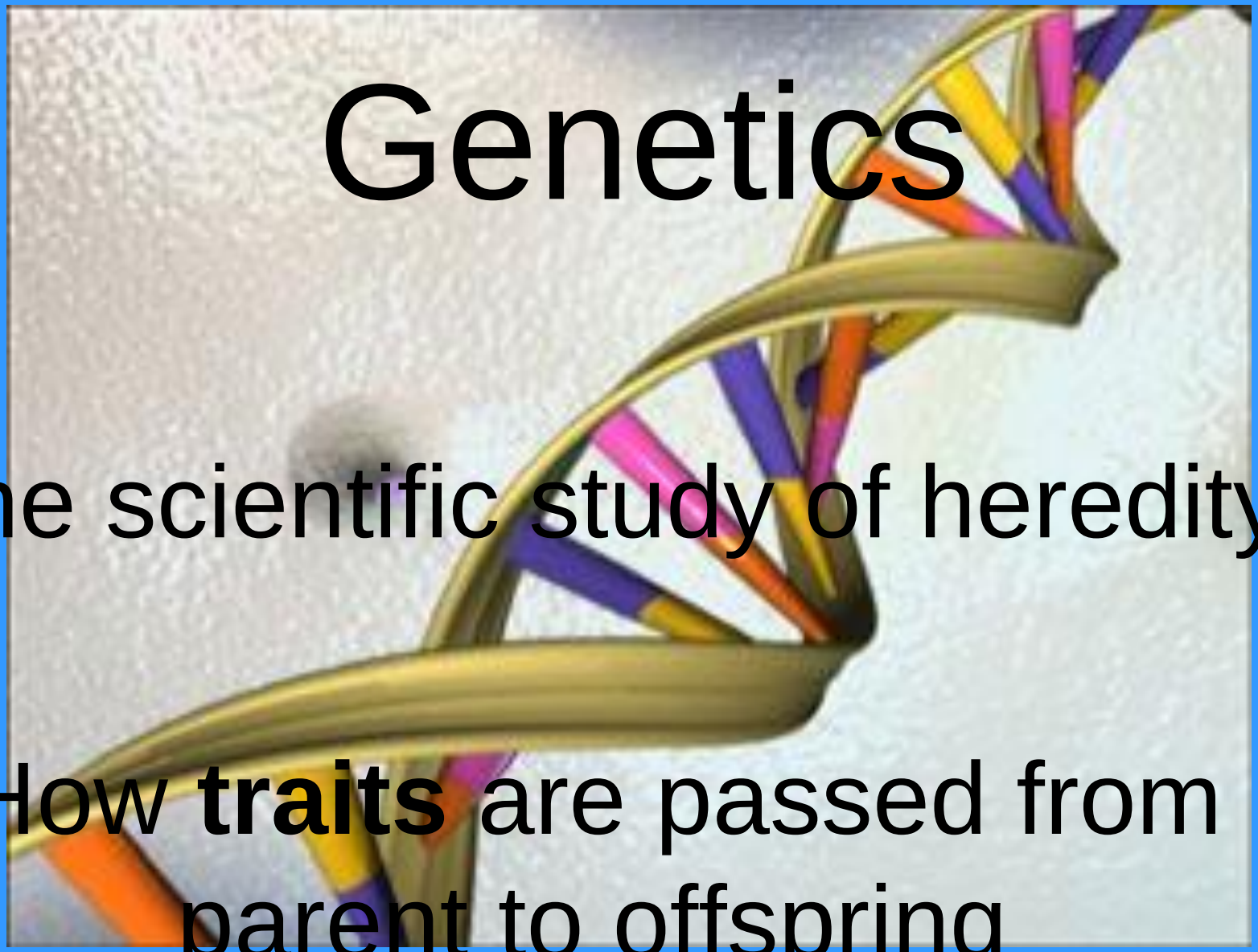


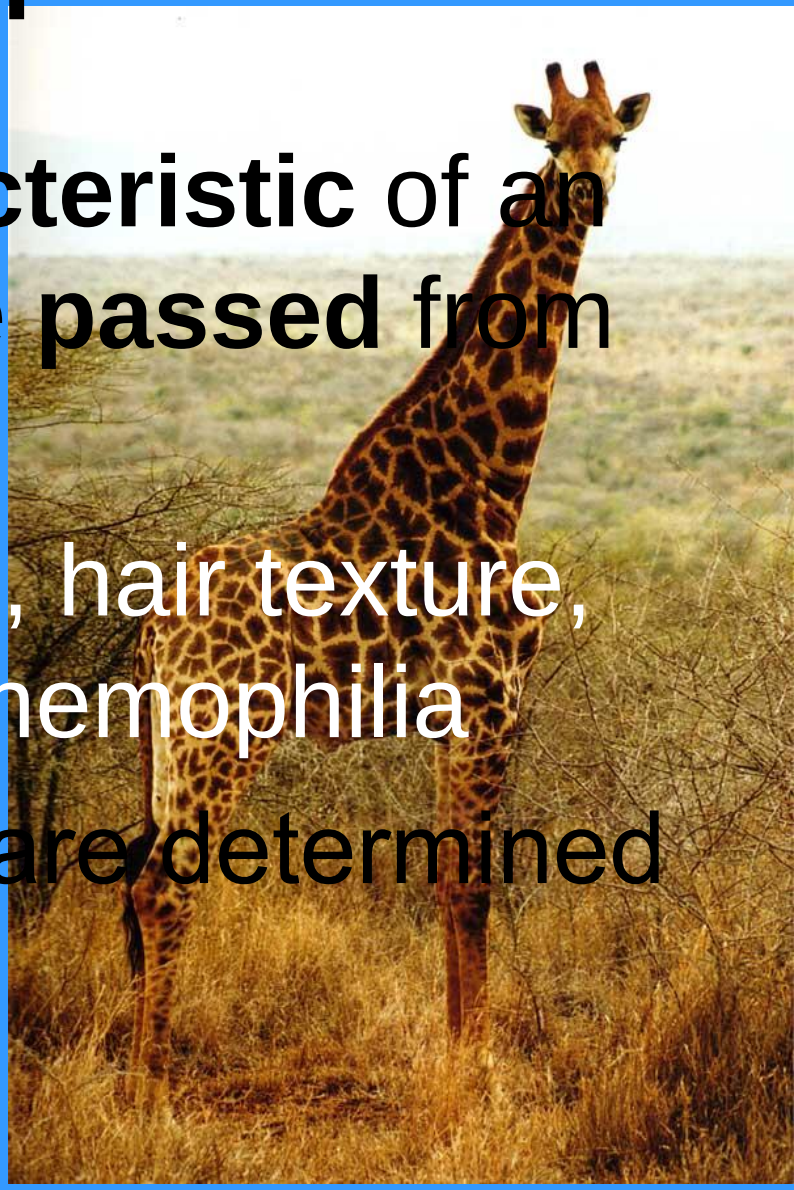
Genetics

The scientific study of heredity

How **traits** are passed from parent to offspring

TRAIT

- Any **physical characteristic** of an organism that can be **passed** from parent to offspring.
- **Examples**: eye color, hair texture, hemoglobin protein, hemophilia
- An individual's traits are determined by their **genes**.



Gene

- A section of **DNA** that contains the **instructions** for a particular **protein**
- These proteins determine the physical and functional characteristics of the cell or organism.

Allele

- When there are several different versions of a gene for the same trait.
- **Examples**: The eye color trait has several different gene possibilities or alleles, such as brown, green, blue and hazel

Genotype

- This refers to the **actual genes** an organism has for a particular trait. The genes are represented by **letters**.
- **Examples**: **TT, Tt or tt** are all genotypes for the height of pea plants.

Phenotype

- This refers to the **physical characteristic** that is displayed by the organisms. The genotype **determines** the phenotype.
- **Examples**: The pea plant is tall or short.

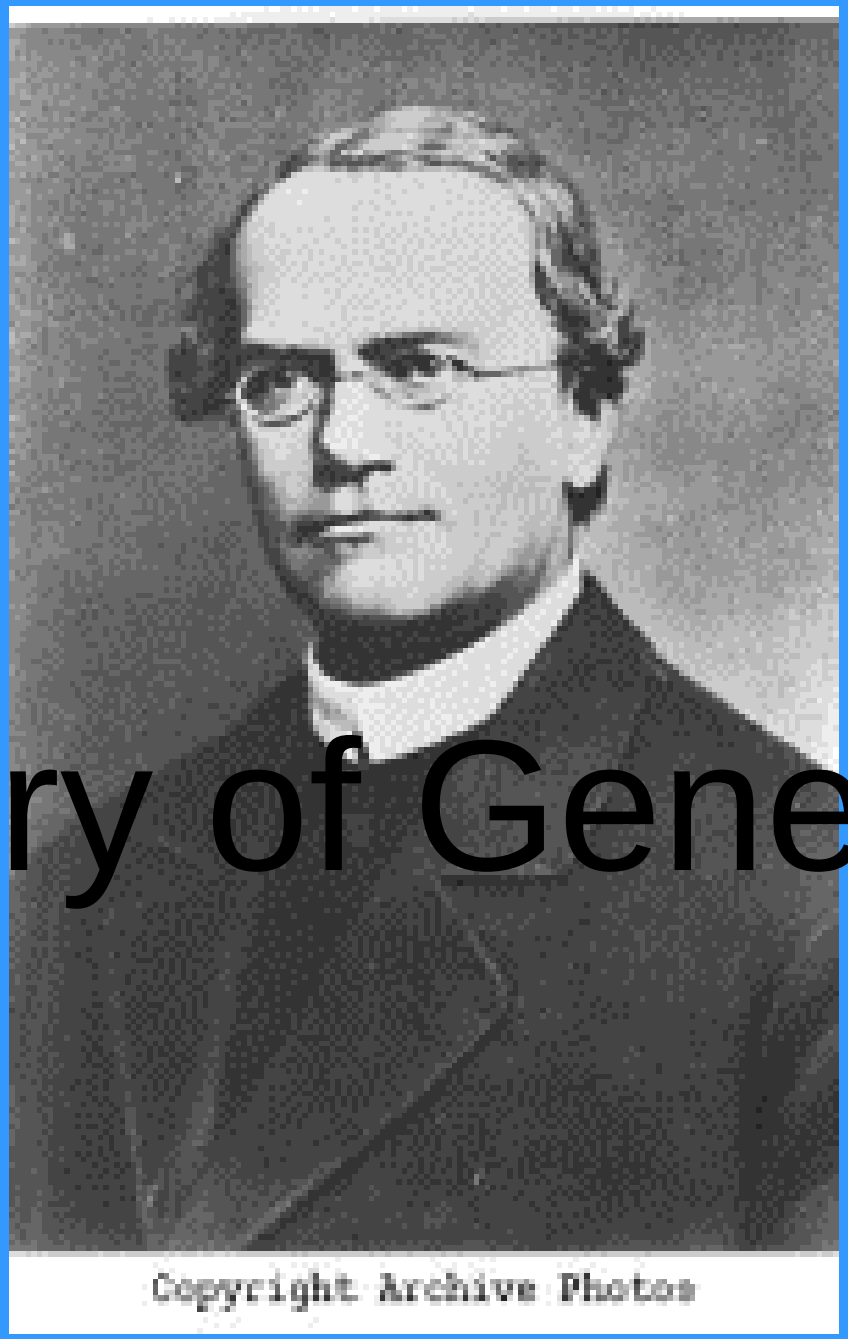
Homozygous

- An individual's **genotype** has two of the **same alleles** for a **trait**. (i.e. **Both capital** letters or **both lower-case** letters)
- **Homo = Same**
- **Example**: TT or tt, GG or gg, RR or rr, etc

Heterozygous

- An individual's **genotype** has two **different alleles** for a **trait**. (i.e. **One capital** and **one lower-case** letter)
- **Hetero=Different**
- **Example**: Tt, Gg, Rr, etc

History of Genetics



Gregor Mendel

- Born in **1822**
- Died in **1884**
- Born in a region of **Austria**
- Ordained as a **priest** in **1847** (when he was 25 years old)
- Sent to study **math and science** at the **University of Vienna**

Gregor Mendel

- Conducted experiments with the **inheritance** of **traits** in **pea plants**

- His work was published in **1865**, but its significance was not realized until **1900**, after his death

Why did he use pea plants?

1. **Easy to grow and study – fast** life cycle and **inexpensive**
2. **Mating** is easily controlled and **manipulated**
3. **Traits are distinct** – See the chart on your notes

Character	Dominant trait	Recessive trait
Seed shape	 Spherical	 Wrinkled
Seed color	 Yellow	 Green
Flower color	 Purple	 White
Pod shape	 Inflated	 Constricted
Pod color	 Green	 Yellow

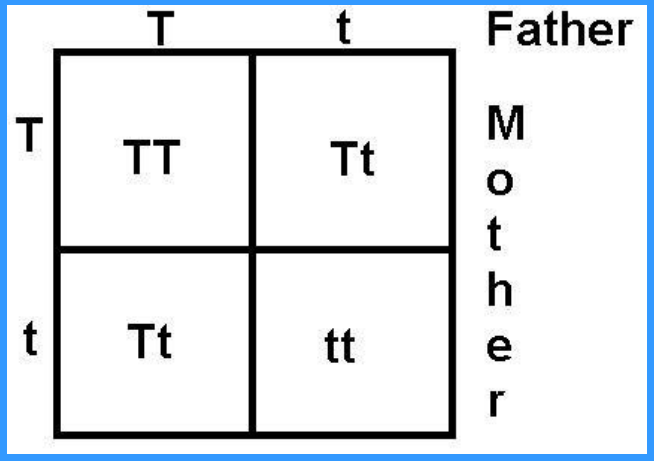
Character	Dominant trait	Recessive trait
Flower position	 Axial	 Terminal
Stem height	 Tall	 Dwarf

Mendel's experiments

Monohybrid cross – cross involves only **one pair** of **contrasting traits**

Example: Cross a **purple flowered** plant with a **white flowered** plant

(ignore all other traits)



1. Mendel allowed each variety of plant to **self-pollinate** for **several** generations.

- This ensured that the plants would be “**True breeding**” or “**Purebred**”
  - i.e. Purple plants would only carry **purple alleles**
  - These plants are called the **Parental generation** or **P generation**

2. Cross a **purebred purple** plant with a **purebred white** plant.

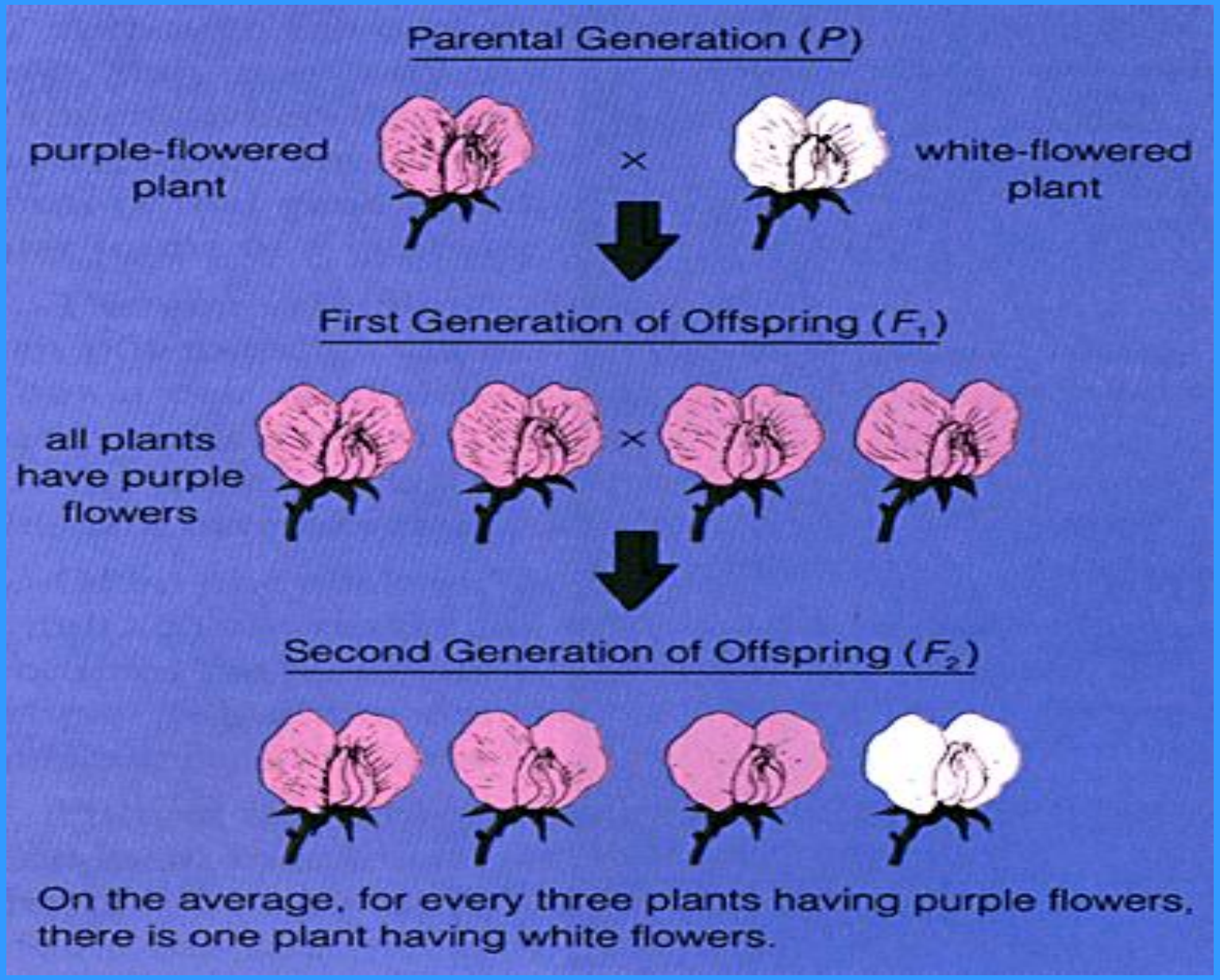
- The **offspring** of this cross are called the **F1 generation** (first filial)
- Results:

100% purple flowering offspring

3. Cross the **F1 generation** plants with each other.

- **Offspring** of this cross are called the **F2 generation** (second filial)
- **White flowered** plants re-appear at a ratio of

  3:1 (purple:white)


Parental Generation (P)
purple-flowered plant
×
white-flowered plant
First Generation of Offspring (F_1)
all plants have purple flowers
×
Second Generation of Offspring (F_2)
On the average, for every three plants having purple flowers, there is one plant having white flowers.

Mendel's Hypothesis

1. For each trait, there are **2 copies of a gene**: 1 from each parent.
2. There must be **alternate versions** of genes:

- The **flower color** trait has 2 different **phenotypes**: purple and white
- These different versions are now known as **alleles**

Mendel's Hypothesis

3. When **2 different alleles** occur together, one allele may be completely **expressed**, while the other is not observed at all.

- The **expressed** allele is considered to be **dominant**
- The **hidden** allele is considered to be **recessive**

Language of Genetics

- **Dominant alleles** are indicated by using the **first letter** of the dominant phenotype
- **Dominant alleles** are always indicated by a **capital** letter
- Example: Purple is dominant over white, so we would use **capital P**

Language of Genetics

- **Recessive alleles** are indicated by using the same letter as the dominant phenotype
- However, the **lower-case** version is used
- Example: White is recessive to purple, so we would use

  lower-case p

Language of Genetics

- If an individual is **PURE** for a trait, then both alleles are the same.
- **Homozygous** =

  Homozygous dominant =**PP**

  Homozygous recessive = **pp**

Language of Genetics

- If an individual has **2 different** alleles for a specific trait:

Heterozygous =

Heterozygous = **Pp**

Practice Problems

1. T= tall
t=short

2. YY Tt pp

3. Purple flowers
Tall
Green seeds

http://www.cccoe.net/genetics/mendel.html

http://player.discoveryeducation.com/clickDirector.cfm/type/video/action/download/guidAssetID/342118ba-1059-4350-9dc6-15181a36248d/strRealname/The_Genetic_Work_of_Gregor_Mendel.asf