# The Origins of Genetics

## Mendel and the Garden Pea Experiment

TOPIC PREVIEW

Answer the following questions with a partner or your classmates.

1. Why do people look the way they do? Why do you look similar to, but different from, your parents, brothers, and sisters?

2. Look at the title of this chapter. Can you guess who Mendel was and how his study of pea plants furthered our understanding of heredity and genetics?

3. How can an understanding of genetics help agriculture?
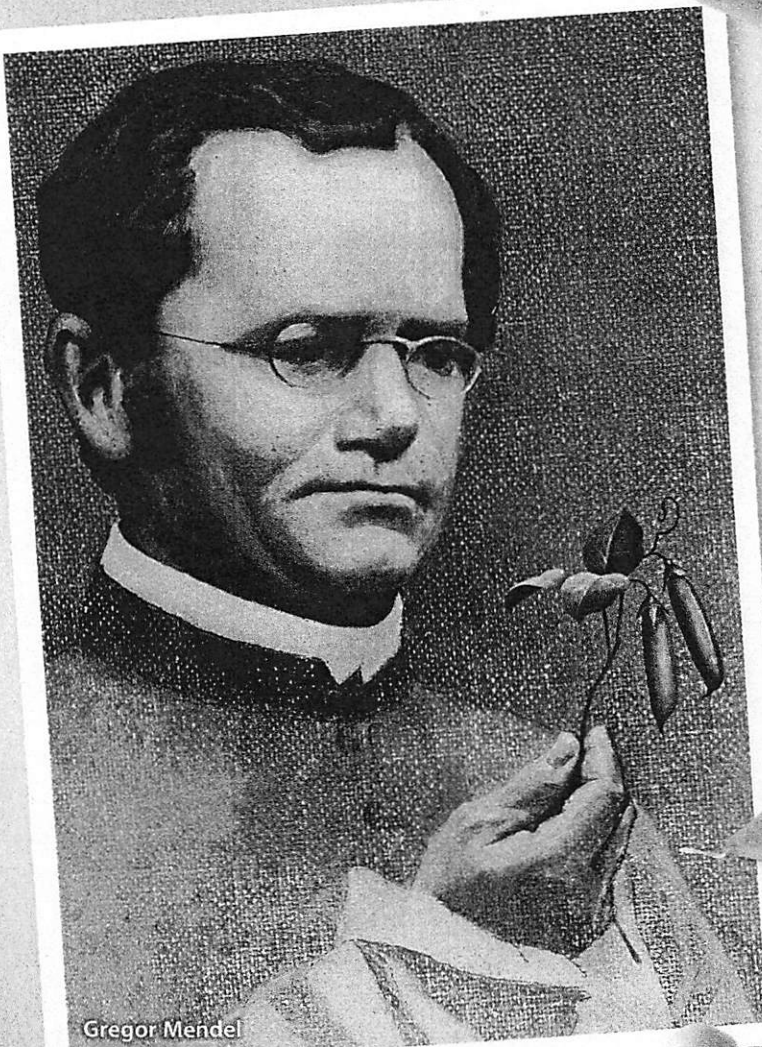
Gregor Mendel
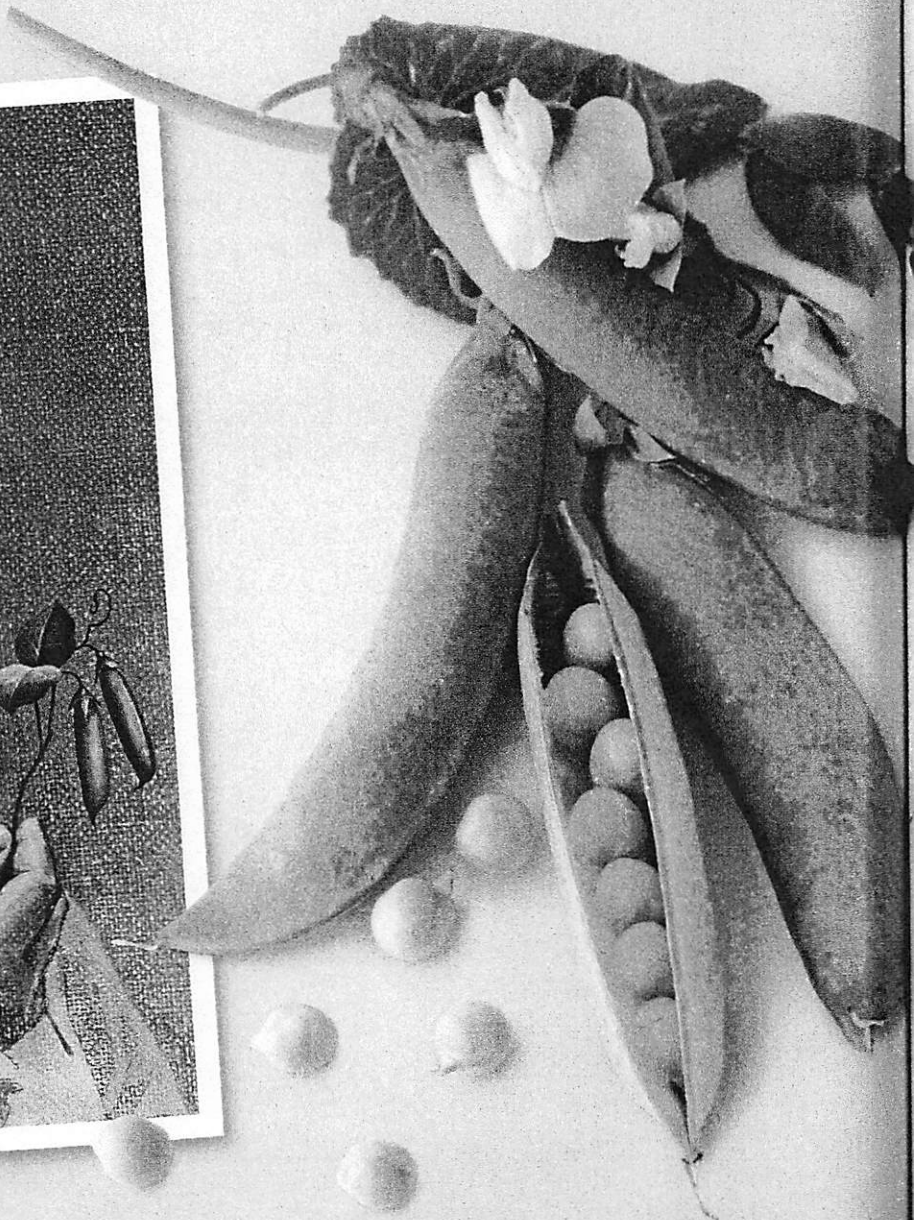
VOCABULARY PREVIEW

🔊 · Ⓐ **Read through the sentences below, which are missing vocabulary from the**
CD 4, TR 1   **lecture. Listen to the sentences and write the missing words in the blanks.**

1. _____ determine how every living creature on earth appears, how it functions, how it _____, and generally, how it behaves.

2. Inherited _____, or characteristics, are determined by _____ of genes that are different for every human being.

3. The scientists who study how genes are _____ and passed from one generation to the next are called _____.

4. I want to _____ and briefly examine the work of a _____ in biology, Gregor Mendel.

5. Mendel studied science at the University of Vienna, and there he learned how to use mathematics to try to explain natural _____.

6. When a variety of garden pea that had violet flowers was _____ with a variety that had white flowers, all the _____ surprisingly had only violet flowers.

7. Mendel applied his knowledge of mathematics and statistics to help him _____ the results of the _____ of the white-flowering and violet-flowering plants.

8. The pea plants could be _____ quickly, and with little effort.

9. We now know that genes are tiny _____ structures inside each cell that determine eye color, blood type, height, and so on.

10. A person may have a genetic _____ toward being overweight, but the person's actual weight will depend on a number of environmental _____.

Ⓑ **Check the spelling of the vocabulary words with your teacher. Discuss the meanings of these words and any other unfamiliar words in the sentences.**

PREDICTIONS

Think about the questions in the Topic Preview on page 90 and the sentences you heard in the Vocabulary Preview. Write three questions that you think will be answered in the lecture. Share your questions with your classmates.

NOTETAKING PREPARATION

Anticipating and Recording Examples

In the course of a lecture, you will almost always hear examples that explain or reinforce an important point. Here is some language a lecturer might use to introduce an example:

For example, ...   *... like ...*   *Let me give you an example. ...*
... including ...   *... such as ...*

When you hear a lecturer use any of these phrases, use one of the following abbreviations in your notes to show you are recording an example:

EX –   For ex –   e.g. –

Remember that examples support a main point.

- List them under the related main point in your notes.

- Indent them to show that they are less important than the main point.

- Leave extra room so that you can later add examples or details you may have missed.

Recording Numbers and Dates in Notes

Lectures often include numbers and dates. There are many different ways that numbers are stated. Here are some examples:

2010	*twenty ten* or *two thousand and ten* (listen for the reduced *n* instead of *and*)
2,500,000	*two and a half billion* or *2.5 billion* ("2 point 5 billion")

When taking notes about numbers, the following are useful abbreviations:

2000→	since 2000	K	thousand	ht	height
←2000	until 2000	M	million	wt	weight
950–2000	from 950 to 2000	B	billion	'	foot, feet
C20	20th century	m	meter(s)	"	inch, inches
bce	before the common era	km	kilometer(s)	~	about, approximately
↓	lower, decrease, less	g	gram(s)	=	is, are, have, equals
↑	higher, increase, more	kg	kilogram(s)	≤	at least

(A) Look at the notes. What do they mean?

1. 2614–2502 bce _____

2. ~2.3 M _____

3. ~15K kg _____

4. ht=147m _____

5. 3 m ↓ _____

6. 2500 kg _____

🔊 **FIRST LISTENING**
CD 4, TR 3

Listen to the lecture and number the slides on this page and the next in the order they would be shown during the lecture. Write the number of the slide on the line provided and answer the question to the right of the slide.

The Garden Pea Experiments

Thomas Knight
- Unexplained results

Gregor Mendel
- Repeated Knight
- Applied statistical analysis

Advantages of pea plant
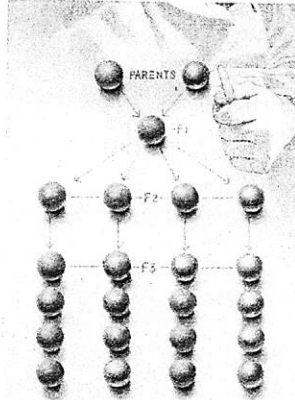
Slide #_____

What is one reason why Mendel used pea plants in his experiments?

What Are Genes?

What genes do

DNA

Genes are inherited

Field of study

Slide #_____

What do genes determine?

Genetics Today

What we learned from Mendel

Genes and heredity

Nongenetic factors that influence who we are

Do we understand genetics and heredity completely today?

Gregor Mendel (1822–1884)

Early experiments with pea plants

Monestary
- Teacher
- Study at University of Vienna

How are Mendel's principles referred to today?

Interest in How Heredity Works

Examples
- Crops
- Animals

What example does the lecturer use to illustrate how heredity works in an animal?

SECOND LISTENING

Now that you have listened to the lecture once, listen to it again and take notes. Write on a separate piece of paper.

THIRD LISTENING

You will hear parts of the lecture again. Look through your notes as you listen. A notetaking mentor will discuss the notes. Circle the answer that is closest to the notes you took, and put a check (✓) next to the notes that the mentor wrote.

Part 1

1. a.

Gs
- • in bd cells
- • md of DNA (=instrs for Gs)
- • inher'd
  EX – hair col

b.

Gs fnd in cells of bod
md of deoksy___ ?
instrs each cell supposd... ?
Gs passd dn
inher int trts frm grmoth/fath

Part 2

2. a.

Mendel –intr – see rl man
1843 became monk
1851 – Univ Vien
math & exper biol
2 yrs – left un.
- • nrvs tak exam
- • bcm famous sci

b.

Mendel
1842 monk – teach
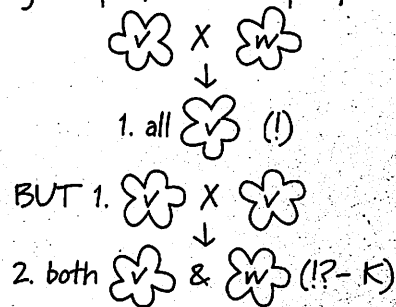1851 Univ Vien – math & biol

c.

Mendel

Part 3

3. a.

Tm Knight – pea flwr exp:
viol fl X wh. fl = all v offspr (!)
BUT v X v offspr = v & w (!)
– w reapp – K cdnt expl

b.

Tm Knight exp w/viol & wh pea flwrs

❀ X ❀
↓
1. all ❀ (!)

BUT 1. ❀ X ❀
↓
2. both ❀ & ❀ (!?– K)

PRE-READING

The following Reading is about how genetic patterns can be traced through human history. Before you read, answer the following questions. Share your answers with a classmate.

1. Look at the picture of a cell below. Can you identify the different parts of the cell? Where are the genes?

2. Scan the article and locate the two subtitles. For each subtitle, write a question that you would like to have answered.

READING

Now read the article.

Genes and Population Genetics

The human body is made of some 50 to 100 trillion cells, which form the basic units of life and combine to form more complex tissues and organs. Inside each cell, genes comprise a "blueprint" for protein production that determines how the cell will function. Genes also determine physical traits. The complete set of some 20,000 to 25,000 genes is called the genome. Only a tiny fraction of the total genome sets the human body apart from those of other animals.

Most cells have similar basic structure. An outer layer, called the cell membrane, contains fluid called cytoplasm. Within the cytoplasm are many different specialized "little organs," called organelles. The most important of these is the nucleus, which controls the cell and houses the genetic material in structures called chromosomes. Another type of organelle is the mitochondria. These "cellular power plants" have their own genome, and do not recombine during reproduction.

During reproduction, each cell's DNA, which is in the form of a double helix, separates into two unique strands. The individual strands duplicate themselves for the next generation, but the process is not always perfect. Random "copying errors," or mutations, can and do occur along the genome's long spelling sequence of base pairs.

When mutations are passed down through the generations they become genetic markers of descent, forming a complex story that can be traced backward in time. The exact shape of this tree is also affected by natural selection and migration.
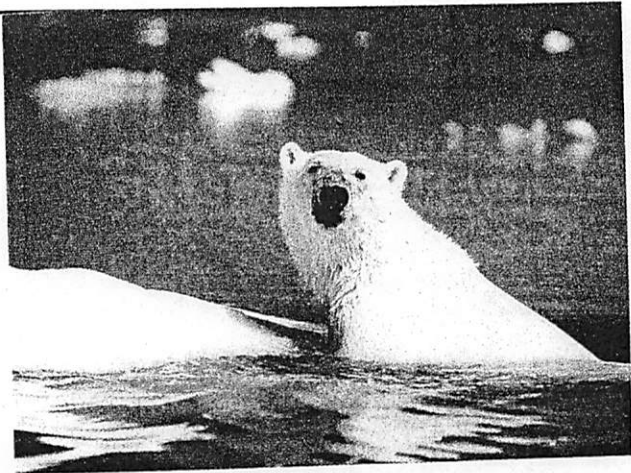
Cut-away view of a human cell
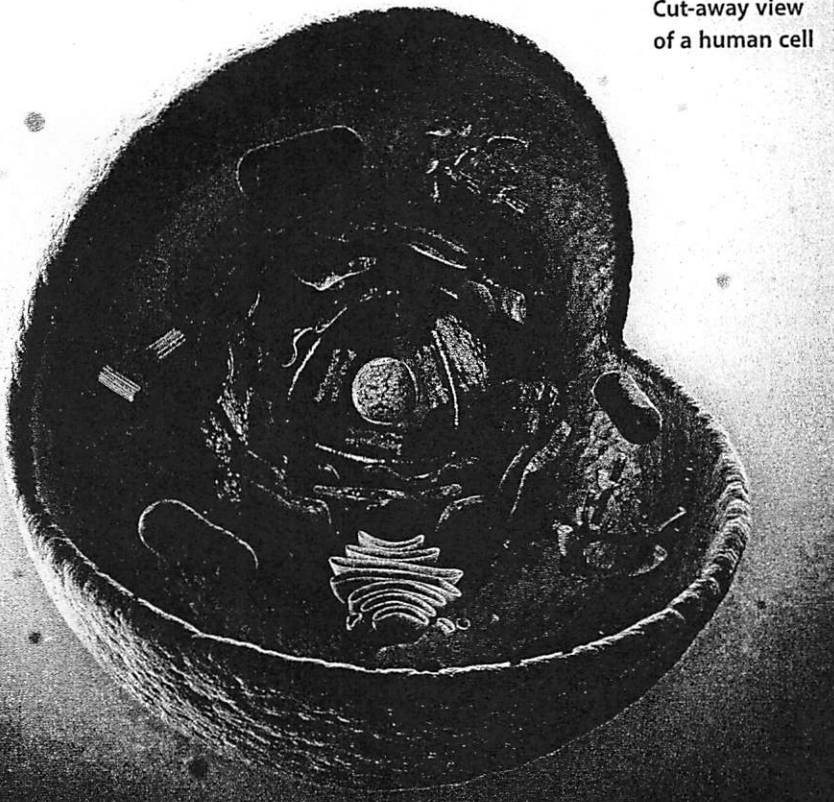
Natural selection

Natural selection is a process that favors beneficial genetic mutations and limits harmful ones. Organisms that possess an advantageous trait either attract mates more easily or survive in greater numbers. Such traits are passed on to increasingly larger numbers of individuals with each successive generation. The cumulative effect of natural selection produces populations that have evolved to succeed in their unique environments. This effect is readily seen in the physical diversity of plants, animal species, and human populations worldwide.

Migration

Y-chromosome DNA, passed from father to son, and mitochondrial DNA, passed from a mother to all her children, are varied through the generations only by occasional natural mutations, or genetic markers. These mutations, occurring in an otherwise continuous string of genetic replication, serve as genetic signposts for tracing human evolution. By following a marker back though time to its origin, geneticists can identify the most recent common ancestor of everyone alive who carries a given marker. The divergent branches of the human family tree, represented by groups carrying a particular genetic marker, can be followed back to "nodes" on the tree where a mutation split a branch into two directions. Eventually, these branches can be followed backward all the way to a common African root—a common ancestor of us all.

DISCUSSION

Discuss these questions with a classmate.

1. How much of the article was a review of what you heard in the lecture?

2. What information in the reading surprised you?

3. Compare the concepts of natural selection, discussed in the reading, with selective breeding, discussed in the lecture. How are they similar and how do they differ? Do humans always make good choices when they breed animals and plants?

RESEARCH PROJECT

Individually or in a group, research one of the following topics. Write a short paper on the topic, or plan and present a group presentation to inform the class about the topic.

1. Research the mechanism of recessive inheritance and try to find examples of recessive traits that you share with your grandparents and not your parents.

2. Choose an area of the world that has a distinctive physical environment and research its plant and animal species. Analyze how the species have adapted to their environment.

3. Choose another related topic that interests you or your group.