

1 **Classical Genetics**

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2 **Heredity Vs. Environment**

- There are two great influences on organisms:
 - heredity - the genetic material inherited from parents

3 **Heredity Vs. Environment**

- There are two great influences on organisms:
 - environment – surroundings of the organism
 - food
 - education
 - weather conditions
 - parenting

4 **Heredity Vs. Environment**

- The study of genes and their influence is called genetics or heredity

5 **What kinds of traits are inherited?**

- Species traits - genes that each member of a species inherits

6 **What kinds of traits are inherited?**

- Individual traits
 - genes that make each of us different

7 **Gregor Mendel ***

- The father of genetics (classical genetics) *
- Austrian monk - not a "scientist by trade"
- In charge of the garden - he was aware
- 1865 he published his findings

8 **Pollination (plant sex)**

- Flower - the reproductive organ of plants
 - male parts - stamen - produce pollen (plant sperm)

9 **Pollination (plant sex)**

- female parts - pistil - produce ovules (eggs)

10 **Pollination (plant sex)**

- fertilization is called pollination in plants (safe term)
- some plants are capable of self-pollination – they have both gametes
- most plants are capable of cross pollination (crossing of sperm from one plant to the eggs of another) - this promotes diversity!

- 11 Pea Plant Crosses
- Parent plants are denoted by P1
 - Offspring plants are denoted by F1 or F2 *

 - F1 are kids and
F2 are grandkids * of P1
- 12 Plant Characteristics
- tall
 - short
 - green
 - yellow
 - wrinkled seeds
 - smooth seeds
- 13 Mendel's Hypotheses
- Concept of Unit Characters - inherited traits are controlled by genes which occur in pairs
 - TT or Tt or tt
 - one is from your mother and one from your father
 - you will be able to give only one of these to your offspring
- 14 Mendel's Hypotheses
- Principle of dominance and recessiveness * - one gene can be stronger (dominant) than another and mask the weaker gene (recessive) *
 - TT and Tt are both tall
 - TT is NOT taller than Tt
 - tt is short
- 15 Mendel's Hypotheses
- Law of Segregation - the pair of genes is segregated or divided in forming gametes
- 16 Mendel's Hypotheses
- Law of Independent Assortment - the chance of receiving one gene is not affected by receiving another gene
- 17 Genetic terms
- Letters are used to stand for each gene
 - T = tall gene (dominant) *
 - Use a capital letter
 - Use printed non-cursive letter
 - Make it larger
 - t = short gene (recessive) *
 - Use a lower case letter
 - Use cursive or handwriting
 - Make it smaller
- 18 Genetic terms

- Genotype - genes present in the organism
(*letters*)

- Phenotype - the visual effect of the genes - what you see *

19 Genetic terms

- Homozygous - when both of a pair of genes are the same (TT or tt) *
- Heterozygous or Hybrid - when the pair is different (Tt or Yy)

20 Genetic terms

- Alleles - different forms of the genes that have contrasting traits such as T for tall and t for short or R for red and r for white *

21 Punnett Squares

- R.C. Punnett invented the Punnett square
- It is used to predict the offspring in mating
- The probability of the outcome of mating is shown

22 Punnett Squares

- The result is an average that is more closely reached as more offspring are made
- Monohybrid Cross - cross (mating) of 1 pair of contrasting traits (4 squares)

23 Punnett Squares

- What percentage of offspring are homozygous recessive?*
- What percentage are heterozygous? *
- What percentage are homozygous dominant?*

24 Punnett Squares

- Dihybrid cross - cross of 2 pairs of contrasting traits (16 squares)

25 Test Crosses – PLEASE learn this! *

- If you have a dominant looking phenotype in an organism (black, rough or tall) you cannot tell what the actual genotype is by looking at it.
- It could be either homozygous dominant BB or heterozygous Bb
- To find out you must perform what is called a TEST CROSS
- In a test cross you mate the unknown organism with a homozygous recessive (bb or rr or tt)

26 Test Crosses

- You would need two separate Punnett squares one for the homozygous dominant (BB) and one for the heterozygote (Bb)
- So one would cross BB x bb
and the other would cross Bb x bb

27 Test Crosses

- after making the Punnett square you will notice that the homozygous dominant will have ALL dominant-looking offspring (Bb) and the heterozygote will have ½ dominant-looking and ½ recessive-looking

28 Test Crosses

- there are logical statements that follow:
 - If unknown was homozygous dominant (BB) then all offspring will have a dominant phenotype
 - If the unknown was heterozygous (Bb) then 1/2 offspring will have a dominant phenotype and 1/2 will have a recessive phenotype

29 Incomplete Dominance

- Genes that are neither dominant or recessive
- Both alleles have an effect on the offspring
- There is a blending of traits

30 Incomplete Dominance *

- Classic examples:
 - 4 o'clock flowers *
 - roan cows
(brownish red and white cows)
- You will see all lower case letters
- You will see different letters

31 Incomplete Dominance *

- A Punnett square using 4 o'clocks *
- Cross a red and a white 4 o'clock
- $rr \times ww$

the phenotypes would all be pink

32 Incomplete Dominance

- A Punnett square using roan cows
- Cross a roan cow with another roan cow
- $rw \times rw$

phenotypes would be
1 red, 2 roan & 1 white cow

33 Incomplete Dominance

- What two cows would a rancher or farmer mate if he/she wanted more roan cows (rw)? *