!...