

Welcome to Genetics Lecture 1: Traits and Gregor Mendel

How Organisms Get their Traits?

We share certain features with more than _____ kinds of organisms. Even so, each human being also has feature that make him or her different from every other living thing even from every human. You may want to know where your features came from, long legs, high cheekbones, blue eyes, dark curly hair???. They may be similar to someone else, but will not be identical. In fact, every living thing has **specific characteristics that are called** _____ Traits are unique.

Terms to know:

_____ specific , inherited characteristics of an organism, they can be _____ in a family and may be nearly identical or similar. Examples: dimples, hair color. They are controlled by genes carried on chromosomes.

_____ Form of a gene. For each gene there can be 2 alleles

_____ This is the GENETIC alleles of a trait: BB, Bb, bb

_____ What the organism looks like. The genetic expression of the genotype. What we see!!

_____ the strongest allele/the one expressed, that has the ability to mask another. Always expressed in capital letter: B, R, C, etc

_____ an allele that can only be expressed when 2 are together. Always expressed in lower case letters: b, r, c. It can only be expressed in cases such as: rr, bb, cc.

_____ Identical genetic alleles, that express a dominant trait. BB, CC, RR

_____ : Identical genetic alleles, that express a recessive trait: bb, cc, rr

_____ : This is a combination of two alleles that are dominant AND recessive. The trait that is expressed is the dominant trait. It MASKS the recessive trait. Bb, Cc, Rr

_____ This is a box method that is used to show the genotypes of combinations: (mom) CC x (dad) cc:

_____ : A pedigree is a diagram that shows _____ of a trait from one generation to the next. Can you tell which people are closely related in a family by just looking at a photograph.

Some family members look very similar, others look totally different. To find out how family members can have such different features we can use a tool called a pedigree to trace each trait in a family.

Which of your features have you inherited?

Complete the questions here + conclusion:

Which of your features have you inherited?

Have you ever heard words similar to these: "You got your curly, red hair from Grandfather," or "You are tall, just like Aunt Nikki"? The very features that make you you first appeared in your parents or other ancestors, then were passed down to you. See what some of your traits are in this activity. If you prefer, you can observe a friend's traits.

What To Do

1. Look at yourself in a mirror. Identify at least five of your features.
2. What color are your eyes?
3. What color is your hair? Is it straight or curly?
4. What is the shape of your nose or mouth? For example, does your nose turn up at the end? Is one of your lips fuller than the other?
5. Who else in your family has each of your features? Write a paragraph in your Journal about which features you inherited.



Do traits appear randomly??

Do you see a pattern in the appearance of traits such as curly hair?? Do traits appear and disappear at random? _____: **that nothing is causing 1 trait to appear more often than another.** It's like the lottery, each number has an equal chance of coming up. No number is favored. In the case of 2 traits, if the traits are appearing randomly, there is an equal chance that either trait will appear...or in a large group of people, 50% will have 1 trait and 50 % will have the other. To find out if traits appear in patterns or randomly, we are going to do the next activity.

Lab: Do More Students have attached or unattached earlobes??

Data & Conclusions:

Do more students have attached or unattached earlobes?

Some people have earlobes that are attached like the one on the left in the illustration. Others have earlobes that hang free like the one on the right.


What To Do

1. Count the number of your classmates with each type of earlobe.

Conclude and Apply

1. How do the two numbers compare—are they nearly equal, or is one much larger than the other? If so, which?
2. What might your data suggest about the occurrence of this trait?

3. Do you think the trait occurs randomly? In your journal, explain how you think traits are inherited—either randomly or in patterns.



Lect 2: Mendel & Genetics: Mendel's work with peas

Video: Take notes: _____

_____ was an Australian monk who did a series of experiments to show that traits _____ occur purely at _____. He recognized that traits occur in family pedigrees according to certain patterns of inheritance. While at the monastery Mendel did experiments with pea plants. He did pea plant studies, and discovered some seeds were _____ others _____ some were _____ others _____, some _____ others _____. All sorts of variations were observed. He would record and experiment over and over, and he came across some patterns: He observed the variation in these plants.

Term to know: _____: the occurrence of an _____ that makes a person or thing **different** from other members within the same species.

TALL X TALL = _____

TALL X TALL = _____

TALL X SHORT = _____

SHORT X SHORT = _____

Was there a pattern in these results that supported Mendel's hypothesis... that the traits of offspring came from their parents??? or were the results random??? Cross pollination of plants with certain traits with plants having contrasting traits. He determined which traits were inherited by offspring plants. Established **mathematical ratios** from the counts of the contrasting traits that were displayed. These ratios describe _____ that control traits in terms of probability. Mendel's "Factors" are now known as _____.

Definition: Gene: _____ a discrete portion of a chromosome thought to be responsible for the production of a single type of "**factor**". The "factor" responsible for the inheritance of a genetic trait.

Definition: A theory of genetic inheritance that is based on current understanding of the relationships between the biochemical control of traits and the process of cell division.

Chromosomes/Chromatids: (Remember meiosis & mitosis) the chromosome is made up of _____

Definition: One pair of genes that exist at the same location on a pair of homologous chromosomes and cause parallel control over the same genetic trait.

SOME MAJOR GENETIC PATTERNS: Genes of certain pairs can have contrasting (different or opposite) effects on the same trait. However, only one may be _____ while the other is _____

_____ **The gene that is expressed**

_____ **The gene that is masked**

In "dominance problems" _____ are usually symbolized by a _____ while the _____ for the same trait is given the _____ of the same letter. If the two inherited traits are **alike** (TT or tt) the combination is called: _____. If the two inherited traits of this allelic pair are **different** (Tt) this combination is called : _____ (or hybrid)

Example:

Garden peas: tall plants vs short plant

T = tall allele **t** = short allele

In fertilization homologous chromosomes are separated in meiosis, and the fertilization of the egg brings together the union of 2 different chromosomes.

In this cases two alleles for every trait are inherited.

_____ The **physical appearance**(what you see)expression of the genetic make-up of the offspring

_____ The **genetic makeup** (the genes!) of the offspring that determines the phenotype

So Mendel tried to cross his tall plants and see what would happen. Remember, each trait has 2 genes. Mom will donate HALF of 2 genes and Dad will donate HALF of 2 genes. When Mendel crossed this is what the cross pattern looked like:

	Mom's	Mom's	all 4 offspring are HOMOzygous dominate 100% dominate
Dad's			
Dad's			

Next Mendel tried to cross 2 short plants and see what would happen. Remember, each trait has 2 genes. Mom will donate HALF of 2 genes and Dad will donate HALF of 2 genes. But this time the results were different! WHY?? When Mendel crossed this is what the cross pattern looked like:

	Mom's	Mom's	all 4 offspring are homozygous Recessive this time! They're all SHORT! 100% recessive
Dad's			
Dad's			

Next Mendel tried to cross 2 tall plants and see what would happen. Remember, each trait has 2 genes. Mom will donate HALF of 2 genes and Dad will donate HALF of 2 genes. But this time the results were different! WHY?? When Mendel crossed this is what the cross pattern looked like:

	Mom's	Mom's	3 offspring are dominate, but only 1 is homozygous (TT) and this time there's a recessive or SHORT who's also homozygous (tt) and then 50% are heterozygous or Tt.
Dad's			
Dad's			

Note that 3 of these offspring would show the phenotype of the dominant gene,(being tall!) even though their "genetic make-up is different, (TT, Tt) while only one would show the recessive trait (tt) and be short.

Punnett Square Examples

What are the chances of mm x MM parents having a homozygous recessive offspring:

DADs Genes	Moms Genes	

What are the chances of Mm x Mm having a homozygous dominant offspring:

DADs Genes	Moms Genes	

What is the percent of mm x mm parents having heterozygous offspring:

DADs Genes	Moms Genes	

What is the percent of Mm x Mm having heterozygous offspring:

DADs Genes	Moms Genes	

What is the percent of Mm x Mm having homozygous recessive offspring:

DADs Genes	Moms Genes	

What percent of Pp x pp offspring will be heterozygous

DADs Genes	Moms Genes	



Genetics Quiz

- Which cells in your body contain DNA?
 - Reproductive cells (sperm and eggs)
 - All of them
 - All the cells in your brain
- What is heredity?
 - A kind of genetic disorder
 - The way that DNA divides
 - The passing down of traits from parents to children
- What are genes?
 - The outer backbones of DNA molecules
 - The part of a chromosome that determines a particular characteristic
 - Female sex cells
- What is the function of DNA?
 - It determines your entire personality
 - It protects against infection
 - It's a blueprint for your body
- Which of these is NOT coded into your DNA?
 - Your eye color
 - What language you speak
 - Your bone structure
- What type of gene causes traits that are more likely to occur?
 - A dominant gene
 - A recessive gene
 - A progressive gene
- What type of gene causes traits that are less likely to occur?
 - A dominant gene
 - An incessant gene
 - A recessive gene
- What other factors can contribute to your body's appearance and growth?
 - How you treat others
 - Studying hard
 - Nutrition and environment
- What does DNA stand for?
 - Deoxyribonucleic acid
 - Deoxyrhboneuro acid
 - Dermographic nitric acid
- Who are the only people with the same exact genes?
 - Fraternal twins only
 - Identical twins only
 - Any kind of twin



Heredity Quiz

- What are traits?
 - Individual chromosomes
 - Characteristics passed on from parents to children
 - Special molecules the body makes when it's done something good
- What is heredity?
 - The passing of traits from one generation to the next
 - Material goods inherited from one's parents
 - A set of privileges your parents give you
- What do you call the different forms a gene may have for a trait?
 - Chromosomes
 - DNA
 - Alleles
- What system did Reginald Punnett invent for predicting when certain traits would appear?
 - The Punnett Circle
 - The Punnett Cube
 - The Punnett Square
- When did Gregor Mendel conduct his experiments?
 - The 19th century
 - The 18th century
 - The 17th century
- What did Mendel learn about pea plants?
 - The tall plant form dominates the short plant form
 - The short plant form dominates the tall plant form
 - Peas are good with ketchup
- Which of these traits cannot be passed on from parent to child?
 - Eye color
 - Height
 - A broken arm
- What are the two types of traits?
 - Dominant and submissive
 - Dominant and recessive
 - Dominant and successful
- What percentage of pea plants show the short (recessive) trait?
 - One out of four
 - One out of two
 - Two out of three
- What was Gregor Mendel's profession?
 - Physicist
 - Monk
 - Doctor

**PUNNETT SQUARES—
CROSSES INVOLVING ONE TRAIT**

In a certain species of animal, black fur (B) is dominant over brown fur (b). Using the following Punnett square, predict the genotypes and phenotypes of the offspring whose parents are both Bb or have heterozygous black fur.

	B	b
B		
b		

Genotypes: _____ % homozygous black fur (BB)
 _____ % heterozygous black fur (Bb)
 _____ % homozygous brown fur (bb)

Phenotypes: _____ % black fur
 _____ % brown fur

Now do the same when one parent is homozygous black and the other is homozygous brown.

Genotypes: _____ % homozygous black fur (BB)
 _____ % heterozygous black fur (Bb)
 _____ % homozygous brown fur (bb)

Phenotypes: _____ % black fur
 _____ % brown fur

Repeat this process again when one parent is heterozygous black and the other is homozygous brown.

Genotypes: _____ % homozygous black fur (BB)
 _____ % heterozygous black fur (Bb)
 _____ % homozygous brown fur (bb)

Phenotypes: _____ % black fur
 _____ % brown fur

**PUNNETT SQUARES—
CROSSES INVOLVING TWO TRAITS**

In a dihybrid cross, when two traits are considered, the number of possible combinations in the offspring increases. Suppose that black hair (B) is dominant over blonde hair (b) and brown eyes (E) are dominant over blue eyes (e).

What percent of offspring could be expected to have blonde hair and blue eyes if:

1. The father has black hair (heterozygous) and brown eyes (heterozygous) and the mother has blonde hair and blue eyes.

Genotype of father—BbEe
 Genotype of mother—bbEE

In the Punnett square below, complete the remaining gametes of the father. Then, fill in the boxes below.

	BE	Be		
be				

_____ %

2. Both parents have black hair (heterozygous) and brown eyes (heterozygous).

Genotype of father—_____
 Genotype of mother—_____
 Complete the Punnett square below.

_____ %

In each dihybrid cross, the phenotype ratio of individuals with brown hair and brown eyes, brown hair and blue eyes, blonde hair and brown eyes and blonde hair and blue eyes is