

Mutations

Vocabulary

Mutation -

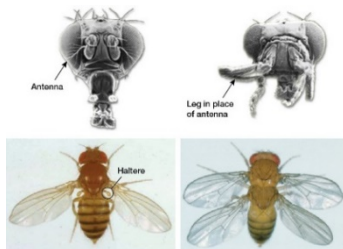
a permanent change in the structure of a gene; usually resulting in a non-beneficial trait, but not always

Exogenous factors -

exo = external/outside, *-genous* = producing; Examples: sunlight, radiation, smoking, etc.

Endogenous factors -

endo = internal/inside, *-genous* = producing; Examples: a deletion, insertion, rearrangement of the DNA, etc.



Causes of Mutations

Exogenous factors -

This means these mutations are caused by _____ factors.

Endogenous factors -

This means these mutations are caused by _____ during DNA replication.

Which type of factor is it? A canister of a radioactive isotope landing in a bowl containing four baby turtles would be a _____ factor.

Benefits & Disadvantages of Mutations

BENEFITS: Mutations can lead to _____ changes which leads to an increase in survival and reproductive success. Examples: ability to digest milk, antibiotic resistant bacteria, resistance to plague and small pox.

DISADVANTAGES: Mutations can lead to _____ changes which results in lower survival rate or reproductive success. Examples: disease (such as cancer), developmental delays, and structural abnormalities.

Genetic Disorders and an Example of a Mutation

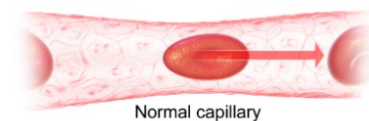
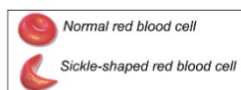
Genetic Diseases are caused by an accidental change or abnormality in the genetic makeup of an organism. Mutations can be inherited or happen in your lifetime during DNA replication or due to environmental factors. The impacts of mutations can be minimal to severe. There are many reasons genetic diseases occur.

Some genetic diseases are a result of one mutation – for example: cystic fibrosis, sickle cell anemia, fragile X syndrome, etc. While other genetic diseases stem from many factors – genetic mutations combined with environmental factors = for example: heart disease, high blood pressure, diabetes, cancer, etc. Some genetic diseases are linked to issues with whole chromosomes, like Down syndrome.

Sickle Cell Anemia (see image to left)

Disadvantage – Why is this mutation “bad?”

Benefit – Why is this mutation “good?”



Link for Sickle Cell Research:
<https://kidshealth.org/en/teens/sickle-cell-anemia.html>

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Vocabulary

Natural Selection –

process where organisms with certain traits survive to reproduce and pass on those traits

Selective Breeding –

process of breeding the most desired traits into a population; Example: livestock or crops

Genetic Engineering –

the manipulation of DNA to produce molecules or organisms with new properties; Examples: drug and vaccine production, pest or disease resistant crops

Gene Therapy –

a process used to treat or correct a genetic disease or disorder by replacing missing or defective genes

Vector –

the carrier of a genetically engineered gene

Adenovirus –

any of a group of DNA viruses first discovered in adenoid tissue, most of which cause respiratory diseases; modified and used as a vector for gene therapy

Genetic Engineering: Insulin Production

Prior to the genetically engineered insulin, pig and cow insulin was used by diabetics to control diabetes, but there were side effects with this other species insulin.

In 1955, Frederick Sanger determined the amino acid sequence of human insulin. This sequence was used to genetically engineer bacteria to produce large amounts of pure human insulin. This allowed safer and more efficient quantities of insulin to be produced.

Use this link to discover how this works:

<https://www.nlm.nih.gov/exhibition/fromdnatobeer/exhibition-interactive/recombinant-DNA/recombinant-dna-technology-alternative.html>

Cite this resource and in your own words:

Explain how bacteria are used to make insulin.

BENEFITS and RISKS to Genetic Engineering

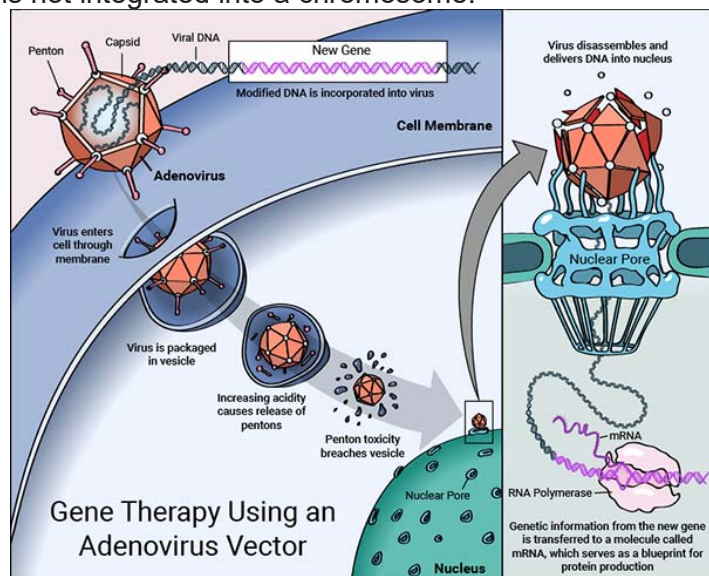
Since genetically altered organisms interact with the environment, scientists must consider if the potential benefits are greater than potential environmental harm.

- **EXAMPLE:** What if a plant containing a gene that made a crop resistant to pests somehow crossbred with a weed?

Answer:

Gene Therapy

A new gene is inserted directly into a cell. A carrier called a vector is genetically engineered to deliver the gene. An adenovirus introduces the DNA into the nucleus of the cell, but the DNA of the virus is not integrated into a chromosome.



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Use this link to discover how this works:

<https://ghr.nlm.nih.gov/primer/therapy/procedures>

Cite this resource and in your own words:

Explain how gene therapy works.