Gregor Mendel

Who Was Gregor Mendel?

Gregor Mendel was born in 1822. He worked in a monastery garden, using pea plants to study heredity.

What led to Mendel's experiments?

Through his experience breeding plants, Mendel knew that patterns of inheritance sometimes seemed simple, and sometimes didn't. Mendel noticed that a trait would sometimes skip a generation, and then show up again. He wanted to know why this happened.

Why did Mendel choose pea plants for his experiments?

Garden peas were a good choice for multiple reasons. They grew quickly, exist in many varieties, and can self-pollinate. **Self-pollinating** plants contain both male and female reproductive structures. This means pollen from one flower on a plant can pollinate itself or another flower on that plant.

What did Mendel study?

During his experiments, Mendel studied one characteristic at a time. He studied characteristics that had two forms. He was careful to use truebreeding plants. When these plants self-pollinate, the offspring has the same trait as the parent. Mendel cross-pollinated true-breeding plants to carry out his experiment.

What were Mendel's two experiments?

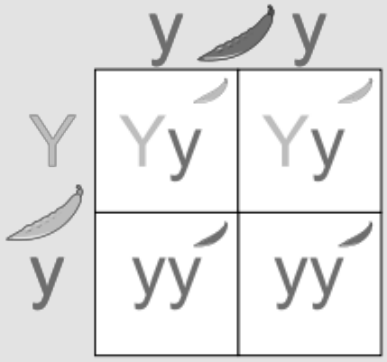
In his first experiment, Mendel studied 7 characteristics. He performed crosses between the two traits of each characteristic. The offspring of these crosses is called the first generation. One trait (dominant) always appeared, and one trait (recessive) seemed to disappear. Mendel then performed another experiment. He allowed the first generation to self-pollinate. The recessive trait appeared at a 3:1 ratio (25%).

Gregor Mendel (cont)

What did Mendel realize as a result of his two experiments?

Mendel realized that his results could only be explained if each parent had two sets of instructions per characteristic (genes). Each parent gives the offspring one set, so it has two. The different forms of a gene are called alleles. This can be shown with a Punnett square.

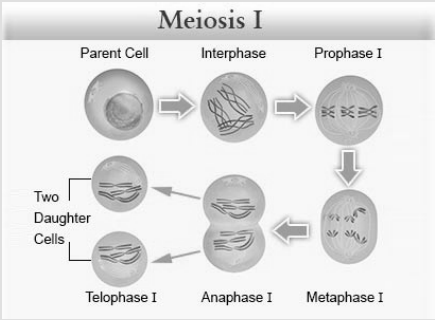
Punnett Square



Genotype: Inherited combination of alleles
Phenotype: An organism's appearance

Meiosis

Meiosis



Interphase
Prophase
Metaphase
Anaphase
Telophase
Cytokinesis

DNA

What are the two types of reproduction?

> **Asexual reproduction**: One parent is needed for reproduction. Internal structures of the cell are copied by mitosis. The parent cell divides creating two identical daughter cells. Most one-celled organisms reproduce this way.
> **Sexual reproduction**: Two parent cells, known as sex cells, join together to form a new individual. One half of the chromosomes an organism needs is given to it by each parent cell. Male sex cells are called *sperm*. Female sex cells are called eggs, or *ova*. Each sex cell has one of the chromosomes from each homologous pair.

What is meiosis?

> A process which produces new cells with half the usual number of chromosomes (sex cells). The chromosomes are then copied and the nucleus divides twice. The result is sperm and eggs with half the number of chromosomes found in a normal body cell.

Who is Walter Sutton?

> Walter Sutton was a young graduate student who made an important observation. He realized that *GENES ARE LOCATED ON CHROMOSOMES!*

What are sex chromosomes?

> Sex chromosomes carry genes that determine whether the offspring is male or female. Female: XX Male: XY Females always pass on X. Males pass X or Y. If an X sperm fertilizes an egg, a female is born. If a Y sperm fertilizes an egg, a male is born.

What are the subunits of DNA?

> DNA is made of four subunits, known as nucleotides. Each consists of a phosphate, a sugar, and a base. The three bases are:
> (A) Adenine - Pairs with T
> (T) Thymine - Pairs with A
> (G) Guanine - Pairs with C
> (C) Cytosine - Pairs with G
> Because A always bonds with T and G always bonds with C, one side of a DNA sequence is complementary to the other.

How does DNA replicate?

> DNA replicates by splitting down the middle. Each original molecule is like a template. A complementary molecule forms along it.

What are Chargaff's rules?

> Erwin Chargaff found that the amount of adenine in DNA is equal to that of thymine, and the amount of guanine is equal to that of cytosine.

Who was Rosalind Franklin?

> In the lab of Maurice Wilkins, Rosalind Franklin created X-Ray images of DNA. These suggested that DNA had a spiral shape. James Watson and Francis Crick later used this research.

Who are James Watson and Francis Crick?

> Watson and Crick built on the research of others and concluded that DNA resembles a double helix shape. Upon discovery of this, Crick is said to have exclaimed, "*We have discovered the secret of life!*"

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Patterns of Inheritance

Law of Dominance

One allele is dominant. It always shows unless it isn't present (Homozygous Recessive)

Law of Segregation

During production of gametes, 2 copies of each allele separate. Therefore, one allele is needed from each parent.

Law of Independent Assortment

Individual alleles assort independently. This gives different traits equal chance of occurring together.

Incomplete dominance

Dominant allele partially expressed, resulting in an intermediate phenotype (Example: Rr If Red is Dominant and White is recessive, the phenotype is pink).

Codominance

2 dominant alleles, Phenotype is neither dominant nor recessive.
Example: In blood, types A and B are codominant, O is recessive. AB blood is therefore possible.

Sex-Linked Inheritance

A trait is associated with the X or Y chromosome. (Males can never be carrier).

Polygenic Inheritance

Multiple genes affect one trait (Examples: Hair color, skin color, eye color).

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