

NOTES – 5.2

Chapter 5 – Genetics

Lesson 2 – Understanding Inheritance

What controls traits?

Mendel concluded that two factors control each trait. One factor comes from the egg cell and one factor comes from the sperm cell. What are these factors? How are they passed from parents to offspring?

Inside each cell is a nucleus that has threadlike structures called chromosomes. Chromosomes contain genetic information that controls traits. What Mendel called “factors” are parts of chromosomes. Each cell in an offspring contains chromosomes from both parents. These chromosomes exist in pairs—one chromosome from each parent.



Each chromosome can have information about hundreds or thousands of traits located within your genes.

Q: What is a gene?

A: a segment of DNA on a chromosome that controls a specific trait

Ex. a gene of a pea plant might have information about flower color

An offspring inherits two genes (factors) for each trait, one from each parent called alleles. The genes can be the same or different, such as purple or white for pea flower color.

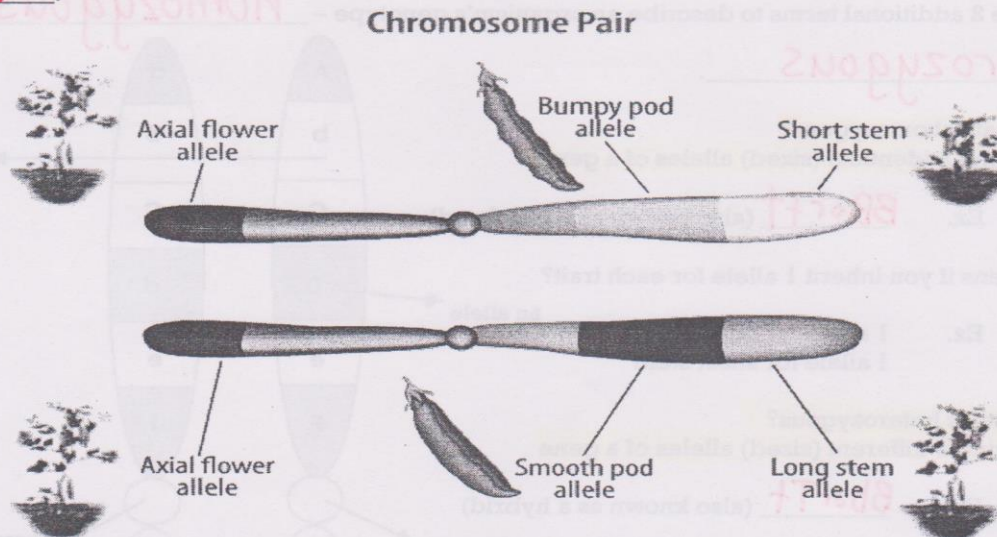
Q: What are alleles?

A: different forms of a gene

Ex. pea plants can have two purple alleles, two white alleles, or one of each allele

These factors are known as genes which can appear in different forms called alleles.

Chromosomes are made up of many genes joined together that control specific traits.



A trait controlled by a recessive allele will only show up if the organism does not have the dominant allele.

In pea plants, the allele for tall stems is dominant over the allele for short stems. Therefore, only pea plants that inherit 2 recessive alleles for short stems will be short.

Okay, so is there a better way to write about alleles without having to use so many words?

YES! Scientists use letters to represent alleles where a -

- dominant allele is a UPPERCASE letter
- recessive allele is a lowercase letter

Ex. tall (T) vs. short (t)

Therefore, if a plant inherits -

- 2 dominant alleles for tall stems → TT (purebred)
- 2 recessive alleles for short stems → tt
- 1 dominant allele for tall stems/1 recessive allele for short stems → Tt (hybrid)

In 1866, Mendel presented his results after years of study. Unfortunately, many scientists did not understand the importance of Mendel's work and it was forgotten for nearly 34 years!

2 useful terms that geneticists use to describe organisms are phenotype and genotype.

Q: What is phenotype?

A: an organism's physical appearance or its visible traits

Ex. black fur, tall height

Q: What is genotype?

A: an organism's genetic makeup or allele combinations

Ex. BB, Ff, aa

1 Classwork - Q: If a pea plant's genotype is Tt, what is its phenotype?
A: (answer on your **CW** sheet)

Geneticists use 2 additional terms to describe an organism's genotype - homozygous and heterozygous.

Q: What is homozygous?

A: having 2 identical (sized) alleles of a gene

Ex. BB or tt (also known as a purebred)

But what happens if you inherit 1 allele for each trait?

Ex. 1 allele for tall stem
1 allele for short stem

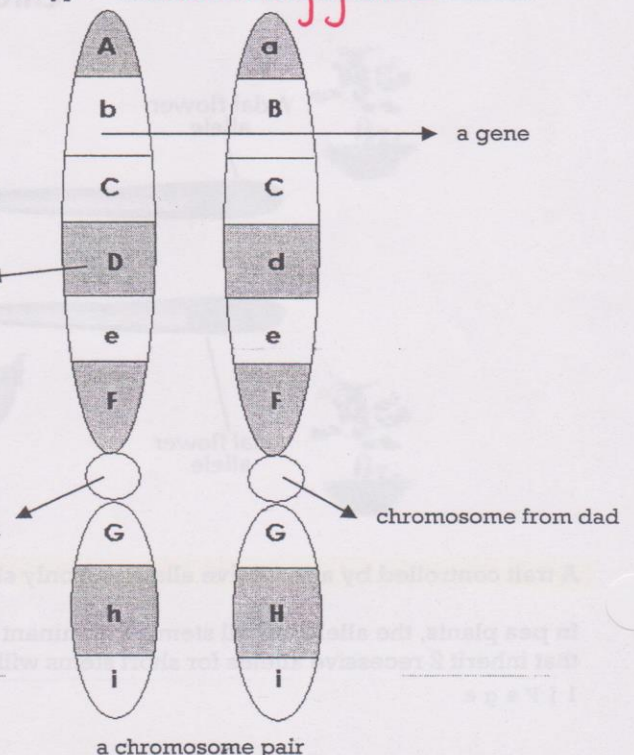
Q: What is heterozygous?

A: having 2 different (sized) alleles of a gene

Ex. Bb or Tt (also known as a hybrid)

chromosome from mom

chromosome from dad



2 **Classwork** – Q: Imagine the chromosome pair is from an unknown organism you are genetically researching. For which genes is the organism homozygous? For which genes is this organism heterozygous?

A: (answer on your **CW** sheet)

Modeling Inheritance



3 **Classwork** – Activity – “What’s the Chance?”

Step 1 – Predict how many times out of 20 your coin will land “heads up” and “tails up”.

Write your prediction on your CW sheet and circle it.

Step 2 – Flip your coin 20 times (carefully and without dropping it!)

Step 3 – Record the # of times the coin lands “heads up” and “tails up”.

Q1: How did your results in Step 3 compare to your prediction?

A1: (answer on your **CW** sheet)

Q2: How can you account for any differences between your results and your classmates results?

A2: (answer on your **CW** sheet)

So what do you call the chances of a coin landing on “heads or tails”? ... probability !

Q: What is probability?

A: the likelihood that a particular event will occur

Therefore, the probability that a coin will land –

- “heads up” is 1 in 2 or 50%
- “tails up” is 1 in 2 or 50%

Classwork – Q: Why is there a 1 in 2 probability that a tossed coin will land heads up?

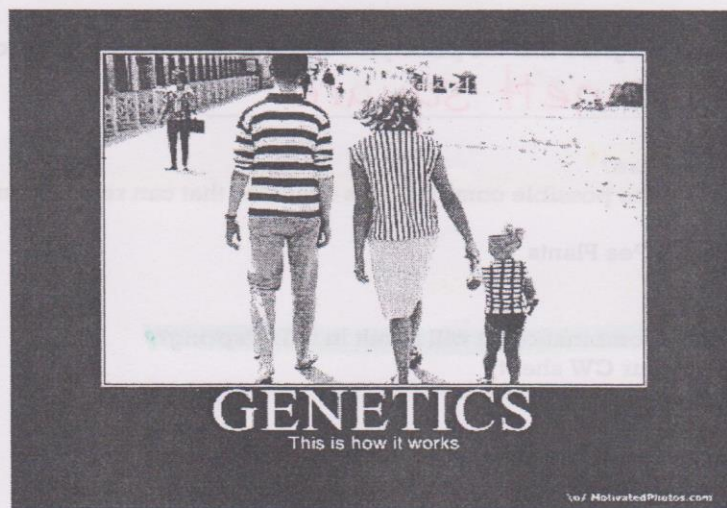
A: (answer on your **CW** sheet)

5 **Classwork** – Q: What is the probability that a coin will land tails up?

A: (answer on your **CW** sheet)

So, how is probability related to genetics?

Plant breeders and animal breeders use tools to help them predict how often traits will appear in offspring that does not require performing the crosses thousands of times.



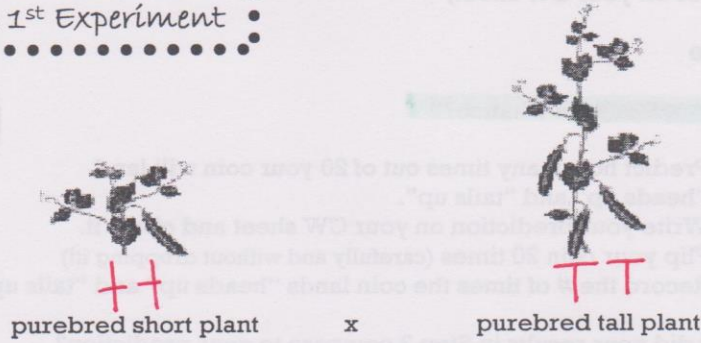
Punnett Squares

Think back to -

Mendel's 1st Experiment

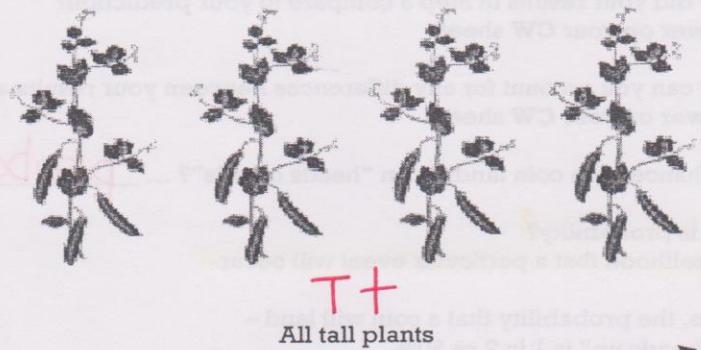


parental generation →
(P generation)



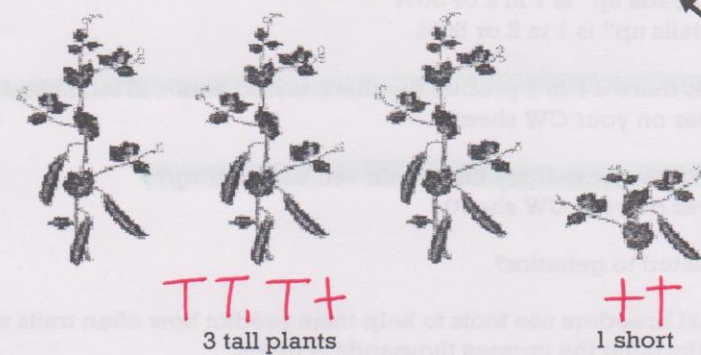
This P generation will always produce a 4:4 ratio or 100% of tall plants.

1st filial generation →
(F₁ generation)



This F₁ generation will always produce a 3:1 ratio or 75% : 25% of tall plants to short plants.

2nd filial generation →
(F₂ generation)



Mendel was the 1st scientist to recognize that the principles of probability can be used to predict the results of genetic crosses or punnett square.

Q: What is a punnett square?

A: a chart that shows all the possible combinations of alleles that can result from a genetic cross

Focus - Punnett Square - Pea Plants





6 **Classwork -** Q: Which allele combination(s) will result in tall offspring?
A: (answer on your CW sheet)

Let's look @ Mendel's 1st Experiment as a punnett square -

Punnett Square—Pea Plants

new offspring resulting in a pair of alleles make a row together to "add" each side is



	T	t
T	 TT 25%	 Tt 25%
t	 Tt 25%	 tt 25%



© Prentice-Hall, Inc.

SCIENCE EXPLORER Life Science

In Mendel's 1st experiment, he crossed a purebred tall pea plant (T T) with a purebred short pea plant (t t) this would look like the following in a punnett square -

Notice that each side is "added" together to make a new pair of alleles resulting in a new offspring.

The most important information gathered from a punnett square is that of probability.

In the above cross, the probability is divided among 4 squares, each = _____ or _____ total.

Ex. black guinea pig (BB) vs. white guinea pig (bb)

	b	b
B	Bb	Bb
B	Bb	Bb

7 **Classwork** - Q: What is the probability that an offspring in the above cross will have white fur?
A: (answer on your **CW** sheet)

8 **Classwork** - Q: If 2 guinea pigs with the alleles Bb are crossed, what is the probability that an offspring will have white fur?
A: (answer on your **CW** sheet)

9 **Classwork** - Punnett Squares (answer on your **CW** sheet)

Pp x Pp

PP x pp

