🧬 Lesson Plan: Genetics - Study of Heredity

Grade Level: 6
Subject: Life Science
Duration: 45–60
NGSS MS-LS1-5: Construct a scientific explanation based on evidence for how environmental and genetic factors influence the growth of organisms.

🎯 Learning Objectives

By the end of this lesson, students will be able to:

- **Explain** how traits are passed from parents to offspring through heredity.
- **Identify** the roles of genes, chromosomes, and alleles in inheritance.
- **Distinguish** between genotype and phenotype in organisms.

its genotype.

- **Punnett Square:** A diagram used to predict the possible outcomes and probabilities of a genetic cross between two organisms.
- **Dominant Allele:** An allele whose trait will always show up in an organism when the allele is present.

💼 Materials Needed: (all links are included in this PDF)

- Printed copies of the Study Guide (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-genetics-study-of-heredity-1.pdf)
- Activity Lesson: Genetics - The Study of Heredity (https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-genetics-study-of-heredity-1-genetics-the-study-of-heredity-3.pdf)
- Genetics worksheet (multiple choice) (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-genetics-study-of-heredity-1-0.pdf)
- Genetics worksheet (Punnett squares) (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-genetics-study-of-heredity-1-1.pdf)
- Vocabulary matching worksheet (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-genetics-study-of-heredity-1-1.pdf)
- Pea plant samples or images (green and yellow pods, tall and short stems)

- Use the Study Guide to explain the key concepts: genes as segments of DNA, chromosomes as carriers of genes, and alleles as different forms of genes. (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-genetics-study-of-heredity-1.pdf)
- Demonstrate Mendel's pea plant experiment using the Activity Lesson: cross purebred tall plants with purebred short plants to show that all F1 generation plants are tall, then explain dominant and recessive alleles. (https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-genetics-study-of-heredity-1-genetics-the-study-of-heredity-3.pdf)

- Introduce Punnett squares using the Activity Lesson examples, showing how to set up a simple monohybrid cross (Gg x Gg) and calculate probability ratios. (https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-genetics-study-of-heredity-1-genetics-the-study-of-heredity-3.pdf)
- Explain the difference between genotype (genetic makeup like GG, Gg, gg) and phenotype (observable traits like green or yellow pods).

Step 3: Guided Practice (12 minutes)

- Work through Punnett square problems as a class using examples from the Activity Lesson, such as the green pod (G) vs. yellow pod (g) cross. (https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-genetics-study-of-heredity-1-genetics-the-study-of-heredity-3.pdf)
- Complete the vocabulary matching worksheet together, reinforcing terms like allele, genotype, phenotype, and Punnett square. (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-genetics-study-of-heredity-1-1.pdf)

Step 5: Assessment (10 minutes)

- Review answers to the multiple-choice worksheet as a class, clarifying any misconceptions about dominant vs. recessive alleles and Mendel's experiments. (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-genetics-study-of-heredity-1-0.pdf)
- Have students share their Punnett square solutions and explain their reasoning for one problem, such as determining the genotypes that produce black fur in rabbits (BB or Bb).

(https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-genetics-study-of-heredity-1-1.pdf)

- Ask students to classify real-world examples: Is a child with one tall parent and one short parent more likely to be tall or short if height follows simple dominance? Have them justify their answer using a Punnett square.

Differentiation Strategies

For advanced learners:

- Challenge advanced learners to explore incomplete dominance and codominance patterns, such as flower color in snapdragons where red (RR) crossed with white (WW) produces pink (RW) offspring.
- Have students research human genetic traits like blood type or tongue rolling and create Punnett squares to predict inheritance patterns in their own families.

- Research and present on a genetic disorder caused by recessive alleles, such as cystic fibrosis or sickle cell anemia, explaining how carriers can pass on the trait without showing symptoms.

Complete List of Available Resources:

- NewPathWorksheets: Genetics - Study of Heredity (https://newpathworksheets.com/science/grade-6/genetics-study-of-heredity-1)

- Study Guide PDF (https://newpathworksheets.com/api/guide/study-guide-science-grade-6-genetics-study-of-heredity-1.pdf)
- Activity Lesson PDF (https://newpathworksheets.com/api/activity-lesson/activity-lesson-science-grade-6-genetics-study-of-heredity-1-genetics-the-study-of-heredity-3.pdf)
- Worksheet PDF 1 (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-genetics-study-of-heredity-1-0.pdf)
- Worksheet PDF 2 (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-genetics-study-of-heredity-1-1.pdf)
- Worksheet PDF 3 (https://newpathworksheets.com/api/worksheet/worksheet-science-grade-6-genetics-study-of-heredity-1-2.pdf)
- Vocabulary PDF 1 (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-genetics-study-of-heredity-1-1.pdf)
- Vocabulary PDF 2 (https://newpathworksheets.com/api/vocabulary/vocabulary-science-grade-6-genetics-study-of-heredity-1-2.pdf)
- Vocabulary PDF 3 (https://newpathworksheets.com/api/vocabulary/vocabulary-science-

PREVIEW

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GENETICS: THE STUDY OF HEREDITY

Mendel's Work

Gregor Mendel was a high school teacher from Austria who developed the foundation of genetics. He worked with pea plants in the monastery where he lived in the 17th century. Without his work the study of heredity would not be where it is today.

Gregor wondered how and why pea plants had different physical characteristics, otherwise known as traits. Some of the pea plants grew short while others grew tall, and some had green pods while others had yellow pods.

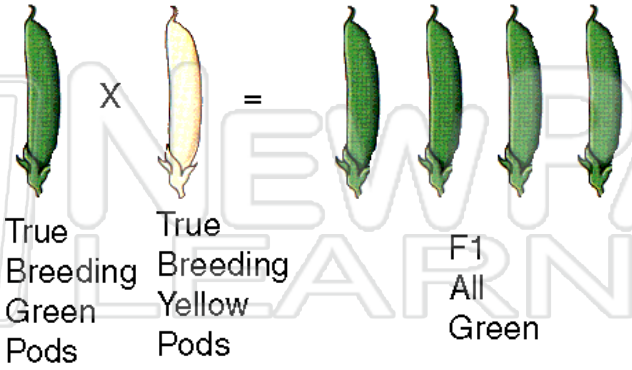
grow and reproduce. The results of the F_2 generation were a mix of tall and short plants.

Dominant and Recessive Alleles

From Mendel's work on peas, he was able to hypothesize that the traits existed in pairs and that each parent contributed one trait to the offspring.

What is an Allele?

Mendel reasoned further that one trait can be masked by another trait in the parents. For example, the purebred parents for green and yellow pod colors F_1 generation will all have a green pod. So the yellow pod color will not show up at all in the F_1 generation.



In the F_2 generation the yellow pod color comes back at a ratio of

example, the green allele is the dominant allele.

A **recessive allele** is the allele that will be masked if the dominant allele is present. The only possible way that the recessive allele will show up is if the dominant allele is not present at all.

Lesson Checkpoint: What is a dominant allele?

Hybrids

A hybrid is the F1 generation that has two different forms of an allele.

Probability and Heredity

Probability is the chance that a certain event will occur. If you were to flip a coin into the air and let it hit the ground, which side would it land on?

There are two different possibilities, heads or tails. It is equally probable that the coin will land on the heads side as it is that it will land on the tails side.
This translates to... the probability of a coin landing on heads or tails is 1 in 2. There is a 50% chance that the coin will land on the heads side and there is a 50% chance that it will land on the tails side totaling 100%.
Mendel's probability illustrated that probability can be used to predict an organisms traits.

Lesson Checkpoint:
What is the probability of a coin landing on tails?

particular trait and show the ratio's of those traits. Probability of this Punnett Square: GG = 25%, Gg = 50%, and gg = 25%

Phenotypes and Genotypes

There are **four important terms** that geneticists use on regular basis and they are phenotype, genotype, homozygous, and heterozygous.

- A **phenotype** is the physical appearance of a particular organism. A pea plant can have one of two different physical appearances for pod color: either green or yellow.

- The **genotype** is the genetic make-up of a particular organism. An organism has two separate alleles for a trait. The allele combination is the genotype.
- A **homozygous** organism is one that has two of the same alleles for a particular trait. A pea plant with the alleles GG has a green pod while a pea plant with the alleles gg has a yellow pod. Both are said to be homozygous (Homozygous = the same).
- A **heterozygous** organism is one that has two different alleles for a particular trait. A pea plant with the alleles Gg has a green pod in every circumstance and are considered to be heterozygous (heterozygous = different).

Chromosomes and Inheritance

A chromosome is a strand of DNA that contains genes which define the traits of the individual. Chromosomes are passed on from parents to their offspring through the sex (eggs or sperm). These sex cells

different according to their particular species.

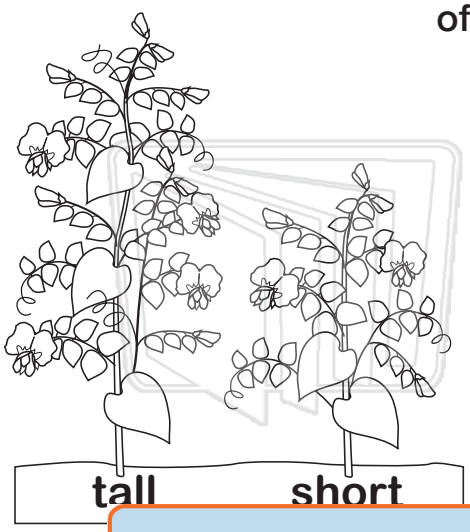
Each chromosome is made up of thousands of different genes and on those chromosomes are genes that have two alleles on opposite chromatid that can either be the same or different from one another.

Genetics - The Study of Heredity

Sci F

Name _____ Class _____ Date _____

Gregor Mendel (1822-1884) is known for his **pea plant experiments** that demonstrated the process of **heredity**. His discoveries form the foundation of **genetics** – *the study of heredity.*



P Generation

In a typical experiment, Mendel crossed purebred tall-stemmed plants with purebred short-stemmed plants (**P generation**).

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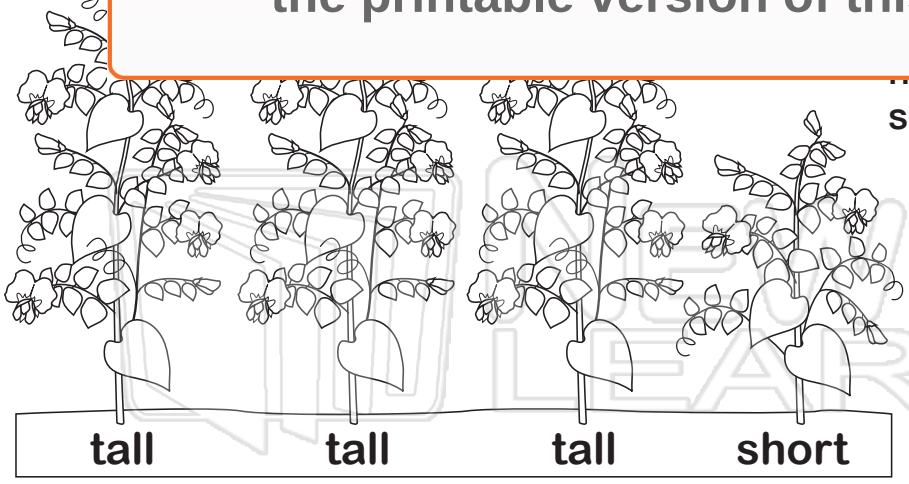
short- stemmed plants.



F_2 Generation

Mendel hypothesized that each parent passes to the offspring a **factor** or set of *genetic information* which controls a **trait**. The factors, now called **genes**, exist in pairs known as **alleles**, one inherited from each parent.

Genetics - The Study of Heredity

Sci F

Name _____ Class _____ Date _____

An **allele** is a different form of a **gene**. A **dominant allele** is one whose trait will **always show up** in its presence. A **recessive allele** is one whose trait **will be masked** whenever the dominant allele is present.

	seed shape	seed color	pod shape	pod color	stem height
dominant allele	round	yellow	smooth	green	tall (dominant)
recessive allele	wrinkled	green	pinched	yellow	short (recessive)

PREVIEW

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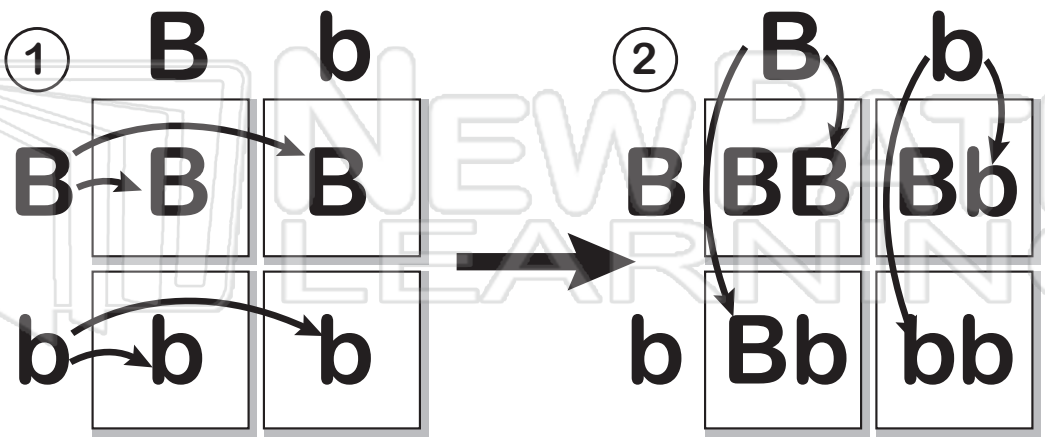

Genetics - The Study of Heredity

Sci F

Name _____ Class _____ Date _____

Green pea pods (**G**) are **dominant** to yellow pea pods (**g**).

Fill in the Punnett square below to show the possible offspring from a **Gg x Gg cross.** Then fill in the genotype and phenotype table.

	G	g
G		
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	Phenotype	Genotype
Offspring		
Offspring		
Offspring		

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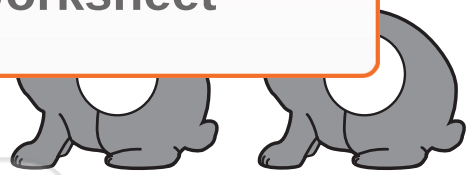

Tall pea plants (**T**) are dominant to short (**t**) plants. Two plants were crossed and **all** the plants in F_1 were **tall.** List the **genotypes** of the parents. Include all possibilities.

_____

Genetics - The Study of Heredity

Sci F

Answer Key

Green pea pods (**G**) are **dominant** to yellow pea pods (**g**).

Fill in the Punnett square below to show the possible offspring from a **Gg x Gg cross.** Then fill in the genotype and phenotype table.

	G	g
G	GG	Gg
g	Gg	gg

	Phenotype	Genotype
Offspring	green pods	GG
Offspring	green pods	Gg
Offspring	yellow pods	gg

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BB, Bb

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TT & Tt, TT & TT, TT & tt

Genetics - Study of Heredity

Sci F

Name_____ Class_____ Date_____

1 **Gregor Mendel** laid the foundation for what field of science?

A biology
B ecology
C genetics
D botany

2 What kind of **plant** did Gregor Mendel test the most?

A corn
B grass
C roses
D peas

3 What is a **characteristic** that Gregor Mendel looked for on his pea plants?

A how long the stems were on the plant
B the quality of the soil the plant was planted in

4 In studying **genetics**, what did Gregor Mendel notice about the pea plants he studied?

A the plants grew better with a lot of sunlight
B the plants grew better with good soil

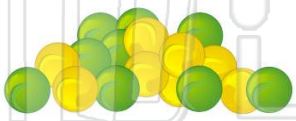
5

7

C It is how a gene is chosen.
D It is the best gene.

D 4

9 Organisms receive **one** allele for every gene.



A true
B false

10 A **dominant** allele _____.

A overpowers and masks the other allele
B is better than other alleles
C is worse than other alleles
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Genetics - Study of Heredity

Sci F

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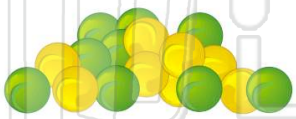

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A

Genetics - Study of Heredity

Sci F

Name_____ Class_____ Date_____

1 A **recessive** allele _____.

A overpowers and masks the other allele
B is better than other alleles
C is worse than other alleles
D is masked by another allele

2 What does the term **hybrid** mean?

A an organism made mostly of hydrogen
B an organism that can change into another organism
C an organism that has two different forms of an allele
D an organism that has similar characteristics as another organism

3 Probability is **certainty** that an event will occur.

A true
B false

4 How many **possible** sides can a coin land on if you were to toss it in the air?

A 1
B 2
C 3

5

7

alleles for a particular trait
D an organism that has two different alleles for a particular trait

C two of the same alleles for a particular trait
D two different alleles for a particular trait

9 An organism that is **homozygous** has _____.

A the physical appearance of a particular organism
B the genetic make-up of a particular organism
C two of the same alleles for a particular trait
D two different alleles for a particular trait

	G	g
G	GG	Gg
g	Gg	gg

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Genetics - Study of Heredity

Sci F

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Genetics - Study of Heredity

Sci F

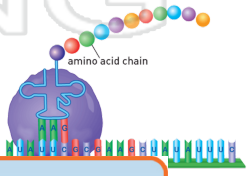
Name_____ Class_____ Date_____

Match each of the following terms to its definition:

Cell cycle	Anaphase II	Anaphase I	Allele
Amino acid	Anticodon	Anaphase	Cell plate

1. - different forms of a gene

2. - the building blocks of protein molecules



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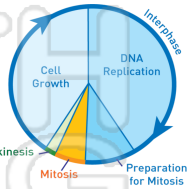
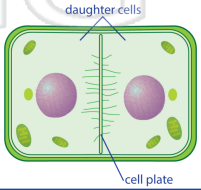
7. - the sequence of stages of growth and division that a cell undergoes



8. - develops in the middle plane of a plant cell separating it into two daughter cells during cell division



Genetics - Study of Heredity

Sci F

Name_____ Class_____ Date_____

Match each of the following terms to its definition:

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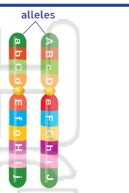
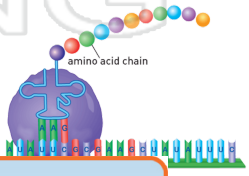
1. allele - different forms of a gene



2. amino acid - the building blocks of protein molecules



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PREVIEW

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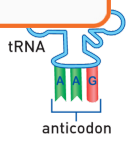
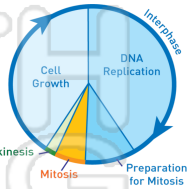


7. cell cycle - the sequence of stages of growth and division that a cell undergoes



8. cell plate - develops in the middle plane of a plant cell separating it into two daughter cells during cell division