Chapter 3 Genetics: The Science of Heredity

Video - HDTV Discovery 100 Greatest Discoveries 6of9 Genetics
Bill Nye - 45 Min.

Objectives
Describe the results of Mendel's Experiment.
Identify the role of alleles in controlling the inheritance of traits.

Page 70 This Baby Koala
What is similar and different about the mother and joey?

Does the joey have any pigment in its eyes?

no

If the pink color is not pigment, why are the eyes pink?

blood flow moving through the tissues

What do these phrases mean????
Runs in the family
You look like your parents

Gregor Mendel
Father of Genetics
Heredity
passing of physical characteristics from parents to offspring
Experimented with pea plants
Why peas?
fast growing, short life cycle, produce large quantity of flowers, observable traits, easy to manipulate pollination

People knew that every living thing has traits inherited from its parents. Until the work of Mendel, people did not understand how traits were passed from parents to offspring.

Traits
an inherited characteristic
example - eye color, seed color, hair color,

From Mendel studying these traits is how genetics was started.

Genetics
the study of heredity

Mendel worked with pea plants by controlling the fertilization of the pea plant.

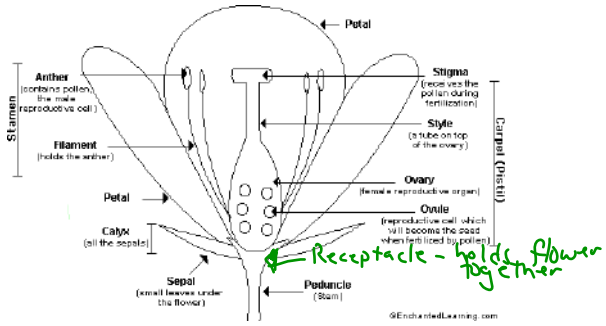
Fertilization
when an egg and sperm cells join

Figure 1
pistil - produces female sex cells (eggs)

stamen - produces male sex cells (sperm)
found in pollen

pollen must reach the pistil of the pea flower which is called pollination

Mendel cross pollinated - took pollen from one plant and put it on the stigma of another plant. He cut off the stamens of a plant so he could add the pollen from a different plant.



Assignment -
Start to create a concept map about Heredity. We will be adding onto the map as we go through this chapter.

We have discussed how Mendel experimented with pea plants. Ended our discussion with cross-pollination and fertilization of a flower and the flower parts. This leads us to today's topic of crossing the pea plants with different traits.

Crossing
exchanging traits

Purebred
an organism which will only produce one trait

green pod will only produce green pods

When Mendel crossed purebred tall plants with purebred short plants, the offspring were all tall plants. page 76

The cross of plants is called the P generation = parents

The offspring is called the F_1 generation = first filial or first family

When they are crossed this produces an F_2 = second filial

So... Mendel's P generation were tall and short
F_1 were all tall
F_2 were both tall and short

What he discovered was some traits were lost and then reappeared!

How does this work?

Gene
the factors that control a trait on the chromosome

Allele
different forms of the gene

Difference between allele and trait?

trait = general characteristic

allele = specific form of that characteristic

example = trait is that pop contains a sweetener
one allele is sugar and one is artificial sweetener

Two kinds of alleles
1. Dominant
trait is always seen
always represented by a capital letter

2. Recessive
trait is hidden if dominant allele is present
always represented by two lower case letters

Look at page 77 Figure 3

Look at the chart and decide which allele is the dominate form of the trait and circle it.

We use capital letters to represent purebred dominate

For example = TT = tall

We use lower case letters to represent purebred recessive

For example = tt = short

Hybrid represents a tall plant but is presented by both alleles.

For example = Tt = tall

Homozygous = Purebred
Heterozygous = Hybrid

Assignment
Continue to add to the concept map. Complete "What is Heredity?" packet.

Review

1. Dominate

2. Recessive

3. Hybrid

4. Write what purebred dominate alleles would look like.

5. Write what purebred recessive alleles would look like.

6. Write what a hybrid would look like.

7. Homozygous

8. Heterozygous

9. Now set-up a cross with a purebred dominate and a hybrid.

Assignment

Complete "What is Heredity?" packet.

A tool was used called a Punnett Square to help predict his results. Developed by Reginald C. Punnet as he and another scientist, William Bateson, were studying animal traits and crosses.

Punnett Square

graphic organizer that shows all possible ways alleles can combine in a genetic code

can also be used to predict probability

Male

_____ _____

_____

_____

Female

Let's cross a purebred dominate for Brown eyes with a purebred recessive for blue eyes.

What were the results?

What is the probability of having a brown eyed offspring occur? Find the Ratio of all possibilities.

Now cross hybrid with a recessive.

List results and probabilities of having both brown and blue eyed offspring.

Assignment

Green is dominate over yellow

1. Gg x Gg
2. Gg x gg
3. GG x Gg

1. Complete these crosses by showing complete Punnett Squares.

2. List results for phenotypes, genotypes, probabilities and ratio's of all outcomes.

We use Punnett Squares to determine the Phenotypes and Genotypes of crosses.

Phenotype
physical appearance or visible traits
what you see

example - brown eyes, green pod color

Genotype
genetic makeup or its alleles

example - Aa AA aa

So the phenotype is the expression of the genotype.

Homozygous and heterozygous are two additional words used to describe the genotype.

Homozygous
same
identical alleles - AA aa

Heterozygous
different
two different alleles - Aa

Review questions

1. What is the term used to describe an organism whose genotype consists of two identical alleles for a trait?

   homozygous

2. What are the two ways an individual can be homozygous for a trait?

   homozygous dominate and homozygous recessive

3. What is the term used to describe an organism whose genotype consists of two different alleles for a trait?

   heterozygous

4. What term did Mendel use for an individual that was heterozygous?

   hybrid

5. Why can you be certain of the genotype of an organism that shows a recessive trait?

   It must have a homozygous recessive genotype because the recessive allele is not hidden by a dominant allele.

Lab - Make the Right Call!

What's the Chance Lab

Name	Heads	Tails

Name	Heads	Tail

Section 2 Probability and Heredity

What's the Chance Lab?

Objectives

Students should be able to define probability and describe how it helps explain the results of genetic crosses.
Students should be able to explain what is meant by phenotype and genotype.

Probability

a number that describes how likely it is that an event will occur
write it as a %

Ratio

Comparison of results
3:1

In the lab, we tossed coins. In what other situations did you toss coins.

games
who goes first
who has to do a chore

Why did you toss a coin?
Why is a coin toss fair?
50-50 chance of winning

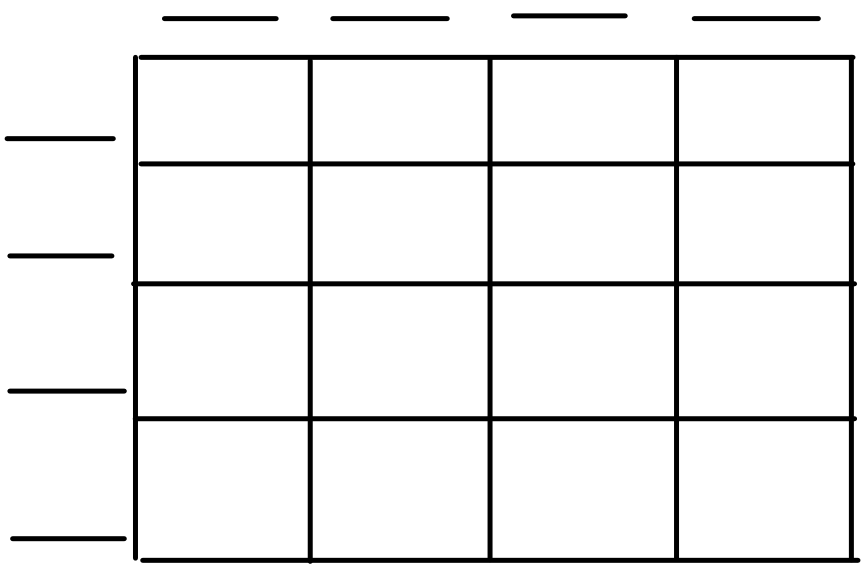
So, how is probability related to Genetics.

Mendel used probability to explain his results. He counted the offspring from every cross. With every cross he learned that patterns developed in the results.

Does probability predict what will definitely occur?
no, it predicts what is likely to occur

What does probability predict will happen if you toss a coin ten times?
The coin will land heads up 5 times and tails up 5 times

RRTT x rrtt



List results of the cross. Include probabilities and ratios.

- now complete this punnett square

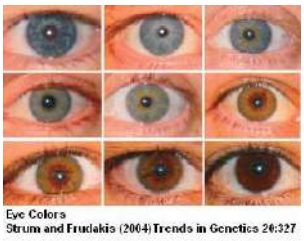
List genotypes, phenotypes, ratios and probabilities.

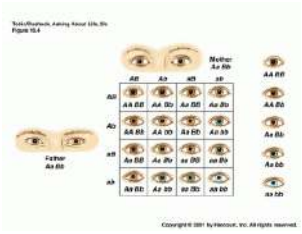
Assignment

Complete all crosses in packet.
List genotypes, phenotypes, ratios and probabilities of the genotypes and phenotypes.

Section 3 Patterns of Inheritance

Inquiry Warm-up
Observing Traits
Goal-Students will be able to understand how physical traits can be identified as patterns of inheritance.


Eye Colors
Strum and Frudakis (2004) Trends in Genetics 20:327



Objectives
Describe at least three complex patterns of inheritance.
Discuss how characteristics result from inheritance and environmental changes.

How are Traits Inherited? page 87
4 Ways
1. Incomplete Dominance
one allele is partially dominant
do not see any allele expressed

example:
Flowers have pink offspring with one flower is red and one is white.

When you cross them: RR x WW

2. Codominance
both alleles are expressed equally
you see both alleles

3. Multiple alleles
three or more alleles determine trait
Remember - only two alleles are inherited

4. Polygenic inheritance
occurs when more than one gene affects a trait

flowers bloom at different times

Traits that are inherited or aquired??
inherited - born with
aquired - skills learned and physical changes

inherited or aquired
height
hairstyle
skin color
muscle tone
eye color
athletic

How the environment affects the expression of traits.
Flowers- sunlight, temperature, soil nutrients, water will affect flowering time.

Some flowers will have a color of the flowers is dependent on how much water the plant gets.

Hydrangea Flowers - more acidic the soil the bluer the flowers will be

less acidic pink flowers

Changes in body cells, can not be passed to offspring.
Changes in sex cells, can be passed to offspring.

NOT all changes are bad.