

Organisms from all kingdoms possess a set of instructions (___**genetic code**___) that determine their characteristics. These instructions are passed from ___**parents**___ to offspring during reproduction.

The inherited instructions that are passed from parent to offspring exist in the form of a code. This code is contained in ___**DNA**___ molecules.

The DNA molecules must be accurately replicated before being passed on. Once the coded information is passed on, it is used by a cell to make ___**proteins**___. The proteins that are made become cell parts and carry out most functions of the cell.

Throughout recorded history, humans have used selective ___**breeding**___ and other methods to produce organisms with desirable traits. Our current understanding of DNA allows for the manipulation of genes and the development of new combinations of traits and new varieties of organisms.

The characteristics of an organism can be described in terms of combinations of traits. Traits are inherited, but their expression can be modified by interactions with the ___**environment**___.

Provide examples of how environment interacts with heredity

-- Grass not exposed to chlorophyll turns brown/white.

-- When white fur is shaved from Himalayan rabbit and an ice pack put on shaved area grows back black

Every organism requires a set of coded instructions for specifying its traits. For offspring to resemble their parents, there must be a reliable way to transfer information from one generation to the next. Heredity is the passage of these instructions from one generation to ___**another**___.

What are these coded instructions called and where are they found?

Hundreds or thousands of genes on each chromosome.

Hereditary information is contained in genes, located in the ___**nucleus**___ of each cell. Each gene carries a separate piece of information. An inherited trait of an individual can be determined by one or by ___**more**___ genes, and a single gene can influence ___**more**___ than one trait. A human cell contains many thousands of different ___**genes**___.

Provide some examples of traits influenced by more than one gene.

Intelligence, skin color

In asexually reproducing organisms, all the genes come from a ___**single**___ parent.

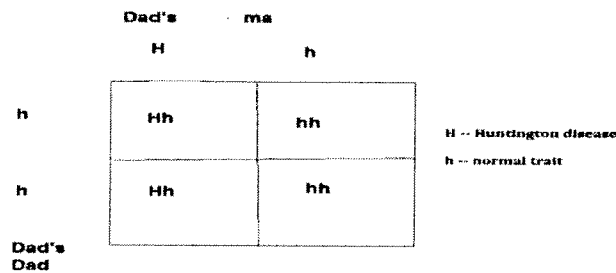
Asexually produced offspring are normally genetically identical to the parent.

How does asexual reproduction resemble a cloned organism?

Both produce offspring identical to the original parent.

In sexually reproducing organisms, the new individual receives half of the genetic information from its Mother (via the egg) and half from its Father (via the sperm). Sexually produced offspring resemble, but are not identical to, either of their parents.

Show half of the characteristics from Mom and half from Dad with a punnett square



State and Explain Two Reasons Sexually Reproduced Offspring Do NOT Resemble their Parents

- a.) They are a mixture of their parents genes. (recombination)
- b.) They are in a different environment so their genes are expressed differently.

Genes are segments of DNA molecules. Random alteration of DNA can cause **mutation**. An altered gene may be passed on to every cell that develops from it.

What is a mutation? Any change in DNA

What are the only kinds of mutations which can be passed on to the offspring?

Only mutations in gametes can be passed on.

In all organisms, the coded instructions for specifying the characteristics of the organism are carried in DNA, a large molecule formed from subunits of four kinds (represented by A, T, C, G). The chemical and structural properties of DNA are the basis for how the genetic information that underlies heredity is both encoded in genes (as a string of molecular "letters") and replicated by means of a template.

Represent a DNA nucleotide and label the parts making it up



What is the nitrogenous base pairing rule? A-T C-G

What is a template? Model or pattern used for replication

Cells store and use coded information. The genetic information stored in DNA is used to direct the synthesis of the thousands of proteins that each cell requires.

What is the central dogma of biology?

The work of the cell is carried out by the many different types of molecules it assembles, mostly proteins. Protein molecules are long, usually folded chains made from 20 different kinds of amino acids in a specific sequence. This sequence influences the shape of the protein. The shape of the protein, in turn, determines its function.

Provide three examples where the shape of a protein determines its function.

Enzyme -- substrate, antibody -- antigen, hormone --target cell

Offspring resemble their parents because they inherit similar genes that code for the production of similar proteins that form similar structures and perform similar functions.

Why do relatives more removed from you look and act different?

1. They have different genes which code for different proteins
2. They are in different environment which cause their genes to be expressed differently.

Cell functions are regulated. Regulation occurs both through changes in the activity of genes and through the selective expression of individual genes. This regulation allows cells to respond to their environment and to control and coordinate cell growth and division.

Some genes are turned on and off depending on which cell is involved, even though all cells in an organism have the same DNA.

The many body cells in an individual can be very different from one another, even though they are all descended from a single cell and thus have essentially identical genetic instructions. **This is because ___different___ parts of these instructions are used in different types of cells, influenced by the cell's _environment___ and past history.**

For thousands of years new varieties of cultivated plants and domestic animals have resulted from ___selective___ breeding for particular traits.

How does selective breeding differ from genetic engineering? How long has each been around?

In recent years new varieties of farm plants and animals have been engineered by ___manipulating___ their genetic instructions to produce new characteristics.

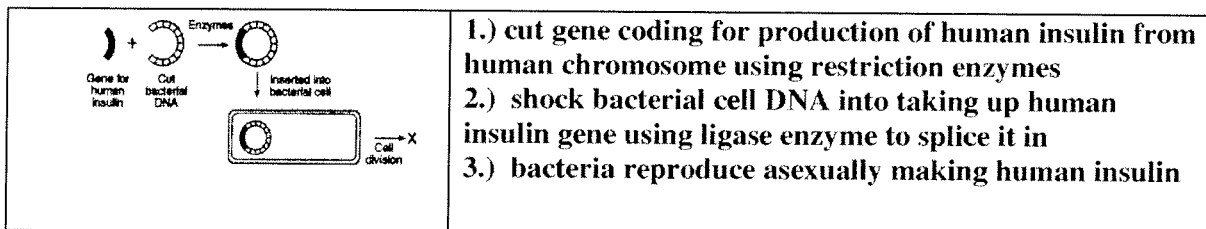
What is recombinant DNA?

Taking a piece of DNA from one organism and putting it into another organism.

Different ___enzymes___ can be used to cut, copy (clone), and move segments of DNA. Characteristics produced by the segments of DNA may be expressed when these segments are inserted into new organisms, such as ___bacteria___.

What do restriction enzymes do? Cut DNA into smaller sections

How can we make bacteria produce human insulin?



Define the following mutation types:

Insertion adding a piece of DNA to a chromosome

Deletion removing a piece of DNA from a chromosome

Substitution switching a piece of DNA between different chromosomes

Provide two specific examples where genetic engineering has aided human health.

1. Making human insulin and human growth hormone in bacteria cells.
2. Making interferon in bacterial cells (virus fighting chemical).