Biology Chapter 8 notes

Principles of Genetics

I. Gregor Mendel (The father of modern genetics)

A. Gregor Mendel was a monk in a monastery in Czechoslovakia. (1822-1884)

B. Mendel released his report on genetics in pea plants in 1866

C. Mendel worked with traits in pea plants because the reproduced quickly and he could easily maintain a large number of one species to study

1. There are no ethical limitations involved in crossing pea plants

D. Mendel crossed round and wrinkled plants and short and tall plants

E. The results of Mendel's experiments

1. Round and a wrinkled were crossed (parent cross)

2. The offspring were all round (first filial or also called the f_1 generation)

3. Mendel then crossed the all round seeds from the first cross

4. The result of this cross was a three round to one wrinkled ratio (second filial, or the f_2 generation)

5. Mendel noted that the round trait was <u>dominant</u> to the wrinkled trait.

6. The wrinkled trait was called the <u>recessive</u> trait because it was masked over by the dominant.

F. Mendel's hypothesis

1. For every characteristic there must be a pair factor

a. One trait came from the sperm and one from the egg. These traits are now called genes.

b. Mendel reasoned that genes separate during gamete formation. (We now call this process meiosis)

II. Terms

A. Parental Cross- Cross between original parents (Where study starts)

B. First filial or F_1- result from parental or original cross

C. Second filial or F_2 generation- results of the cross of F_1 generation

D. Dominant- The trait that always appears if it is present and is represented by a capital letter.

E. Recessive- is the trait that can be masked over by the dominant trait and is presented by a lower case letter.

F. Letters are used to represent genes

1. **Dominant is always represented by Capital recessive is always represented by lower case**
2. **Example: Round X Wrinkled**
   Parent cross RR X rr
   a. F_1 are all round Rr
3. **F_2 cross Rr X Rr**
   a. F2 results are 1 RR to 2 Rr to 1 rr
4. **Punnett square shows meiosis and crossing results.**
   a. Example: Rr X rr

	R	r
r	Rr	rr
r	Rr	rr

G. Principle of segregation – During gamete formation the pair of genes responsible for each trait separates so that each gamete receives only one gene for each trait.

H. More Terminology:

1. **alleles- the genes for each trait**
2. **genotype- is the alleles an organism has**
3. **phenotype- is the visible feature determined by the genotype**
4. **homozygous- containing two alleles that are the same, rr or RR**
5. **homozygous recessive- both alleles are recessive, rr**
6. **homozygous dominant- both alleles are dominant, RR**
7. **heterozygous- have and allele for each trait Rr**

III. Solving Genetics Problems and Probability

A. Probability/ Chance

1. **Product rule- Multiply the individual probabilities to get the over all probabilities**
   a. **½ x ½ x ½ x ½ = 1/16**
2. **Product rule can be used to solve probable allele combination**
3. **But most of the time we will use the punnett square**

B. The probability of the offspring is reported in ratios

1. Example: Cross two heterozygous round Round X Round

Rr X Rr

R r

RR	**Rr**	**R**
Rr	**rr**	**r**

a. Phenotypic ratio is three round to one wrinkled

b. Genotypic ratio is 1 RR : 2Rr : 1rr

C. **Co dominance (Incomplete Dominance) Neither allele is dominant, so each trait is expressed equally.**

1. **Example: In Four-O-clocks a cross between red and white flower produce pink flowers.**

Red X White

RR X R'R'

R R

RR'	**RR'**	**R'**
RR'	**RR'**	**R'**

IV. Two traits

A. Mendel found when working with more than one trait that each allele would segregate independently

*** B. Principle of independent assortment-Alleles segregate independently during gamete formation**

B. When you figure

C. Example:

1. TtRr X TtRr

2. Heterozygous tall round crossed with a heterozygous tall round (dihybrid cross)

3. **Write all the possible allele combinations**

TR	Tr	tR	tr	
TTRR	TTRr	TtRR	TtRr	TR
TTRr	TTrr	TtRr	Ttrr	Tr
TtRR	TtRr	ttRR	ttRr	tR
TtRr	Ttrr	ttRr	ttrr	tr

4. **Phenotypic ratio 9 Tall Round: 3 Tall Wrinkled: 3 Short Round: 1 Short Wrinkled**
5. **Geno 1:1:2:2:4:2:2:1:1**

D. Multiple Alleles- A condition which a given trait is controlled by more than two different alleles.

1. Example: Would be blood type A, AB,B,O

a. A & B are codominant and O is recessive to A&B

AO X BO

B	O	
AB	AO	A
BB	BO	B

b. Genotype 1:1:1:1 and same phenotype

E. Polygenic inheritance- A condition controlled by many genes that effect one trait such as skin color and hair color.

V. The chromosome theory

A. Genes are located on chromosomes

B. Theory proven by Thomas Hunt Morgan

VI. Sex Determinantion

A. Sex chromosomes

1. X and Y Chromosome

2. XY is male and XX is female in most species

XY x XX

	X	**X**
X	**XX**	**XX**
Y	**XY**	**XY**

B. Autosomes- All other chromosomes in the body

C. Sex-linked Inheritance

1. Genes linked to a sex chromosome

2. The X chromosome has more room for genes than the Y Chromosomes

3. Color blindness and hemophilia are examples of sex linked traits

a. Example: Use X_N for Normal vision and X_n for Color blindness.

X^NX^n x X^NY

	X^N	Y
X^N	X_NX_N	X_NY
X^n	X_NX_n	X_nY

XN

VII. Many Genes – One Effect

A. Presence of many phenotypes from one extreme to another, is an example of continuous variation (polygenic) inheritance.

B. Skin color, hair color, Example p 215

C. Expression of Genes

1. Modifier genes – Genes that causes another gene to be expressed

a. Eye color is an example of this p 217

Read Math Connection p217, & Biology, Technology, and Society p 220 & 221