NAME\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_Unit 7-MEIOSIS and GENETICS-MRS. WEIMER

MEIOSIS

Organisms that reproduce \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are made up of two different types of cells.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are “body” cells and contain the normal number of chromosomes ….called the “Diploid” number (the symbol is 2n). Examples would be … skin cells, brain cells, etc.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ are the “sex” cells and contain only ½ the normal number of chromosomes…. called the “Haploid” number (the symbol is n)….. Sperm cells and ova are gametes.

Gametes

The Male Gamete is the \_\_\_\_\_\_\_\_\_\_\_\_\_ and is produced in the male gonad the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

The Female Gamete is the \_\_\_\_\_\_\_\_\_\_\_ (ova = pl.) and is produced in the female gonad the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_.

During\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ the ovum is released from the ovary and transported to an area where \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the joining of the sperm and ovum, can occur…… fertilization, in Humans, occurs in the Fallopian tube. Fertilization results in the formation of the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(fertilized egg)

Fertilization

The fusion of a sperm and egg to form a zygote.

A zygote is a fertilized egg

DRAW THE PICTURE WITH THE CHROMOSOME NUMBERS:

Chromosomes

If an organism has the \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (2n) it has two matching homologues per set. One of the homologues comes from the mother (and has the mother’s DNA).… the other homologue comes from the father (and has the father’s DNA).

Most organisms are diploid. Humans have 23 sets of chromosomes… therefore humans have 46 total chromosomes….. The diploid number for humans is \_\_\_\_\_\_ (46 chromosomes per cell).

Homologous Chromosomes

Pair of \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (maternal and paternal) that are similar in shape and size.

Homologous pairs (tetrads) carry genes controlling the same inherited traits.

Each l\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (position of a gene) is in the same position on homologues.

Humans have 23 pairs of homologous chromosomes.

22 pairs of autosomes

1 pair of sex chromosomes

Homologous Chromosomes(because a homologous pair consists of 4 chromatids it is called a “Tetrad”)

Humans have 23 Sets of Homologous Chromosomes  
 Each Homologous set is made up of 2 Homologues.

Autosomes  
(The Autosomes code for most of the offspring’s traits)

Sex Chromosomes  
The Sex Chromosomes code for the sex of the offspring.  
\*\* If the offspring has two “X” chromosomes it will be a \_\_\_\_\_\_\_\_\_\_\_\_\_\_

\*\* If the offspring has one “X” chromosome and one “Y” chromosome it will be a \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Sex Chromosomes  
Meiosis is the process by which ”gametes” (sex cells) , with half the number of chromosomes, are produced.   
During Meiosis diploid cells are reduced to haploid cells

Diploid (2n)  Haploid (n)

If Meiosis did not occur the chromosome number in each new generation would double…. The \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Meiosis

Meiosis is Two cell divisions (called meiosis I and meiosis II)with only one duplication of chromosomes.

Meiosis in males is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ and produces sperm.

Meiosis in females is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_and produces ova.

Interphase I

Similar to mitosis interphase.

Chromosomes replicate (S phase).

Each duplicated chromosome consist of two identical sister chromatids attached at their centromeres.

Centriole pairs also replicate.

Nucleus and nucleolus visible.

Meiosis I (four phases)

Cell division that reduces the chromosome number by one-half.

four phases:

a. prophase I

b. metaphase I

c. anaphase I

d. telophase I

**Prophase I**

Longest and most complex phase.

90% of the meiotic process is spent in Prophase I

Chromosomes condense.

\_\_\_\_\_\_\_\_\_\_\_\_ occurs: homologous chromosomes come together to form a tetrad.

Tetrad is two chromosomes or four chromatids (sister and nonsister chromatids).

During Prophase I “\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_” occurs.

During Crossing over segments of nonsister chromatids break and reattach to the other chromatid. The Chiasmata (chiasma) are the sites of crossing over.

Crossing Over creates \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ in the offspring’s traits.

**Metaphase I**

Shortest phase

Tetrads align on the metaphase plate.

INDEPENDENT ASSORTMENT OCCURS:

1. Orientation of homologous pair to poles is random.

2. Variation

3. Formula: 2n

Example: 2n = 4

then n = 2

thus 22 = 4 combinations

**Anaphase I**

Homologous chromosomes separate and move towards the poles.

Sister chromatids remain attached at their centromeres.

**Telophase I**

Each pole now has haploid set of chromosomes.

Cytokinesis occurs and two haploid daughter cells are formed.

Meiosis II

No \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

(or very short - no more DNA replication)

Remember: Meiosis II is similar to mitosis

Prophase II

same as prophase in mitosis

Metaphase II

same as metaphase in mitosis

Anaphase II

same as anaphase in mitosis

sister chromatids\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Telophase II

Same as telophase in mitosis.

Nuclei form.

Cytokinesis occurs.

Remember: four haploid daughter cells produced.

gametes = sperm or egg

Telophase II

Non-disjunction  
Non-disjunction is the failure of homologous chromosomes, or sister chromatids, to \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ during meiosis.

1. Non-disjunction results with the production of zygotes with abnormal chromosome numbers…… remember…. An abnormal chromosome number (abnormal amount of DNA) is damaging to the offspring.
2. Non-disjunctions usually occur in one of two fashions.
   1. The first is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_, the second is called \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_. If an organism has Trisomy 18 it has three chromosomes in the 18th set, Trisomy 21…. Three chromosomes in the 21st set. If an organism has Monosomy 23 it has only one chromosome in the 23rd set.

Common Non-disjunction Disorders

Down’s Syndrome – \_\_\_\_\_\_\_\_\_\_\_\_\_

Turner’s Syndrome – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Kleinfelter’s Syndrome – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Edward’s Syndrome – \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Amniocentesis

An Amniocentesis is a procedure a pregnant woman can have in order to detect some genetics disorders…..such as non-disjunction.

Karyotype (picture of an individual’s chromosomes)

One of the ways to analyze the amniocentesis is to make a Karyotype

What genetic disorder does this karyotype show?

**Genetics and Heredity**

History

Genetics is the study of genes.

Inheritance is how traits, or characteristics, are passed on from generation to generation.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_s are made up of genes, which are made up of DNA.

Genetic material (genes,chromosomes, DNA) is found \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ of a cell.

Gregor Mendel is considered “The Father of Genetics"

Gregor Mendel

Austrian Monk.

Experimented with “pea plants”.

Used pea plants because:

They were available

They reproduced quickly

They showed obvious differences in the traits

Understood that there was something that carried traits from one generation to the next- “FACTOR”.

Mendelian Genetics

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ traits- traits that are expressed.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ traits- traits that are covered up.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the different forms of a characteristic.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- show how crosses are made.

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_- the chances/ percentages that something will occur.

Genotype- the types of genes (Alleles) present.

Phenotype- what it looks like.

Homozygous- two of the same alleles.

Heterozygous- two different alleles.

What is TRUE BREEDING:\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Typical Breeding:

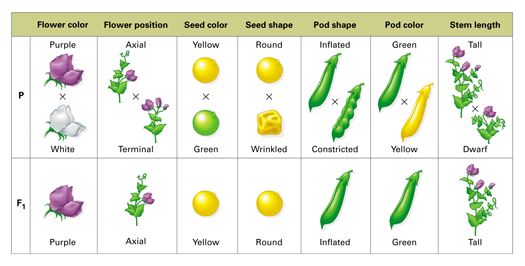
P generation \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ generation)

F1 generation (first filial generation, the word filial from the Latin word for "\_\_\_\_\_\_") are the hybrid offspring.

Allowing these F1 hybrids to self-pollinate produces:

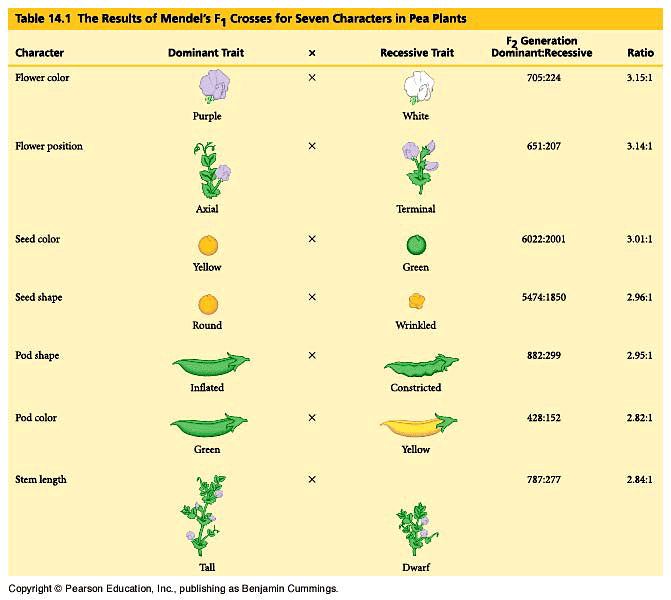
F2 generation (second filial generation).

It is the analysis of this that lead to an understanding of genetic crosses.



Mendel’s 7 Characteristics of a Garden Pea

Statistics of Mendel’s Experiments



**How is it possible to maintain such genetic continuity?**

Chromosomes

Homologous chromosome: one of a matching pair of chromosomes, one inherited from each parent.

DRAW THEM HERE:

**What genetic principles account for the transmission of such traits from parents to offspring?**

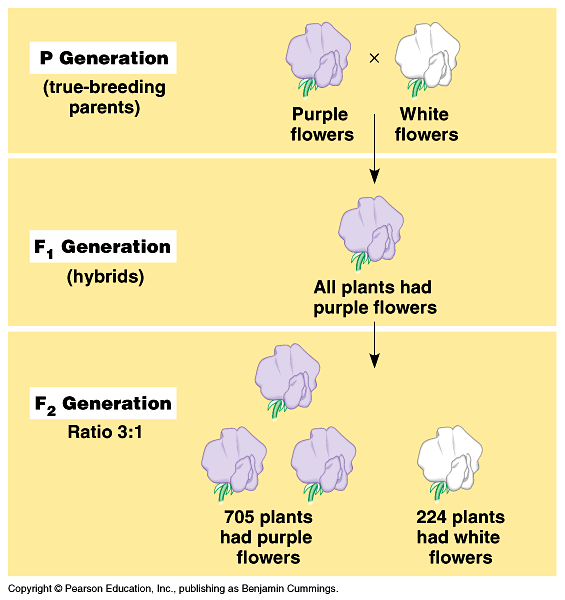
**The Blending Hypothesis of Inheritance**

In the early 1800’s the blending hypothesis was proposed. Genetic material contributed by the two parents mixes in a manner analogous to the way blue and yellow paints blend to make green.

What would happen if this was the case?\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Law of Dominance**

In the monohybrid cross (mating of two organisms that differ in only one character), one version disappeared.

What happens when the F1 Generations are crossed?

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Draw the F2 Generation here:

**Alleles: alternative versions of a gene**.

The gene for a particular inherited character resides at a specific locus (position) on homologous chromosome. Draw them here:

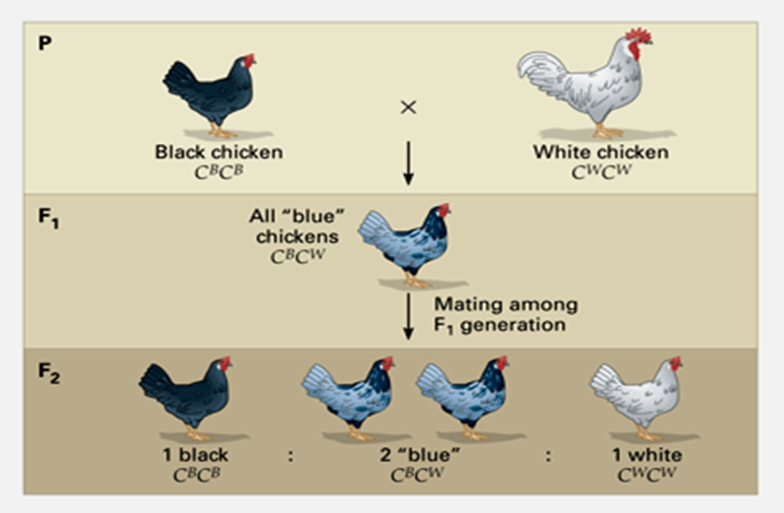
**Dominant** - a term applied to the trait (allele) that is expressed irregardless of the second allele.

**Recessive** - a term applied to a trait that is only expressed when the second allele is the same (e.g. short plants are homozygous for the recessive allele).

**Punnett square:** diagram showing the probabilities of the possible outcomes of a genetic cross

Genotype vs. Phenotype

**How does a genotype ratio differ from the phenotype ratio?**



**Intermediate Inheritance (blending)**: inheritance in which heterozygotes have a phenotype intermediate between the phenotypes of the two homozygotes

**The Importance of the Environment**

The environmental influences the expression of the genotype so the phenotype is altered.

Hydrangea flowers of the same genetic variety range in color from blue-violet to pink, depending on the acidity of the soil.

**Multifactorial**; many factors, both genetic and environmental, collectively influence phenotype in examples such as skin tanning