Chapter 11: Introduction to Genetics

- Notes

11-1 The Work of Gregor Mendel

- Genetics: The branch of bio that studies heredity
- Heredity: The key difference between species. This is what makes us humans, cats cats, and dogs dogs.

I. Gregor Mendel (1822) – "Father of Genetics"

- A. Self-Pollination
  - 1. Mendel studied pea plants.
  - 2. Pea plants have both male and female parts in their flowers so they self-pollinate.

- B. Cross-Pollination
  - 1. Mendel cut the male parts off of some plants and took pollen from other plants – cross pollination.
  - 2. Mendel was able to cross plants with different characteristics.

- Purebred
  - 1. The self-pollinating peas were purebred. They produced offspring that were identical to themselves.

- D. Traits
  - 1. Traits are the characteristics of something.
  - 2. Mendel noticed all of the plants were either short or tall.

II. Genes & Dominance

- Hybrids
  - Mendel decided to cross tall/short, round/wrinkled, yellow/green seeds.
  - When these plants produce seeds, he then planted them – these are called hybrids

B. Mendel's Conclusions

- To his surprise, the tall/short crosses did not grow to be medium size plants.
- This is when Mendel said there are factors that control traits called genes.
  - Alleles- different forms of a gene

  Ex. The gene for plant height occurs in tall and short form.

3. Mendel's 2nd conclusion

- He said some alleles are dominant while others are recessive
- Recessive alleles are not present when a dominant allele is.
- Mendel concluded that tall and yellow alleles were dominant and short and green were recessive.

III. Segregation

-Mendel wanted to know what happened to the recessive genes so he started breeding them but named them to keep them straight.

- P generation-referred to as the purebreds
- F_1 generation- referred to as the first generation of plants produced by cross-pollination

C. F_2 generation- these were the offspring of the F_1 generation

D. Segregation- often many crosses Mendel saw the recessive alleles appear. He questioned the segregation

E. Punnett Square-Mendel came up with this to describe what plants would appear.

F. Phenotype- physical characteristics

G. genotype- genetic makeup

H. homozygous- homo=same; organism with identical alleles

I. heterozygous- hetero=different; organism with different alleles

Punnett Square Examples

- Example – cross heterozygous tall plants – what are the genotypes and phenotypes?

- Show example on board

- Example – cross a homozygous short plant with a heterozygous tall plant – what are the genotypes and phenotypes?
- Show example on board.

IV. Independent Assortment

- Random segregation of different genes.
  - A. Two-Factor Cross
    - 1. In this cross, the two kinds of plants would look like this:

    - Round Yellow Seeds RRYY
    - Wrinkled Green Seeds rryy

V. Summary of Mendel's Work

- A. The factors that control heredity are individual units known as genes. In organisms that reproduce sexually, genes are inherited from each parent.
- B. In cases in which 2 or more forms of the gene for a single trait exist, some forms of the gene may be dominant & others may be recessive.

- C. The 2 forms of each gene are segregated during the formation of reproductive cells.
- D. The genes for different traits may assort independently of one another.

11-2 Applying Mendel's Principles
I. Genetics & Probability

- Probability- the likelihood that a particular event will occur

  Ex. Flipping a coin, winning lotto, boy or girl

  1. Genetics is like probability- the larger the # of organisms examined, the closer the # will get to the expected

II. Using the Punnett Square

- One-factor Cross

ex. Cross TT x Tt

-what are the geno/phenotypic ratios?

**write example on board

B. Two-Factor Cross

Green pods (G)smooth pods (N)

Yellow pods (g)constricted pods (n)

Ex. Cross a heterozygous for both traits with a plant that has yellow constricted pods. What are the geno/phenotype?

GgNn x ggnn

11-4 Meiosis

This section discusses the formation of gametes. Last year you discussed mitosis (process in which the nucleus of a cell is divided into two nuclei, each with the same number and kinds of chromosomes as the parent cell). Now we will talk about meiosis.

I. Meiosis

- Chromosome Number

1. Drosophila melanogaster (fruit fly) has 8 chromosomes; 4 from mom and 4 from dad
2. homologous- corresponding chromosome- each chromosome in the male has a corresponding female chromosome

3. diploid- a cell that contains both sets of homologous chromosomes (one set from each parent)

(2n) fruit flies 2n=8

4. haploid- cells that contain a single set of chromosomes (n)

fruit fly n=4

- In order to only have ½ the chromosomes a process must take place-meiosis

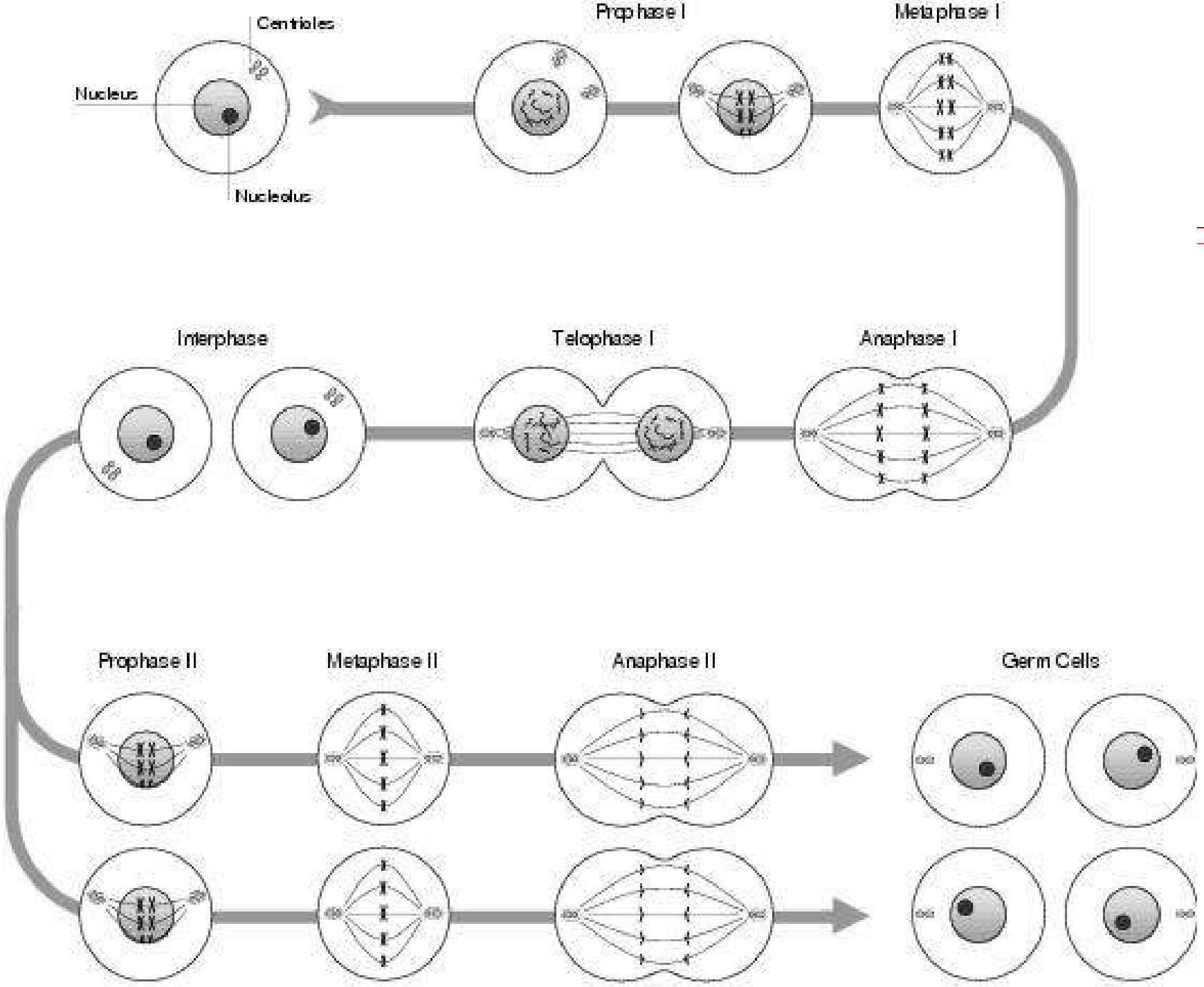
The Process of Meiosis – making of sperm & egg; only occurs in sex cells

- Meiosis I – DNA Replication
  - Looks like Mitosis
  - Purpose of Meiosis – production of haploid gametes.
  - Prophase I – Homologous chromosomes pair off, forming tetrads and crossing over occurs.
  - Metaphase I – Tetrads line up in the middle of the cell.

- Anaphase I – Cell divides the tetrads and moves the chromosomes to opposite ends.
- Telophase I – Wall (plant) or membrane (animal) forms between the cell's two ends. The result is two haploid cells.

Meiosis II

- Same as Mitosis except the parent cell is haploid. Refer to pages 276,277 & 246-247.


Centrioles
Nucleus
Nucleolus
Prophase I
Metaphase I
Interphase
Telophase I
Anaphase I
Prophase II
Metaphase II
Anaphase II
Germ Cells

C. Meiosis vs. Mitosis

Meiosis

- Begins with diploid but ends with 4 haploid cells
- Cells are genetically different
- Occurs only in sex cells

Mitosis

- Results in genetically identical cells
- Begins with a diploid cell and result in 2 diploid daughter cells