NOTES: CH 14, part 1 – Mendelian Genetics & Probability (14.1-14.2)

● One possible explanation of heredity is a **"blending" hypothesis:**

-the idea that genetic material contributed by two parents mixes in a manner analogous to the way blue and yellow paints blend to make green

● An alternative to the blending model is the "particulate" hypothesis of inheritance (the gene idea):

-parents pass on _____, genes

How are traits inherited?

● Trait: _____

● Gregor Mendel documented a _____ through his experiments with garden peas

● Gregor Mendel, an Austrian monk, applied mathematics to his study of genetics. He chose to study the **garden pea plant** to investigate how traits were passed from generation to generation.

Mendel's Experimental, Quantitative Approach

● Mendel chose to work with peas:

-Because they are _____

-Because he could strictly control _____

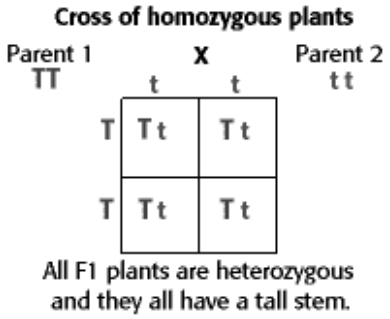
● Mendel studied 7 different traits:

-seed shape	-pod shape
-seed color	-flower position
-**plant height**	-pod color
-**flower color**	

● He chose these traits because they each appeared in _____. For example, the plants were either short or tall…there was no intermediate height.

● Mendel crossed ***pure-breeding*** plants with one another.

● The result: ***HYBRID*** plants (plants which received half of their genetic information form one type of parent, and the other half from a different type of parent).



● **Example:**

-Parent generation

-F_1 generation (possible combinations for offspring are inside square)

F_1 plants self-pollinate and reproduce (Tt x Tt)…

F_2 generation (inside square)

-**Dominant trait:** _____

-**Recessive trait:** _____

The Law of Segregation

● When Mendel crossed contrasting, true-breeding white and purple flowered pea plants, _____ _____

● When Mendel crossed the F1 plants, many of the plants had purple flowers, but some had white flowers (_____ _____)

● Mendel reasoned that

-In the F_1 plants, only the purple flower "factor" was affecting flower color in these hybrids

-Purple flower color was _____, and white flower color was _____

● Mendel observed the same pattern in many other pea plant characters

● His results led him to develop a hypothesis with 4 related ideas:

● First, _____ account for variations in inherited characters, which are now called _____

● **Example**: _____ are alleles of the gene that controls height in pea plants.

● Second, for each character an organism inherits **two alleles**, _____ (a genetic locus is actually represented twice)

● Third, if the two alleles at a locus differ, then one, the **DOMINANT ALLELE**, _____ _____;

● The other allele, the **RECESSIVE ALLELE**, has no noticeable effect on the organism's appearance

● Fourth, the **LAW OF SEGREGATION**: the two alleles for a heritable character separate (segregate) _____ _____

Useful Genetic Vocabulary

● An organism that is **HOMOZYGOUS** for a particular gene:

-has a pair of _____**(RR or rr)**

-exhibits true-breeding

● An organism that is **HETEROZYGOUS** for a particular gene:

-has a pair of alleles that are _____ **(Rr)**

● An organism's **PHENOTYPE** is its _____ **(purple flowers)**

● An organism's **GENOTYPE** is its _____ **(PP or Pp)**

The Testcross:

● In pea plants with purple flowers the genotype is not immediately obvious (could be _____)

● a testcross allows us to _____, but unknown genotype

● an individual with the dominant phenotype is crossed with an individual that is homozygous recessive for a trait

The Law of Independent Assortment

● Mendel derived the law of segregation by following a single trait

● The F_1 offspring produced in this cross were monohybrids, _____

● Mendel identified his second law of inheritance by **following two characters** at the same time

● Crossing two, true-breeding parents differing in two characters produces _____ in the F1 generation, _____

● How are two different characters transmitted from parents to offspring: ***together or independently?***

● A dihybrid cross illustrates the inheritance of two characters

● The result: _____

● Using the information from a dihybrid cross, Mendel developed the **LAW OF INDEPENDENT ASSORTMENT**:

Each pair of alleles segregates _____

For example, in pea plants, the allele for tallness may be inherited with the allele for yellow seed color, ***or* the allele for green seed color. This is because the separation of the chromosomes during meiosis is _____ _____

Laws of Probability & Genetics (14.2)

● **multiplication rule**: to determine the prob. that 2 or more independent events will occur together, we multiply the prob of 1 event by the prob of the other event

● **example**: the prob of 2 coins both coming up "heads" is: _____

MONOHYBRID CROSS: **Punnett Square:**

● Cystic fibrosis is an autosomal recessive disorder. What is the probability that a couple who are both carriers of this disease will have a child who has the disorder?

DIHYBRID CROSS: **Punnett Square:**

● Two plants, heterozygous for purple flowers (Pp) and heterozygous for tall stems (Tt) are crossed. **What fraction of their offspring will have white flowers and tall stems?**

CROSS: _____

*****each plant can produce the following gametes:*** _____

Solving Complex Genetics Problems with Probability:

● Consider the cross: **PpYyRr x Ppyyrr**

● What fraction of the offspring from this cross will exhibit the recessive phenotype for all 3 traits? **(ppyyrr)**

*****Use Probability to Solve!!***

● Consider each gene separately (P, Y, R)

● **Pp x Pp…*what fraction of offspring will be "pp"?***

● _____

● **Yy x yy**…***what fraction of offspring will be "yy"?***

● _____

● **Rr x rr**…***what fraction of offspring will be "rr"?***

● _____

● SO, what fraction of the offspring from this cross will exhibit the recessive phenotype for all 3 traits? (ppyyrr)

● _____ = _____