Chp 10 Notes Pg 216-229

Terms = *

*Hereditary: Transmission of genetic information from parent to offspring.

Gregor Mendel-
- Monk
- Bred Pea Plants
    - Several Advantages
        - Easy to grow
        - Many varieties
        - Available through commercial resources
- Began experiments in 1856

His principles of segregation and independent assortment became foundations of genetics.

*Hybrid: Offspring of two genetically dissimilar plants.

In his Experiments:
- Two main facts about inheritance were widely recognized
    - All hybrid plants that are offspring of the same kind of parents are similar in appearance.
    - When these hybrids are mated to each other, they do not breed true.

*Phenotype: Refers to the physical appearance of an organism.

Process of Mendel's breeding.
1. Worked on developing genetically pure (true-breeding) lines.
    a. True-breeding line produces only offspring expressing the same phenotype.
2. Chose characteristics of his pea plants, which could be studied most easily.
    a. Yellow vs. green seeds
    b. Round vs. wrinkled
    c. Green pods vs. yellow pods
    d. Tall vs. short
3. Finally, Began his experiments by crossing plants from two different true-breeding lines with contrasting phenotypes. (These pure individuals are P generation)
4. Every case, members of first generation of offspring looked alike and resembled one of two parents. (F1 generation)
5. Cross between the F1 Generation is called F2 generation.

-Dominant traits mark recessive ones when both are present in the same individual

*Alleles- alternative forms of a gene
- Govern variations of the same feature (yellow vs. green seed color)

Mendel's principal of segregation states that in order for sexual reproduction to occur, the two alleles carried by an individual parent must become separated.
- Thus each sex cell contains only 1 allele of each pair.
- Benefits because alleles remain intact and can re appear in F2 generation

*Locus- coined to designate the location of a particular gene on the chromosome.

*Monohybrid cross- inheritance of two alleles of a single locus is studied.

Homozyous- two alleles carried are identical
Heterozygous- two alleles carried are different for this locus.

Example:

Guinea Pigs

Black Female BB and Brown Male bb

Gamete: B for the Female BB & gamete b for the male bb makes the F1 generation all (Bb) black.

F2 generation showed below:

	½ B	½ b
½ B	¼ BB (black)	¼ Bb (black)
½ b	¼ Bb (black)	¼ bb (brown)

If above doesn't make sense; look at diagram on pg 221.

Punnett square predicts- rations of genotypes and phenotypes of the offspring of a cross.

Phenotype of an individual DOES NOT always reveals its genotype.

- Genotype- Genetic constitution of that organism, most expressed by its symbols.

Guinea pigs with the genotypes BB and Bb are alike phenotypically with black coats, how can know the exact genotype?
Answer: Test cross: which an individual of unknown genotype is crossed with homozygous recessive individual.

The Rules of Probability Predict the Likelihood of Genetic Events

- To figure out the probability of a specific genotype in a pundit square, multiply the odds of having one allele from the mother and the other from the father together. For example, a 50% chance of allele B from the father and 50% chance of allele b from the mother means that the odds of Bb is 25% (.5 x .5)
- To find out the probability of mutually exclusive genotypes (meaning that if one occurs, the other cannot), add up the probabilities. If both parents are Bb genotypes, the odds of a child that also has a Bb genotype is 50%, which comes from two different allele combinations- one where the dominant allele comes from the father and another where it comes from the mother, each of which has a 25% chance of happening.

Dihybrid crosses- Two different traits are examined in terms of dominance and recessiveness. (BbSs instead of simply Bb or Ss). Pundit squares are 16 instead of 4.

- In a dihybrid cross, it is assumed that traits don't go together (a parent won't have two gametes, one with Bb and no S and the other with Ss and no B- each one will have a combination of 1 B and 1 S)

- In a dihybrid cross with two parents who are heterozygous for both traits (BbSs), there are four genotypes- displaying both dominant traits, displaying one dominant and one recessive (two different ways since there are two different traits, of course) and displaying both recessive traits. The respective ratio for that (out of 16) is 9:3:3:1.

Linked Genes

- Some traits just link together and tend to be found together (blonde hair and blue eyes, for example).
- This happens due to linked genes; that is, the loci of the allele for both of these traits are close to one another.
- Unit used to measure distance on a gene from one allele to another- map unit.
- The closer alleles are to one another on a gene, the more "linked" they are due to the fact that they are more likely to stay together during the recombination process. (See cross-over)

Cross-Over

- During meiosis, chromatids of homologous chromosomes "switch" from one to the other. In other words, a piece of one chromosome switches with a piece from its homologous partner before meiosis finishes.
- In this way, the DNA of your mother and of your father and spliced together in the DNA that will reach your offspring.
- It furthers diversity

Sex Chromosomes

- There is almost always a gene that determines the sex of an animal. While it varies from animal to animal, they share the general trait. These chromosomes are known as the X and Y chromosome.
- Mammals generally have an X and a Y chromosome where the Y chromosome (or lack thereof) determines whether or not the mammal is male.
- Some organisms (such as plants) are hermaphroditic. That is, they have the reproductive organs of both sexes rather than just one.

X-linked traits

- Traits that are found only in the X chromosome
- Because they are not found in the Y chromosome, men who have the trait from their mother's X chromosome will always display it.
- Example- Color blindness: a woman would need two X chromosomes with the trait for colorblindness, while a man would simply need his one X chromosome to display it.
- X-linked traits are recessive

Dosage Compensation Equalizes the expression of X-linked genes in males and females

- Dosage compensation is a mechanism that makes the two doses in the female and the single dose in the male equivalent
- It involves inactivation of one of the two X chromosomes in the female
- During interphase a dark spot of chromatin (Barr Body) is visible and it is inactive
- Because only one X chromosome is active in any one cell and because X chromosome inactivation is a random event, a female mammal that is heterozygous at an X linked locus expresses one of the alleles in about half her cells and the other allele in the other half
- This may cause variegation in which there are patches of one coat color in the midst of areas of the other coat color

Sex-influenced genes are autosomal but their expression is affected by the individual's sex

- Certain sex influenced traits are inherited through autosomal genes, but the expression of alleles at these loci can be altered or influenced by the sex of the animal; therefore males and females with the same genotype with respect to these loci may have diff. phenotypes
- Pattern baldness is an example of this

Incomplete Dominance

- Instead of dominant or recessive traits showing up, neither allele is dominant or recessive so you get intermediate phenotype
- Ex. Pink flowered plants (incomplete dominance from red plants and white plants)

Co-dominance

- Where both alleles are expressed in phenotypes (both are kind of dominant)
- Ex: white horse and a brown horse would produce an offspring that has a roan coat where both white hair and brown hair is present but they're so finely intertwined that it looks caramel

Multiple Alleles

- If three or more alleles for a given locus exist within the population, we say the locus has multiple alleles
- Ex: Blood group ABO

A single gene may affect multiple aspects of the phenotype

- Most genes probably have many diff. effects, a quality known as pleitropy
- Ex: individuals who are homozygous for the recessive allele that causes cystic fibrosis produce abnormally thick mucus in many parts of the body including lungs, pancreas, stomach, and reproductive organs
- Epistatis: different genes interact to form a different phenotype (where two genes depend on each other to produce desired outcome)
- Ex: albinism

Polygenes act additively to produce a phenotype

- The term polygenic inheritance is applied when multiple independent pairs of genes have similar and additive effects on the same characteristic
- Polygenes are responsible for the inheritance of skin color in humans because alleles representing three to four different loci are involved in determining skin color
- Additive affect: adding more alleles makes the affect stronger
- A person who has AABBCC has the darkest skin color and the person who has aabbcc has the lightest skin color

Inbreeding

- Two similar individuals mate
- The strain may become homozygous for multiple undesirable traits
- Human inbreeding increases the frequency with which otherwise very rare genetic disorders are observed to occur in the population
- Causes inbreeding depression
    - Most things we have in us that are bad are recessive so if a brother and sister marry and have a child, the child has a high chance of getting the diseases since it would have a high chance of having homozygous recessive traits

Outbreeding

- Two different individuals
- Much better adapted for survival
- Hybrid Vigor:
    - Hybrid offspring are very fit since they have a better chance of avoiding homozygous traits
    - Hybrid vigor occurs due to heterozygotec advantage which means that if you have one of each allele (one dominant and one recessive) you're adapted to function over a wide variety of surroundings

Example of heterozygote advantage is sickle cell anemia.