

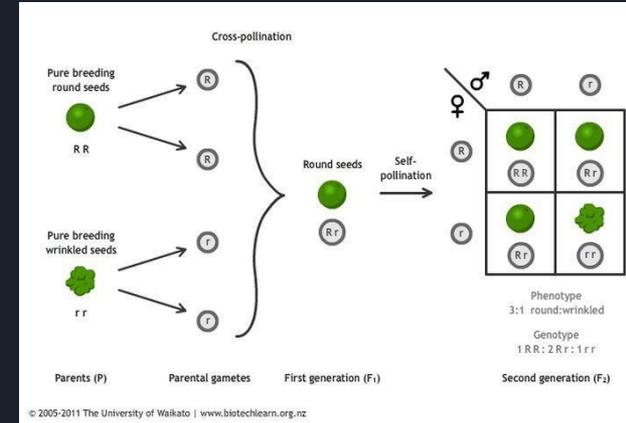


3.4 INHERITANCE

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Mendel and the Principles of Inheritance

- Crossed varieties of pea together by **transferring the male pollen** from one variety to the **female parts** in flowers of another variety
- He then **collected the pea seeds that formed** as a result and **grew them** to find out their characteristics
- He **repeated** this many times with numerous pea plants
- His theory is the basis of inheritance in all plants and animals
- Quantitative measurements with replicates to ensure **reliability**



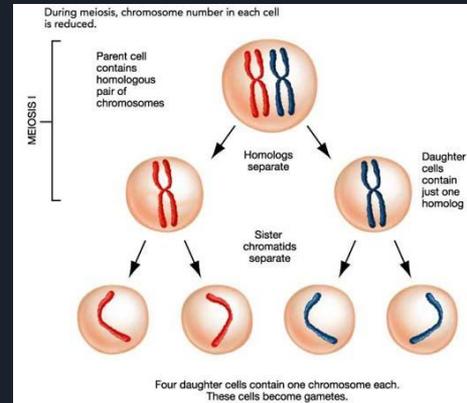


Gametes are haploid so they contain one allele of each gene.

- Gametes = cells that fuse together to produce the single cell that is the start of a new life
- Gametes = SEX CELLS
- The **single cell** that is created when a female and a male gamete fuse is called a **zygote**
- Parents pass genes on to their offspring in gametes
- Gametes contain one chromosome of each type so are haploid → the nucleus of a gamete therefore only has one allele of each gene
- Female and male parents make an equal genetic contribution to their offspring, despite being different in size

The two alleles of each gene separate into different haploid daughter nuclei during meiosis.

- Diploid nucleus divides twice to produce four haploid nuclei → the diploid nucleus contains two copies of each gene, but the haploid nuclei contain only one
- If two copies of one allele of a gene were present, each of the haploid nuclei will receive one copy of this allele (ex: PP)
- If two different alleles were present, each haploid nucleus will receive either one of the alleles, not both (ex: Pp)
- The separation of alleles into different nuclei is called segregation.
- The process of segregation breaks up existing combinations of alleles in a parent and allows new combinations to form in the offspring





Fusion of Gametes

- Results in diploid zygotes with two alleles of each gene that may be the same allele or different alleles.
 - Male and Female fusion of gametes \longrightarrow same nuclei \longrightarrow double chromosomes
 - Nucleus of zygote = 2 chromosomes of each type and 2 alleles of each gene
 - Ex: If there are 2 alleles of a gene, A & a, the zygote would contain two copies of either allele or one of each.
- L** \longrightarrow Outcomes: AA, Aa, aa
- * some genes have more than 2 alleles, ABO blood type has 6 combinations



DOMINANT vs. recessive vs. Co-Dominant

- Dominant alleles mask the effects of recessive alleles, but co-dominant alleles have joint effects
- All offspring from Mendel's seven crosses showed the character of one of the parent, and **not** the other → due to one gene with two alleles
- The tall parents have two copies of an allele that makes them tall, **TT**
- The dwarf parents have two copies of an allele that makes the dwarf, **tt**
- The parents pass on one allele to their offspring, which therefore has one of each allele, **Tt**
- Some genes have pairs of alleles where both have an effect when present together, they are called **co-dominant alleles** (if a red-flowered plant is crossed with a white-flowered plant, its offspring would be pink)



Genetic Diseases due to Recessive Alleles

- Majority of genetic diseases are due to recessive alleles of autosomal genes. (autosomal means not pertaining to sex chromosome)
- No dominant allele = 2 recessive allele copies
- 1 genetic disease allele + dominant allele = no symptoms of disorder
- ;however, carriers.
- Both parents must be carriers, but.....
- 25% probability child will have disorder
- Cystic Fibrosis is caused by recessive allele

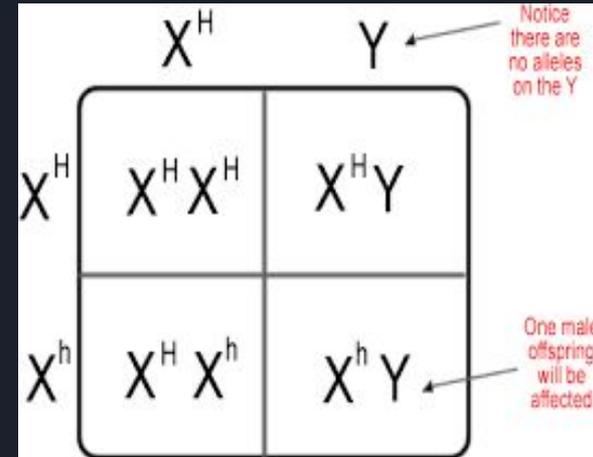
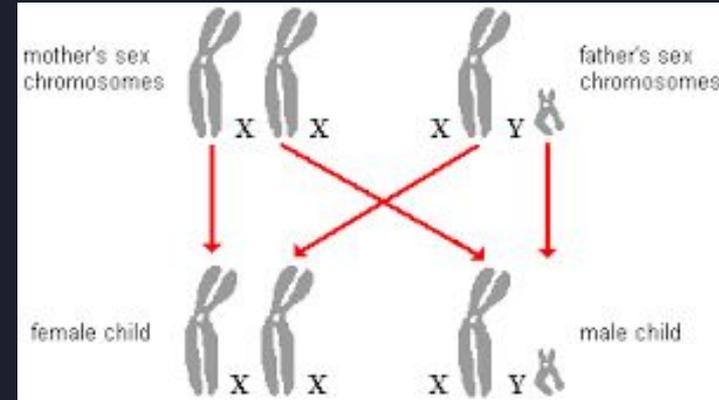


Others Causes of Genetic Diseases

- Some genetic diseases are sex-linked and some are due to dominant or co-dominant alleles
- If a person has one dominant allele, then they themselves will develop the disease
- A very small portion of genetic diseases are caused by co-dominant alleles
- Most genetic diseases affect males and females in the same way, but some show a different pattern of inheritance in males and females (called sex-linkage)

Sex-linked genes

- Plants are hermaphrodite (they can produce both male and female gametes)
- Inheritance of genes paralleled = located on chromosomes
- In crosses involving sex linkage, alleles should be shown as a superscript letter on a letter X (chromosome), the Y to show it doesn't carry allele



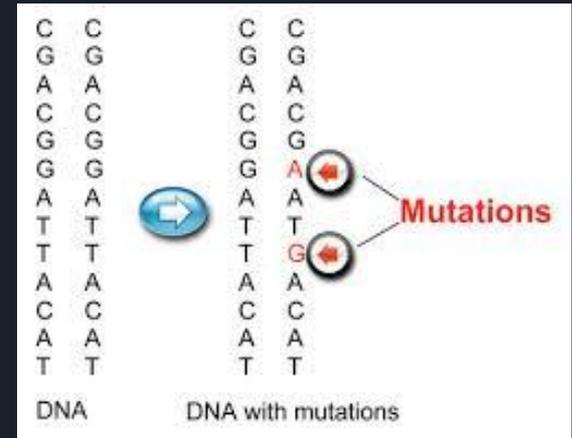


Genetic Diseases in Humans

- Many genetic diseases have been identified in humans, but most are very rare
- Medical research has already identified more than 4,000 genetic diseases, more no doubt remain to be found
- These diseases are caused by very rare recessive alleles that follow the Mendelian patterns of inheritance

Causes of Mutation

- Radiation and mutagenic chemicals increase the mutation rate and cause genetic disease and cancer.
- New alleles are formed from other alleles
- Mutation: *random change to base sequence of a gene.*
- 1. Radiation: Gamma Rays, short-wave ultraviolet rays 2. Chemical: benzo in tobacco smoke
- Majority of mutations are neutral or harmful
- Endless division of cells results in a *tumor.*
- Crucial to stop in gametes of ovaries and testes





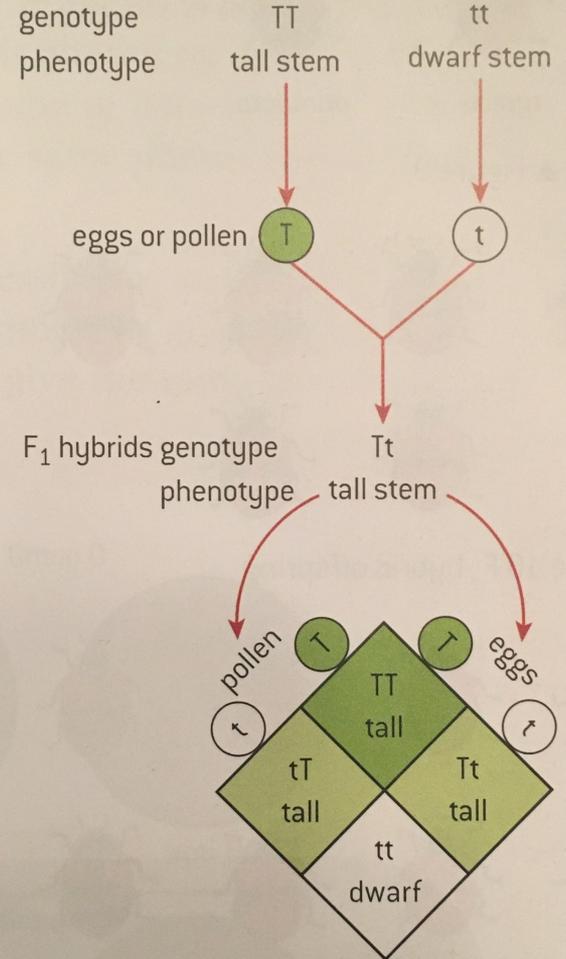
Connection to Evolution

- These traits that are inherited are what allow diversity and natural selection to occur
- Without inheritance, there would be no diversity = extinction would quickly occur
- Traits= Survival/Adaptation
- The new alleles created help with disease & stress factors

DBQ

1. What is the probability that the pea plant will have a dwarf sized stem?
2. Explain why the pea plants with the alleles: Tt and tT both grow to have long stems.

parents:





Quiz

<https://kahoot.com/welcomeback/>