

Istituto tecnico industriale "A. MALIGNANI" Udine

Docente: Prof. Annamaria Boasso

Modulo di genetica realizzato per l'applicazione in classi seconde.  
Durata: 4 ore

## Biology CLIL lesson

### Mendel's work

#### Objectives

- Learn about Mendel
- Listen for specific information
- Read for detailed information
- Use scientific terms

#### Glossary

Genetics

Inherited factors

Dominant

Recessive

Homozygote

Heterozygote

Phenotype

Genotype

## BIOGRAPHY

Gregor Mendel was an Austrian monk, teacher and scientist often called the "father of genetics". He was born in 1822 in the Austrian Silesia (now the Czech Republic) and was the son of a farmer. He entered the Abbey of St. Thomas in Brno in 1843; in 1851 he was sent to study at the University of Vienna, and in 1853 he returned to his Abbey as a teacher.

At the monastery, Mendel kept a small garden where he experimented growing pea plants.

He studied the way their characteristics were passed on from one generation to the next, looking for patterns.

Mendel chose to study features which were easy to observe, such as plant height, flower color and seed shape.

Pea plants were also easy to grow and Mendel was able to either self - pollinate or cross - pollinate the flowers.

Mendel planned his work and meticulously collected and recorded his results. He was also able to analyse the huge amount of data that he had built up and so come to sound scientific conclusions. He collected data for 10 years. His sample size was large; he tabulated results from 29,000 pea plants. He replicated his experiments and analyzed his data with statistics (he tabulated results).

Mendel chose Garden Peas for the following characteristics:

- Peas take little space and are easy to cultivate
- They are inexpensive
- They have a short generation time compared to large animals
- They have some distinct characteristics that are easy to recognize.

He studied such characteristics as pea shape (round - wrinkled), pea color (yellow - green), pod shape (inflated - constricted), pod color (green - yellow), flower color (red - white) and they were either one thing or another.

The amazing thing about Mendel's work is that he worked out the underlying rules of inheritance before anything had been discovered about DNA, genes and chromosomes.

Once scientists knew about chromosomes and genes, they could explain how Mendel's "inherited factors" could be passed on from one generation to the next.

The importance of Mendel's work was not recognised until after his death (1884).

## MENDEL CROSSES

Mendel used pure-breeding individuals in the first generation (P1)

P1    yellow x green

F1 all yellow

F2 75% yellow, 25% green.

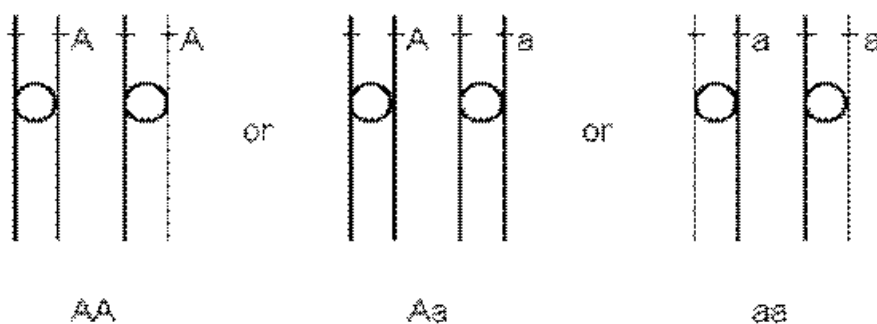
The F1 generation showed only one character that was present in P1. The other character reappeared in the F2.

Mendel concluded that the F1 plants must contain 2 distinct factors, one for each character. The character that was seen in the F1 is called DOMINANT. The character that was not seen in the F1 is called RECESSIVE.

The characteristics studied by Mendel were due to single genes. By convention, upper case letters are used to represent dominant genes (A), lower case letters are used for recessive genes (a).

Because individuals are diploid, two letters can be used to represent the genetic makeup of an individual. The following three gene combinations are possible: AA, Aa and aa. HOMOZYGOTE refers to an individual that has two identical genes (AA or aa).

HETEROZYGOTE refers to an individual that has two different forms of the gene (Aa); a heterozygote is also called HYBRID.



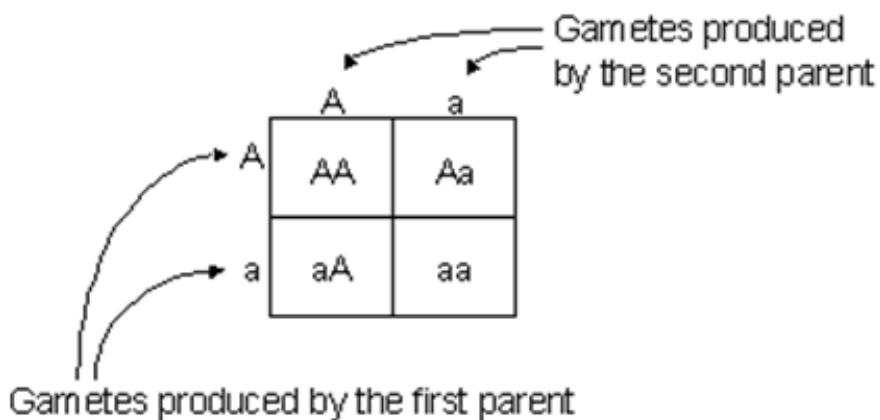
## PRINCIPLE OF SEGREGATION

Mendel's principle of segregation states that paired factors (genes) separate during meiosis and form haploid gametes, which carry one copy of each chromosome. An AA individual produces all "A" gametes; an aa individual produces all "a" gametes. An Aa individual produces two kinds of gametes: A and a.

Individual (genotype)	Type of gametes produced
AA	all gametes will contain an "A"
Aa	1/2 will contain "A" and 1/2 will contain "a"
aa	all "a" gametes

## PUNNETT SQUARES

The Punnett square is a diagram used to show all of the combinations that are formed when an individual is crossed with another one. The Punnett square in the diagram below is used to show the cross between two Aa individuals.



The Punnett square below is used for this cross: AA X Aa.

	A	a
A	AA	Aa
A	AA	Aa

The genetic makeup of an individual is called **GENOTYPE**; the characteristics of an individual are its **PHENOTYPE**.

## After listening to the lesson

### 1) Complete the following sentences with the missing information:

1. Gregor Mendel was an Austrian \_\_\_\_\_, \_\_\_\_\_ and \_\_\_\_\_, often called the "father of \_\_\_\_\_".
2. Mendel kept a small garden and experimented growing \_\_\_\_\_ plants.
3. He chose pea plants because they were \_\_\_\_\_ to grow.
4. He collected data for \_\_\_\_\_.
5. He tabulated results from \_\_\_\_\_ pea plants.
6. He replicated his experiments and analyzed his data with \_\_\_\_\_.
7. Peas take little place and are easy to \_\_\_\_\_.
8. Peas have some distinct \_\_\_\_\_ that are easy to recognize.
9. Mendel worked out the \_\_\_\_\_ of \_\_\_\_\_ before anything had been discovered about DNA, genes and chromosomes.
10. The importance of Mendel's work was not \_\_\_\_\_ until after his death.

### 2) Complete these sentences by choosing the correct word from inside the brackets:

1. A pea plant with a tall (genotype/phenotype) could have a (genotype/phenotype) TT or Tt.
2. A tall pea plant with genotype TT is (homozygous/heterozygous) dominant.
3. A tall pea plant with genotype Tt is (homozygous/heterozygous) dominant.
4. A pea plant with genotype tt is (homozygous/heterozygous) recessive.

### 3) Draw a Punnett square to show the genetic cross between a homozygous dominant and a homozygous recessive. Then write down the possible genotypes or phenotypes.

### 4) Match the names to the correct definitions:

- |                 |   |
|-----------------|---|
| 1. HOMOZYGOTE   | a. The character that was seen in F1                  |
| 2. HETEROZYGOTE | b. The genetic makeup of an individual                |
| 3. DOMINANT     | c. An individual that has two different forms of gene |
| 4. RECESSIVE    | d. The characteristics of an individual               |
| 5. GENOTYPE     | e. The character that was not seen in F1              |
| 6. PHENOTYPE    | f. An individual that has two identical genes.        |

**5) Explain the difference between genotype and phenotype.**

**6) Read the text and answer the following questions:**

Gregor Mendel was an Austrian and Augustinian priest and scientist often called the "father of genetics" for his study of the inheritance of traits in pea plants. He was inspired by both his professors at university and his colleagues at the monastery to study variations in plants, and he concluded his study in the monastery's garden. Mendel showed that the inheritance of traits follows particular laws, which were later named after him. His experiments brought forth two generalisations which later became known as Mendel's Laws of Inheritance. The significance of Mendel's work was not recognized until the turn of the 20th century. Its rediscovery prompted the foundation of genetics.

1. How was Mendel called?
2. What did Mendel study?
3. What did Mendel show?
4. Who was Mendel inspired by?
5. How did Mendel's experiments become known?
6. When was Mendel's work recognized?

Web sites and references:

<http://www.biology.ucsd.edu>

<http://en.wikipedia.org>

<http://mendelweb.org>

"New Biology for you" (G. Williams - Nelson Thornes)

## CLIL lesson - "Mendel's work"

### FINAL TEST

#### 1) Complete the following sentences with the missing information

1. Gregor Mendel was an Austrian \_\_\_\_\_ , \_\_\_\_\_ , often called the "father of \_\_\_\_\_"
2. Mendel kept a small garden and experimented growing \_\_\_\_\_ plants.
3. He chose pea plants because they were \_\_\_\_\_ to grow.
4. He collected data for \_\_\_\_\_.
5. He tabulated results from \_\_\_\_\_ pea plants.
6. He replicated his experiments and analyzed his data with \_\_\_\_\_.
7. Peas take little place and are easy to \_\_\_\_\_.
8. Peas have some distinct \_\_\_\_\_ that are easy to recognize.
9. Mendel worked out the \_\_\_\_\_ of \_\_\_\_\_ before anything had been discovered about DNA, genes and chromosomes.
10. The importance of Mendel's work was not \_\_\_\_\_ until after his death.

#### 2) Explain the difference between heterozygous and homozygous.

#### 3) Draw a Punnett square to show a heterozygous cross and write down the possible genotypes and phenotypes.

#### 4) Match the names to the correct definitions:

- 1) HOMOZYGOTE
- 2) HETEROZYGOTE
- 3) DOMINANT
- 4) RECESSIVE
- 5) GENOTYPE
- 6) PHENOTYPE
- 7) INHERITED FACTORS
- 8) GENETICS

- a. The character that was seen in F1
- b. The genetic makeup of an individual
- c. An individual that has two different forms of gene
- d. The characteristics of an individual
- e. The character that was not seen in F1
- f. An individual that has two identical genes
- g. The study of inheritance
- h. Characteristics that could be passed from one generation to the next.

**5) Say whether the following statements are true (T) or false (F).**

- |   |   |   |
|---|---|---|
| a. The principle of segregation states that paired factors (genes) separate and form haploid gametes. | T | F |
| b. An AA individual produces two kinds of gametes A and a.  | T | F |
| c. A heterozygote is an individual that has two different forms of gene.                              | T | F |
| d. The letter "a" is used for dominant genes.   | T | F |
| e. P1 is the first generation of a genetic cross.   | T | F |
| f. The genetic makeup of an individual is called phenotype.   | T | F |
| g. A Punnett square is a diagram used to show all the combinations in a genetic cross.                | T | F |
| h. A heterozygote is not hybrid.  | T | F |
| i. Homozygote refers to an individual that has two identical genes: AA or aa.                         | T | F |
| l. Mendel discovered genes and chromosomes.   | T | F |

**6) Read the text and answer the following questions:**

Gregor Mendel was an Austrian and Augustinian priest and scientist often called the "father of genetics" for his study of the inheritance of traits in pea plants. He was inspired by both his professors of university and his colleagues at the monastery to study variations in plants, and he concluded his study in the monastery's garden. Mendel showed that the inheritance of traits follows particular laws, which were later named after him. His experiments brought forth two generalizations which later became known as Mendel's Laws of Inheritance. The significance of Mendel's work was not recognized until the turn of the 20th century. Its rediscovery prompted the foundation of genetics.

- 1) How was Mendel called?
- 2) What did Mendel study?
- 3) What did Mendel show?
- 4) Who was Mendel inspired by?
- 5) How did the experiments of Mendel become known?
- 6) When was Mendel's work recognized?
- 7) What did Mendel's work rediscovery prompt?