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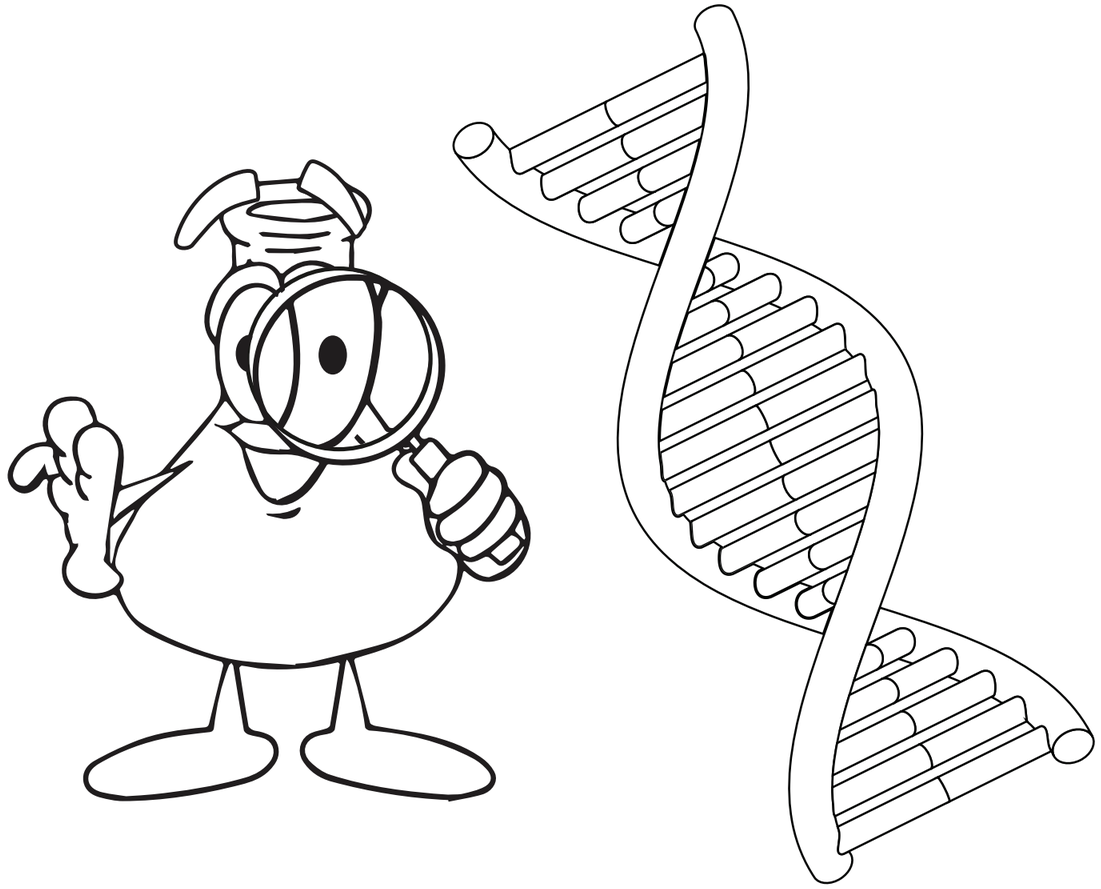
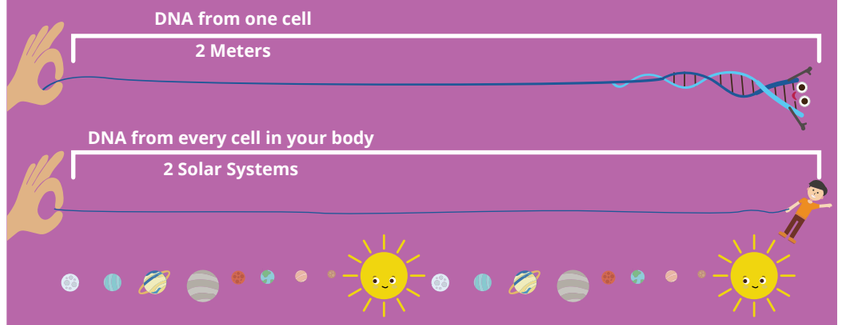


THE AMAZING WAY DNA WORKS!

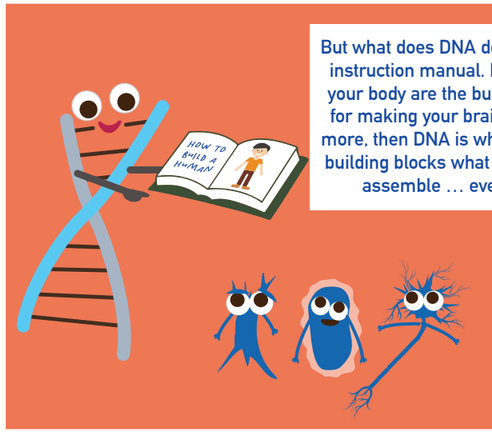
CHILDREN'S MEDICAL RESEARCH INSTITUTE

Jeans for Genes®

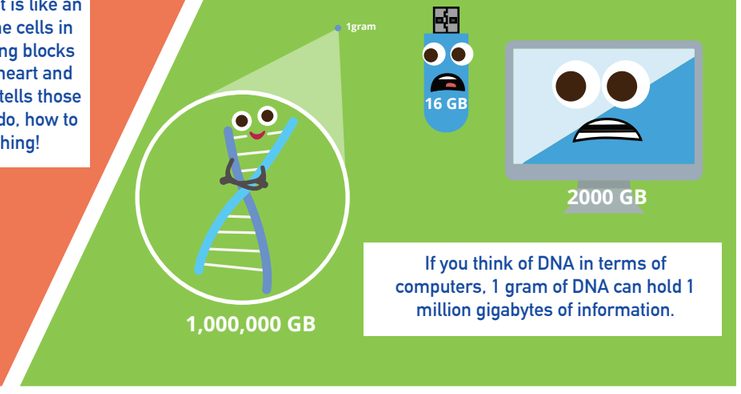
What is DNA? It's a chemical found inside every cell in our body. 'DNA' stands for 'deoxyribonucleic acid'. That's a big word! It's also a big molecule. It forms a spiral staircase-like structure called a 'double helix'. It is so thin you can't see it without a very special microscope.



It is so long that if you stretch out the DNA from one cell in your body it would be 2 metres in length. If you took the DNA from all the trillions of cells in your body and stretched it out, it would be twice as wide as the solar system!



But what does DNA do? It is like an instruction manual. If the cells in your body are the building blocks for making your brain, heart and more, then DNA is what tells those building blocks what to do, how to assemble … everything!



If you think of DNA in terms of computers, 1 gram of DNA can hold 1 million gigabytes of information.

Plants, animals, bacteria and even some viruses all have DNA. Some of the components of DNA have been discovered in meteorites, and scientists have shown DNA can form in outer space. Who knows, there may even be aliens somewhere in the universe who use DNA like we do.

WHAT WOULD ALIEN DNA LOOK LIKE?

DRAW

Q+/2

Q1: DNA stands for?

a. A type of dinosaur
b. Do Not Attack
c. Deoxyribonucleic Acid
d. Ribonucleic Acid

Q2: How many letters in the DNA code?

a. 20
b. 4
c. 100
d. 25,000

Q3: The DNA structure looks like…

a. a spiral staircase
b. a pyramid
c. The Eiffel Tower
d. a ball of twine

Q4: A gene is?

a. an error in the DNA
b. a segment of DNA with instructions for making a protein
c. a type of trousers
d. a movie or rock star

Q5: Proteins are?

a. Made up of amino acids
b. The machines that keep our cells working
c. Created using the DNA code
d. All of the above

Q6: DNA is used by what living things to store information

a. Humans
b. Plants
c. Bacteria
d. Chimpanzees
e. All of the above

Q7: We get our DNA from

a. Our parents
b. Meteorites
c. Mutation
d. Frogs

HAVE YOU BEEN PAYING ATTENTION?

True/False

Q1: There are over 6000 genetic diseases
True or False

Q2: Vectors cause genetic diseases
True or False

Q3: Mutations are like a typo in the genetic code
True or False

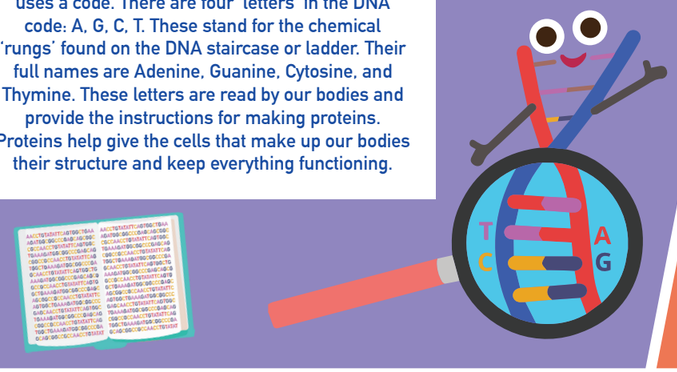
Q4: Genetic diseases can only be inherited from your parents
True or False

Q5: Gene therapy fixes a genetic disease by fixing the error in the DNA
True or False

FLIP FOR ANSWERS
NO PEEKING!

Q1: C-Deoxyribonucleic Acid Q2: B-4 Q3: A-spiral staircase Q4: B-a segment of DNA with instructions for making a protein
Q5: D-All of the above Q6: D-All of the above Q6: A-Our parents
True or False: Q1: True Q2: False - vectors are used to treat them Q3: True Q4: False - while often inherited, many happen out of the blue Q5: True

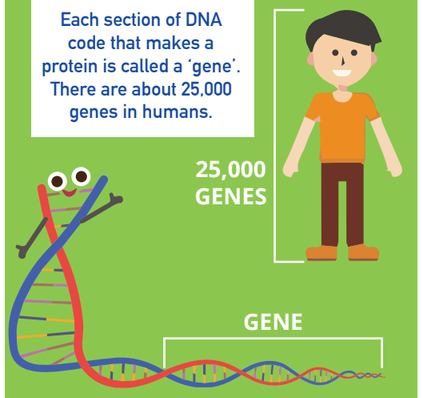
So, how does DNA hold so much information? It uses a code. There are four 'letters' in the DNA code: A, G, C, T. These stand for the chemical 'rungs' found on the DNA staircase or ladder. Their full names are Adenine, Guanine, Cytosine, and Thymine. These letters are read by our bodies and provide the instructions for making proteins. Proteins help give the cells that make up our bodies their structure and keep everything functioning.



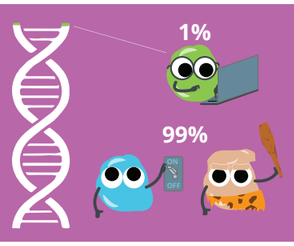
If you think of our body as a house, the DNA is the instructions for building that house and the proteins are the bricks, mortar, wood, glass, nails, and everything that goes into making the house.

Our DNA information is massive. If written out, it would fill 1 million pages. And changing just one single letter in all those pages can cause a genetic disease like cystic fibrosis. That's one terrible typo!

Each section of DNA code that makes a protein is called a 'gene'. There are about 25,000 genes in humans.



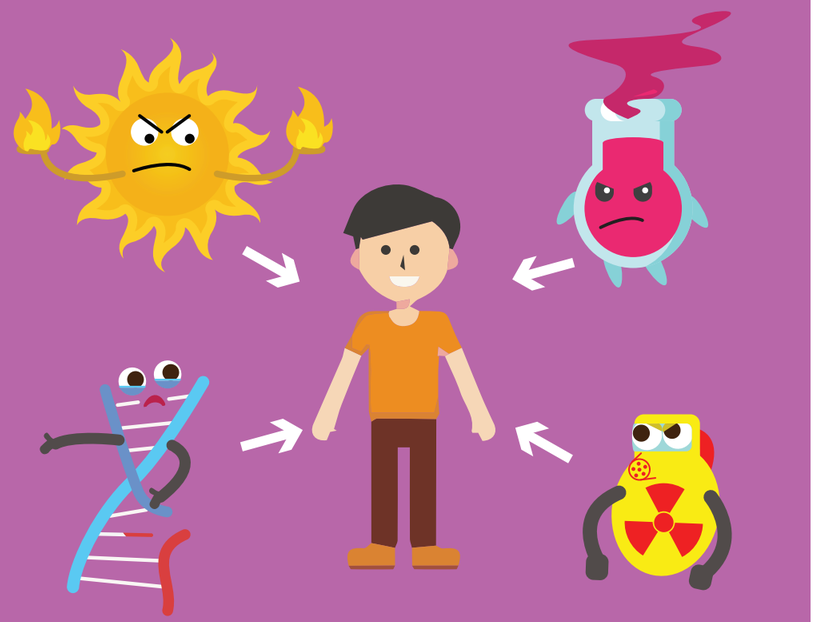
Genes are called 'coding' DNA and make up only 1% of the DNA found in humans. 99% of the DNA is 'noncoding'. Some noncoding DNA is believed to be junk leftover from our evolution, but some controls the coding genes, telling them where and when to turn on and off.

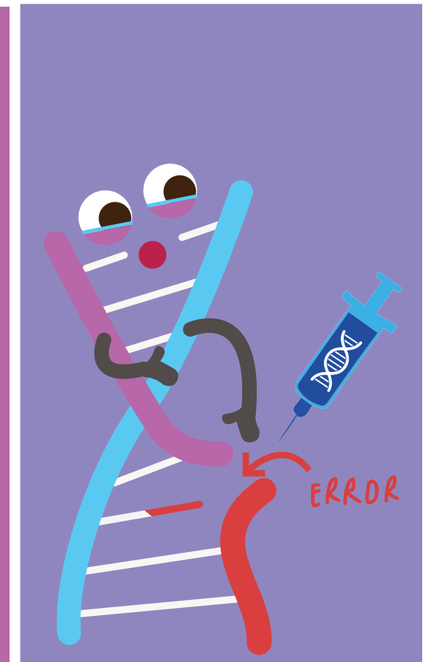


GENETIC DISEASES AND GENE THERAPY

Did you know there are more than 6000 different genetic diseases?

Cancer is a more complex genetic disease that only occurs when multiple genes are damaged. Mostly, that damage is not inherited but results instead from random changes caused by things like UV light, other radiation, or dangerous chemicals. Sometimes, people inherit a damaged copy of a 'cancer gene' from their parents, which results in an increased risk of getting cancer.

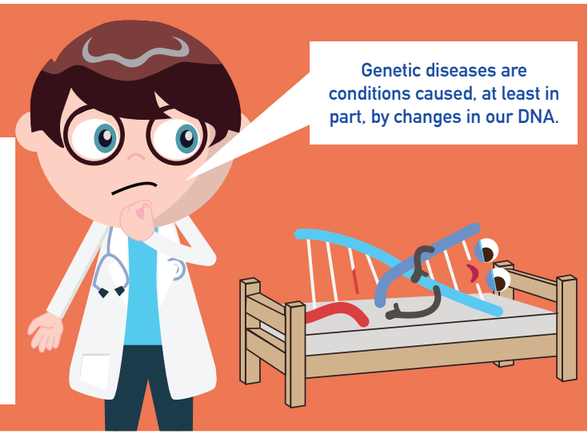




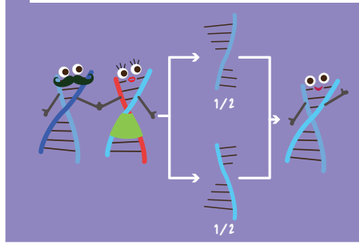
Gene therapy is a method of curing genetic diseases by correcting the cause, by fixing the error in the DNA.

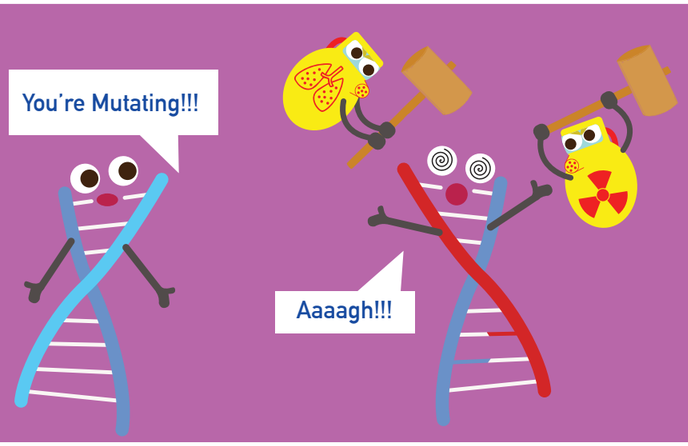
While often inherited, many genetic diseases happen 'out of the blue' due to chance occurrences, so they can affect anyone. Most are poorly understood and have no specific treatments or cures.

Genetic diseases are conditions caused, at least in part, by changes in our DNA.



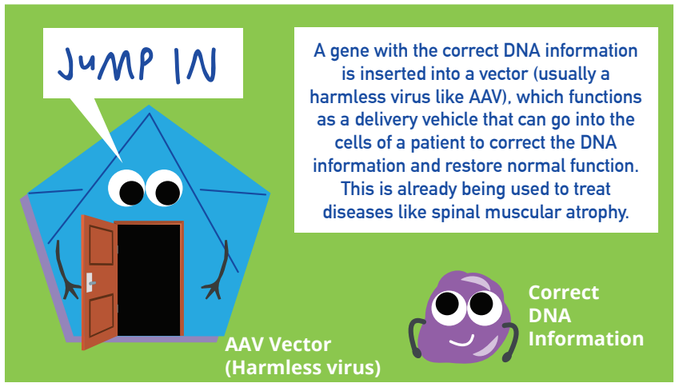
Together with your upbringing, education, and other factors in your environment, DNA has a major role in making you who you are. Unless you are an identical twin, your DNA recipe is unique. We get half our DNA from our mother and half from our father.



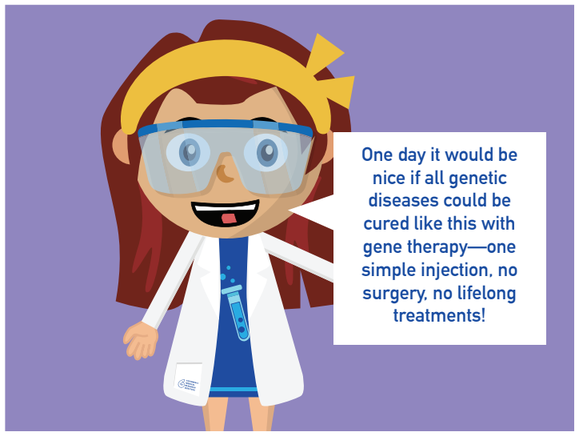


Random errors that occur naturally, or exposure to radiation and harmful things like asbestos, can cause changes in our DNA. These changes are sometimes called 'mutations'. Most of the changes are harmless, but some are not.

HOW DOES GENE THERAPY WORK?



A gene with the correct DNA information is inserted into a vector (usually a harmless virus like AAV), which functions as a delivery vehicle that can go into the cells of a patient to correct the DNA information and restore normal function. This is already being used to treat diseases like spinal muscular atrophy.



One day it would be nice if all genetic diseases could be cured like this with gene therapy—one simple injection, no surgery, no lifelong treatments!