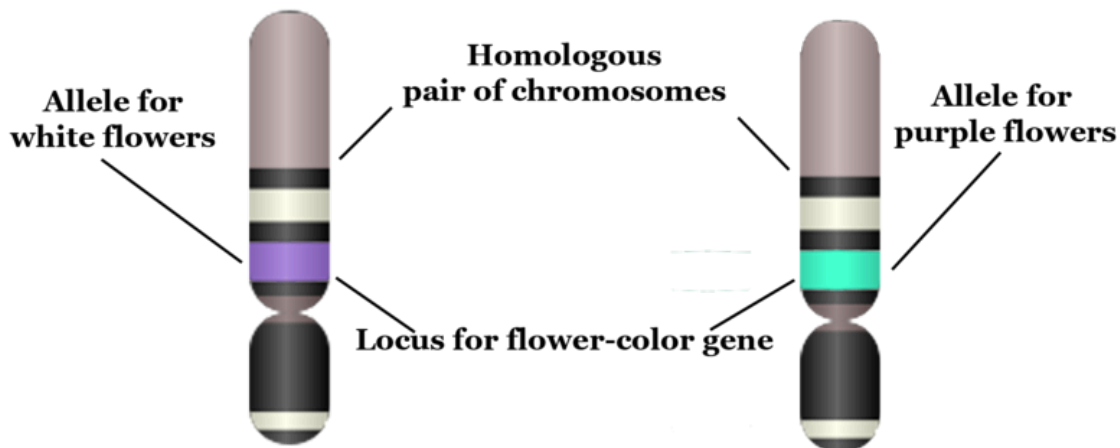


Honors biology Reading Guide Chapter 9

- ❖ Genetic
 - The scientific study of heredity modern genetics began with the work of Gregory Mendel in the 19th century
- ❖ Character
 - A heritable feature that varies among individuals within a population such as a flower or eye color
- ❖ Trait
 - A variant of a character found within a population
- ❖ Self-fertilize
 - A form of reproduction that involves fusion of sperm and egg produced by the same individual organism
- ❖ Cross fertilization
 - The fusion of sperm and egg derived from two different individuals
- ❖ True breeding
 - Referring to the organisms for which sexual reproduction produces offspring with inherited traits identical to those of the parents the organisms are homozygous for the characteristics under consideration
- ❖ Hybrids
 - The offspring of parents of two different species or of two different varieties of one species an offspring of two parents that differ in one or more inherited traits an individual that is heterozygous for one or more pairs of genes
- ❖ P generation
 - The parent individuals from which offspring are derived in studies of inheritance P stands for parental
- ❖ F₁ generation
 - The offspring of two parental (P generation) individuals F₁ stands for the 1st filial
- ❖ F₂ generation
 - The offspring of the F₁ generation F₂ stands for second filial
- ❖ These are the F₁ plants or 1st filial
- ❖ The result of a P generation cross is called an F₁ generation
 - All of the plants of this generation are heterozygous
 - All of the plants appear identical in one trait
- ❖ When plants of the F₁ generation are crossed with each other the resulting offspring generation is called F₂ generation
 - 75% Of the plants have the trait from one parent and 25% of the plants have the trait from the other parent
- ❖ All plants in the F₁ generation appear the same and more plants in the F₂ generation exhibit the same trait as the hybrids
 - This is because only one trait, the dominant trait can be seen in appearance in the F₂ generation then these recessive genes have the ability to show up more when bred again because even though you cant see it in the F₁ generation it still carries the characteristic
- ❖ Mendel's four principals which govern the crossing of trans breeding plants

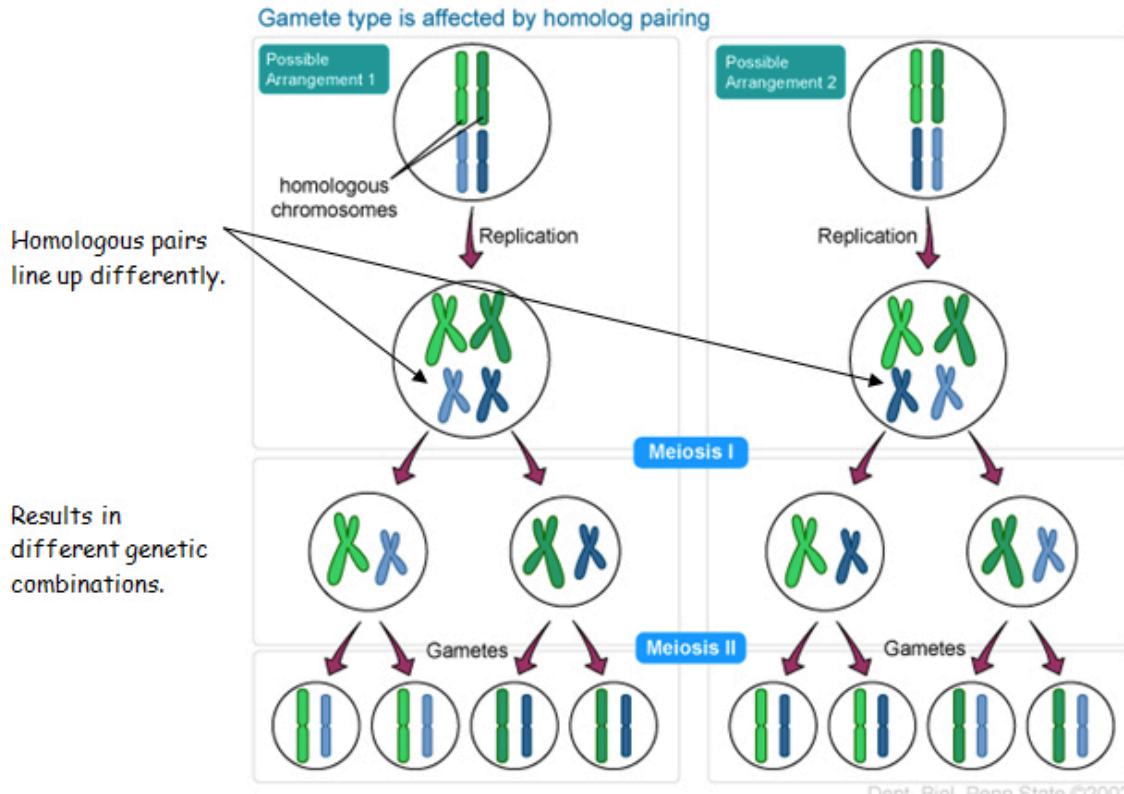
- There are alternative versions of genes that account for variations in inherited characters, called alleles
- For each character an organism inherits two alleles one from each parent
- If two alleles of an inherited pair differ then one determines the organism's appearance and is called the dominant allele the other has a noticeable effect on the organism's appearance and is called the recessive allele
- The sperm and egg carry only one allele for each inherited characteristic because allele pairs separate from each other during the production of gametes
- ❖ Gene
 - A discrete unit of hereditary information consisting of a specific nucleotide sequence in DNA most of the genes of a eukaryote are located in its chromosomal DNA a few are carried by the DNA of mitochondria and chloroplasts
- ❖ Locus
 - The particular site where a gene is found in a chromosome homologous chromosomes have corresponding gene loci
- ❖ Allele
 - An alternative form of a gene



- ❖ Genotype
 - The genetic makeup of an organism
- ❖ Phenotype
 - The expressed trait of an organism
- ❖ Punnett square
 - A diagram used in the study of inheritance to show the results of random fertilization
- ❖ Law of independent assortment
 - A general rule in inheritance (originally formulated by Gregor Mendel) that when gametes form during meiosis each pair of alleles for a particular characteristic segregate independently of other pairs also known as Mendel's second law of inheritance
- ❖ What activity in meiosis does independent assortment represent

- Metaphase
- Independent orientation

Independent Assortment:



- ❖ We can use our knowledge of genetics so far to determine unknown genotypes
 - geneticists perform a test cross to do this
 - One animal has n unknown genotype
 - The mate has a known genotype always homozygous recessive
- ❖ Rule of multiplication
 - A rule stating that the probability of a compound event is the product of the separate probability of the separate probabilities of the independent events
- ❖ Rule of addition
 - A rule stating that the probabilities that an event can occur in two or more alternative ways is the sum of the separate probabilities of the different ways
- ❖ Wild type traits
 - The version of a character that most commonly occurs in nature
- ❖ Pedigree
 - A family genetic tree representing occurrence heritable traits in parents and offspring across a number of generations can be used to determine genotypes of matting's that have already occurred
- ❖ Carrier

- A individual who is heterozygous for a recessively inherited disorder and who therefore does not show symptoms of the at disorder but who may pass on the recessive allele to offspring
- ❖ Dominant traits are not always the most common in a population
- ❖ Incomplete dominance
 - A type of inheritance in which the phenotype of a heterozygote is intermediate between the phenotypes of the two types of homozygotes
- ❖ Co-dominance
 - Inheritance pattern in which a heterozygote expresses the distinct trait of both alleles
- ❖ Multiple alleles
 - ABO blood groups – genetically determined classes of human blood that are based on the presence or absence of carbohydrates An and B on the surface of the RBC and ABOP blood group phenotypes also called blood types are A B O and AB
- ❖ Most genes cab be found in populations in more than two versions known as multiple alleles although any particular individual carries the most 2 different alleles for a particular gene in cases if multiple alleles more than two possible alleles exist in the population
- ❖ Pleiotropy
 - The control of more than one phenotype characteristic by a single gene
- ❖ Polygenic inheritance
 - The additive effects of two or more gene loci on a single phenotype characteristic
- ❖ Lined genes
 - Genes located near each other on the same chromosome that are to be inherited together
- ❖ Recombinant
 - The rearrangement of genetic material especially in crossing over in chromosomes
- ❖ Recombination frequency
 - With respect to two given genes the number of recombinant progeny from a mating divided by the two total number of progeny recombinant progeny carry combination of alleles difference from these in either the parents as a result of crossing over in meiosis
- ❖ Gene mapping
 - Process of determining where genes are located on individual chromosomes
- ❖ Linkage map
 - A listing of relative locations of genes along a chromosome as determined by recombination frequencies
- ❖ Environment
 - Environment has influence on characteristics, not passed onto next generation
- ❖ Crossing over

- The exchange of segments between chromatids of homologous chromosomes during synapsis in prophase I of meiosis also the exchange of segments between DNA molecules in prokaryotes
- ❖ Example of pleiotropy
 - Sickle cell disease
- ❖ What happens to the RBC in individuals with sickle cell disease
 - Make RBC produce abnormal hemoglobin proteins
- ❖ Genetically allele combination results in sickle cell anemia
 - Homozygous for sickle cell allele
- ❖ Are there any other allele combinations that result in sickled RBCs
 - Rare cases heterozygous experience effects when oxygen in blood is severely reduced, like in high altitude
 - Effect because non and sickle cell alleles co-dominant at molecular level both alleles expressed heterozygous individuals RBC contain both normal and abnormal hemoglobin
- ❖ Which population has the highest incidence of sickle cell anemia
 - Those of African descent
- ❖ Symptoms of sickle cell anemia
 - Weakened body
 - Damage organs
 - Kidney
 - Heart
 - Spleen
 - Brain
 - Other
 - Pain
 - Fever
 - Joint problems
 - Anemia
 - Pneumonia
 - Other infections
- ❖ Are there any advantages in having sickle cell anemia
 - Resistant to malaria
 - Live longer than those who get malaria
 - Have more offspring than non-carriers exposed to malaria
- ❖ Example polygenic inheritance
 - Skin color
- ❖ In polygenic inheritance alleles have what kind of effect on a character traits
 - Contributes units – incompletely dominant to other allele
- ❖ For a particular character in a population what effect does polygenic inheritance have on the number of possible phenotypes
 - Many more variations that allow for more possible combinations
- ❖ To compare and contrast pleiotropic and polygenic inheritance...
 - Pleiotropy involves single genes but 1 > phenotypic characters
 - Polygenic inheritance involves <1 genes but only one phenotypic characters
- ❖ How may environment play into phenotypic expression?

- Say skin color, getting tan
- ❖ Which of Mendel's laws of linked genes not follow
 - Law of independent assortment
 - Example
 - Sweet pea genes for flower color pollen shape are located on the same chromosome thus meiosis of the heterozygous (PpLl) sweet pea plant yields mostly two genotypes of gametes (PL and pl) other than equal numbers of the four types of gametes that would result if the flower color and pollen shape gene were not linked
- ❖ If two genes are on one chromosome and are close together what effect might crossing over have during meiosis to the linked genes
 - Cross over between homologous chromosomes produces new combinations of alleles in gametes two linked genes can give rise to four different gamete genotypes
- ❖ How is number of recombinants determined in offspring
 - Fertilization involving recombinant genes
- ❖ **Mathematical equation for recombination frequency**
- ❖ Which genes on a chromosome tend to be inherited together
 - Shorter distance = more likely to be inherited together

The one with the * determines gender of offspring

SPECIES	MALE (GENOTYPE)	FEMALE (GENOTYPE)
Human	*	
Grasshoppers roaches other insects	*	
Fish birds butterflies		*
Ants and bees	Neither = # of chromosomes	Develop from fertilized eggs
Reptiles - green sea turtle	Increase in 30° C	Temperature dependant
Many plants	*	*
Date palm	*	
Wild strawberry		*

- ❖ Explain how the Y chromosome provides clues about human male evolution
 - Y DNA learn ancestry human males
 - Genghis Khan may be responsible 16 million relatives by spread of a unique chromosome