

DNA & GENETICS

What is DNA?

Have you ever put together a toy or a game? It probably came with directions, didn't it? Cells put molecules together in much the same way you might assemble a toy. They follow a set of directions, like Legos[®].

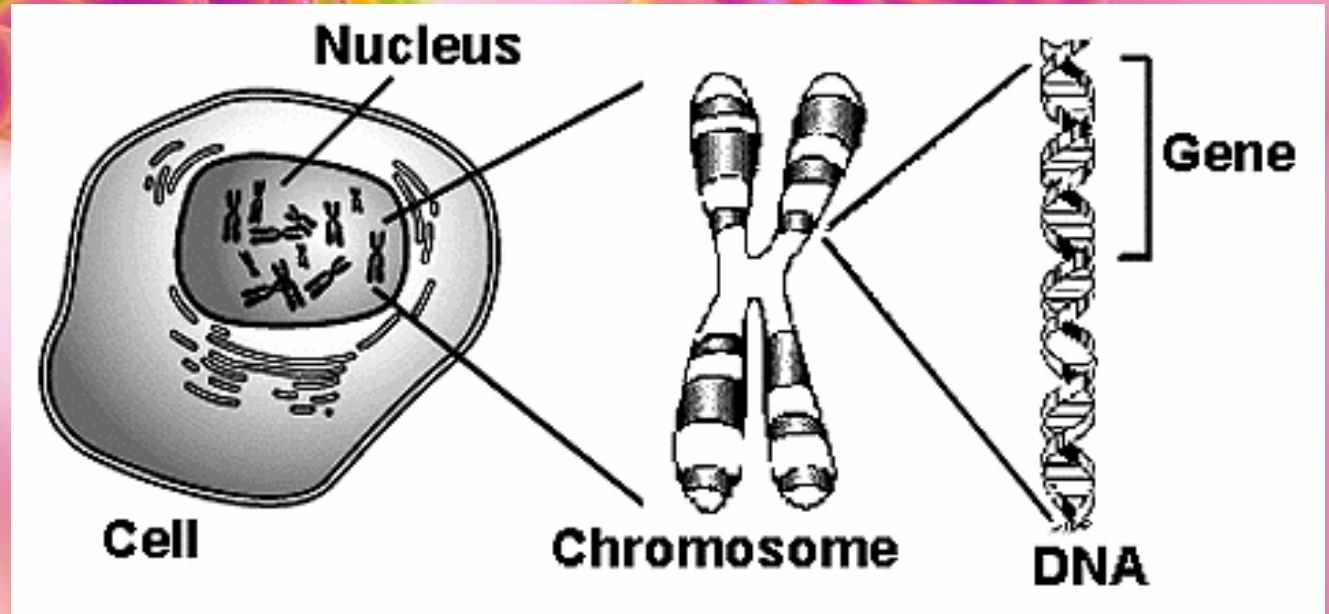
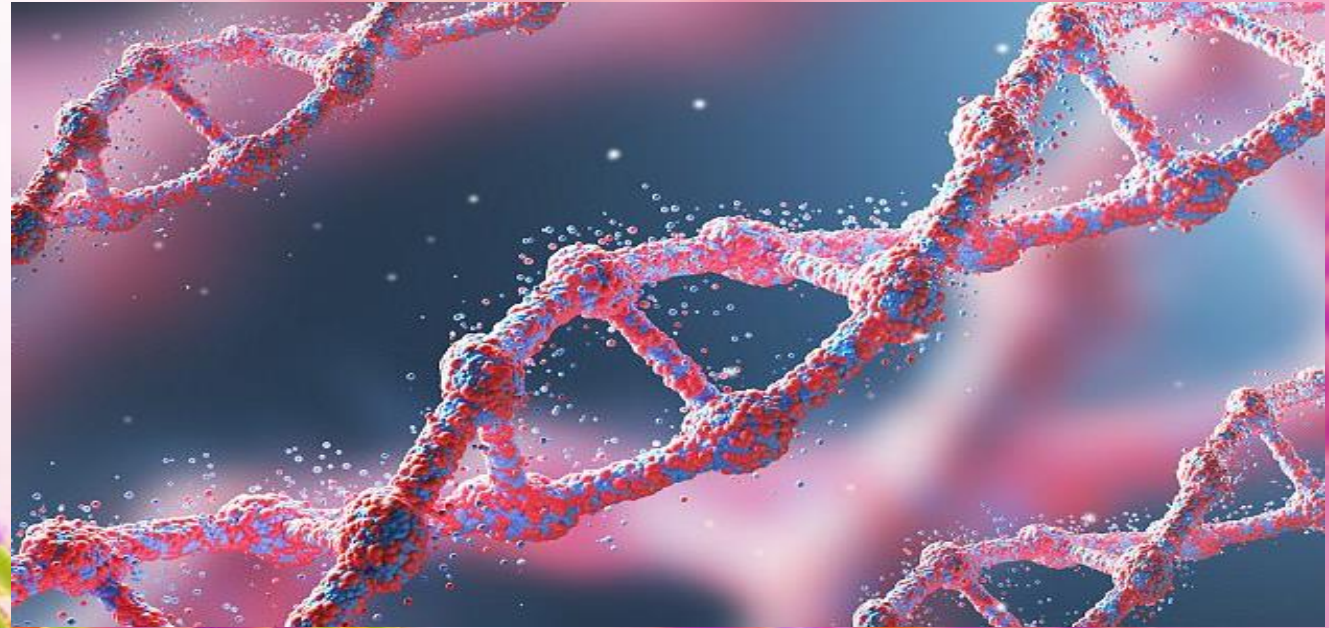


What is DNA?

DNA is an organisms genetic material found in the nucleus of a cell.

Recall that a gene is a segment of DNA on a chromosome.

A cell makes a copy of its DNA before Mitosis occurs.



History of DNA

How did scientists discover the shape of DNA?

Maurice Wilkins and Rosalind Franklin used X-rays to study DNA. Some of the X-rays showed that DNA has a helix shape.



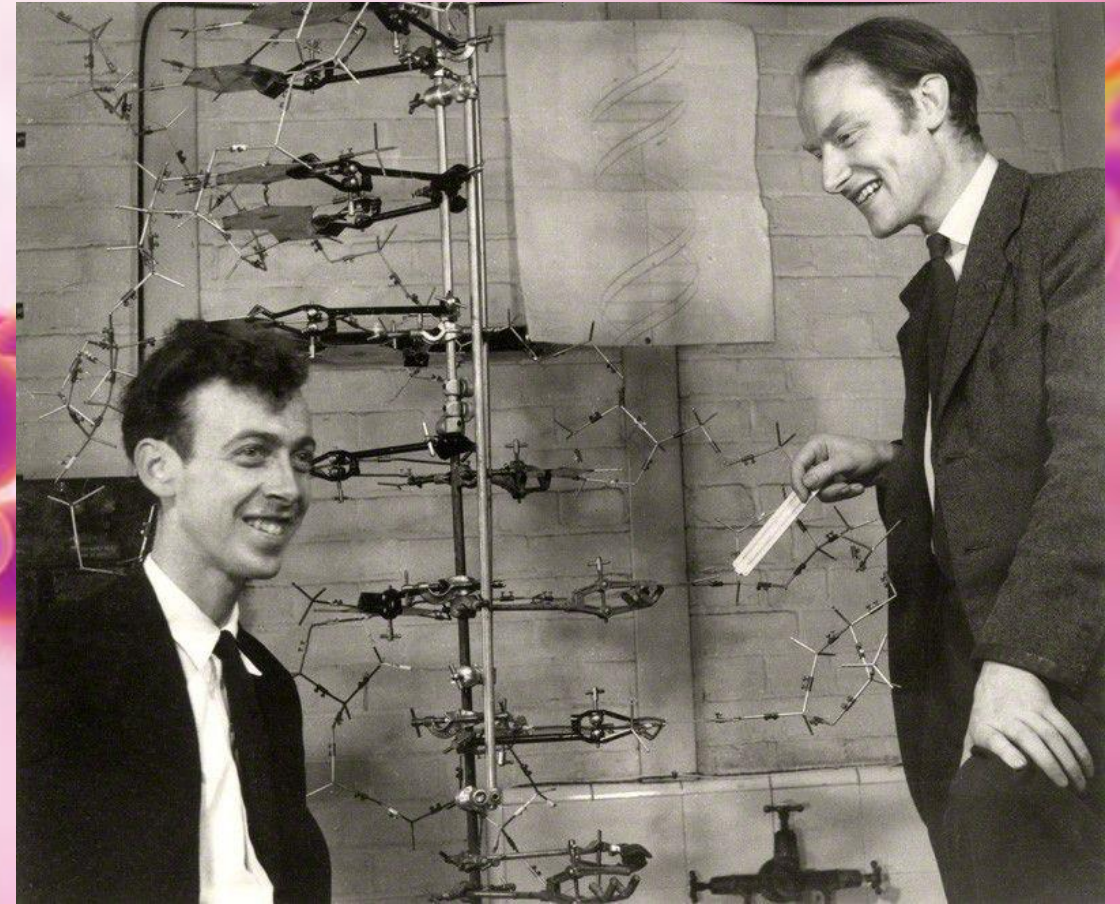
Maurice Wilkins

Rosalind Franklin

History of DNA

Another pair of scientists, James Watson & Frances Crick built a model of DNA.

They built this model to show how smaller molecules of DNA bond together and form a double helix.

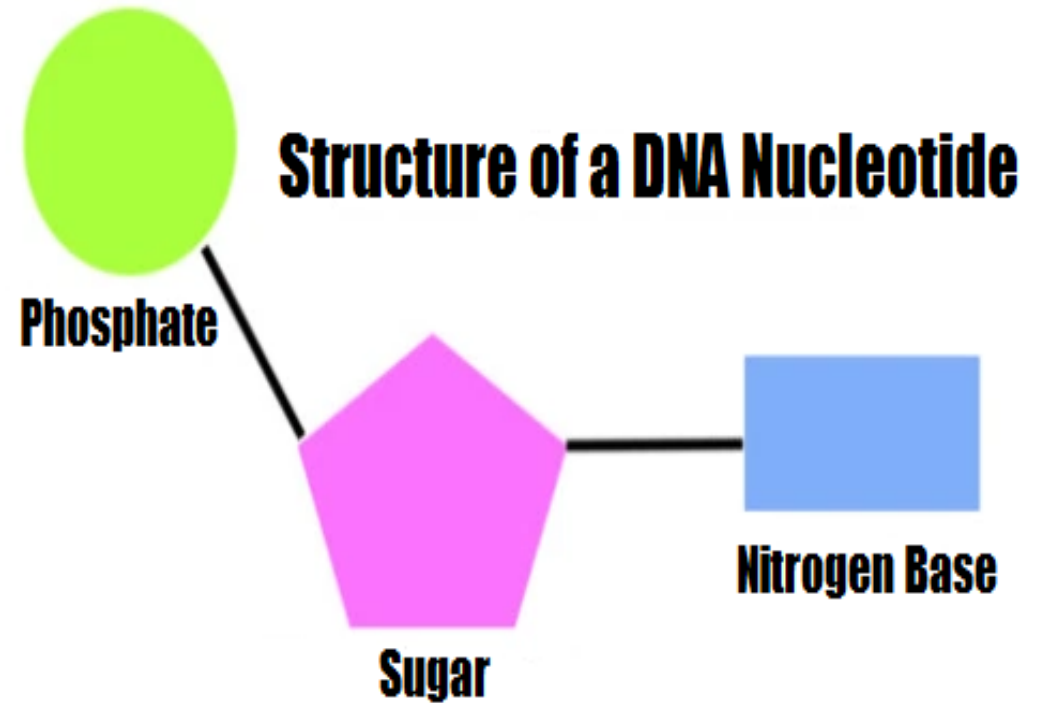


James Watson & Francis Crick

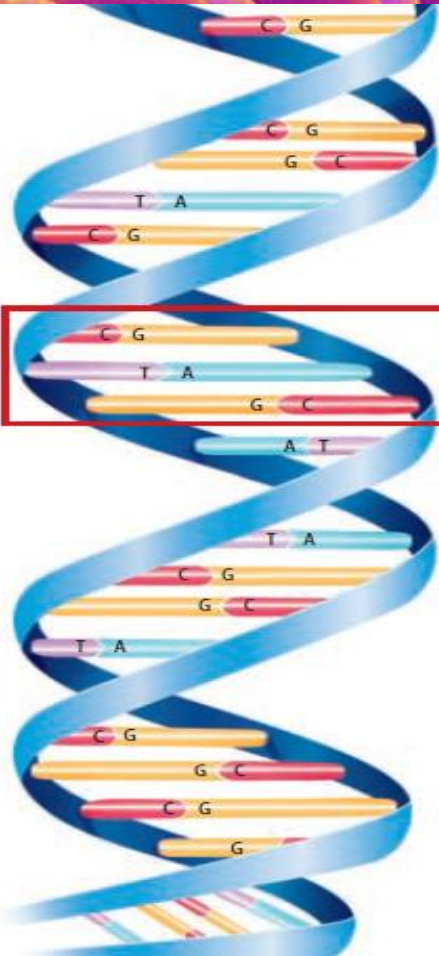
DNA Structure

DNA is constructed like a twisted ladder, called a double helix. It is made up of **nucleotides**.

A **nucleotide** is a molecule made of a nitrogen base, a sugar (deoxyribose), and a phosphate group.

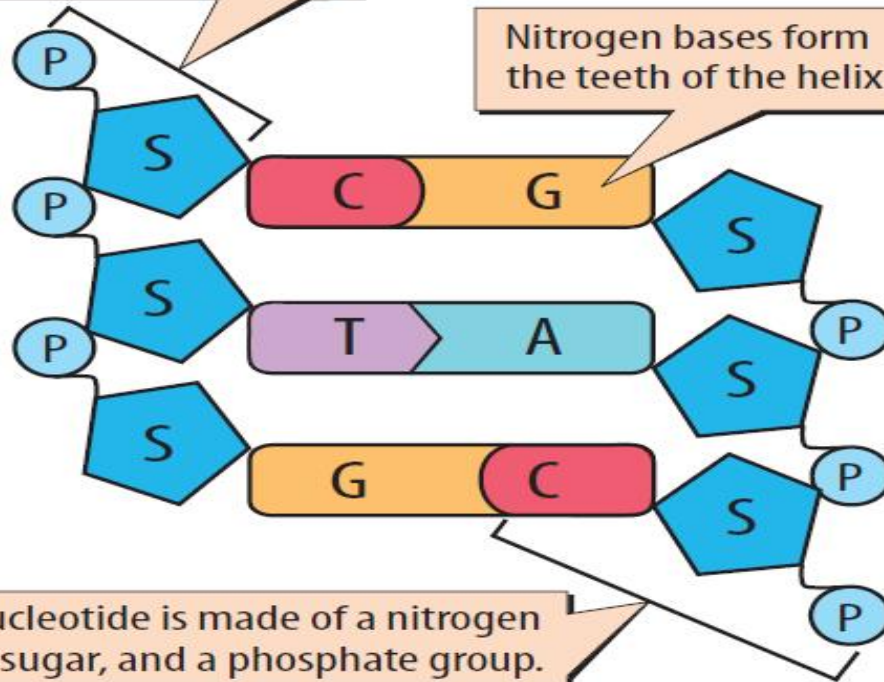


DNA Structure



Sugar-phosphate groups form the sides of the helix.

Nitrogen bases form the teeth of the helix.



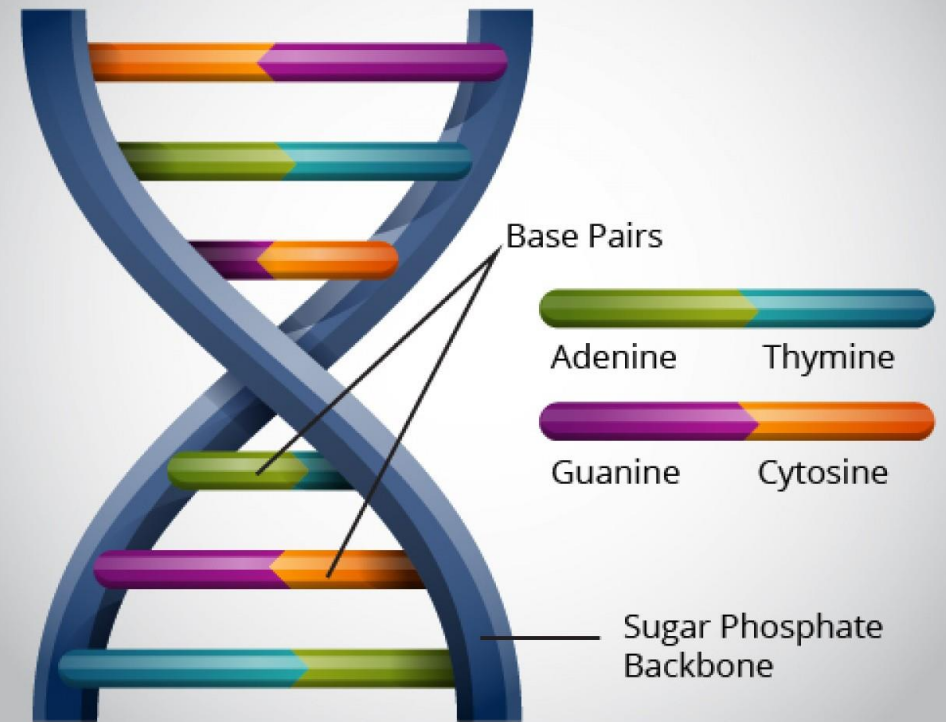
Each nucleotide is made of a nitrogen base, a sugar, and a phosphate group.

DNA Structure

There are 4 nitrogen bases that make up DNA.

Adenine (A)
Thymine (T)
Guanine (G)
Cytocine (C)

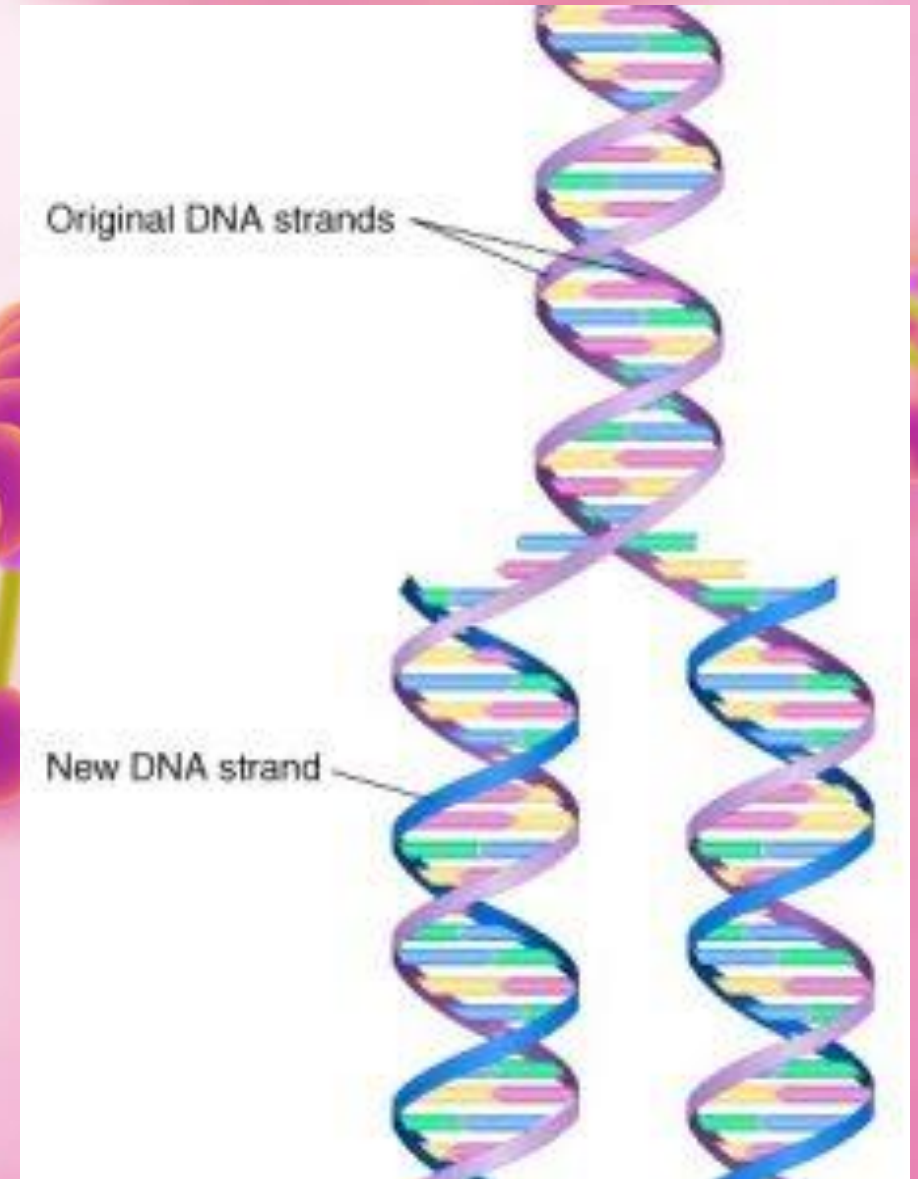
DNA Structure



DNA Replication

Remember, that during Mitosis, a cell's DNA is replicated during interphase.

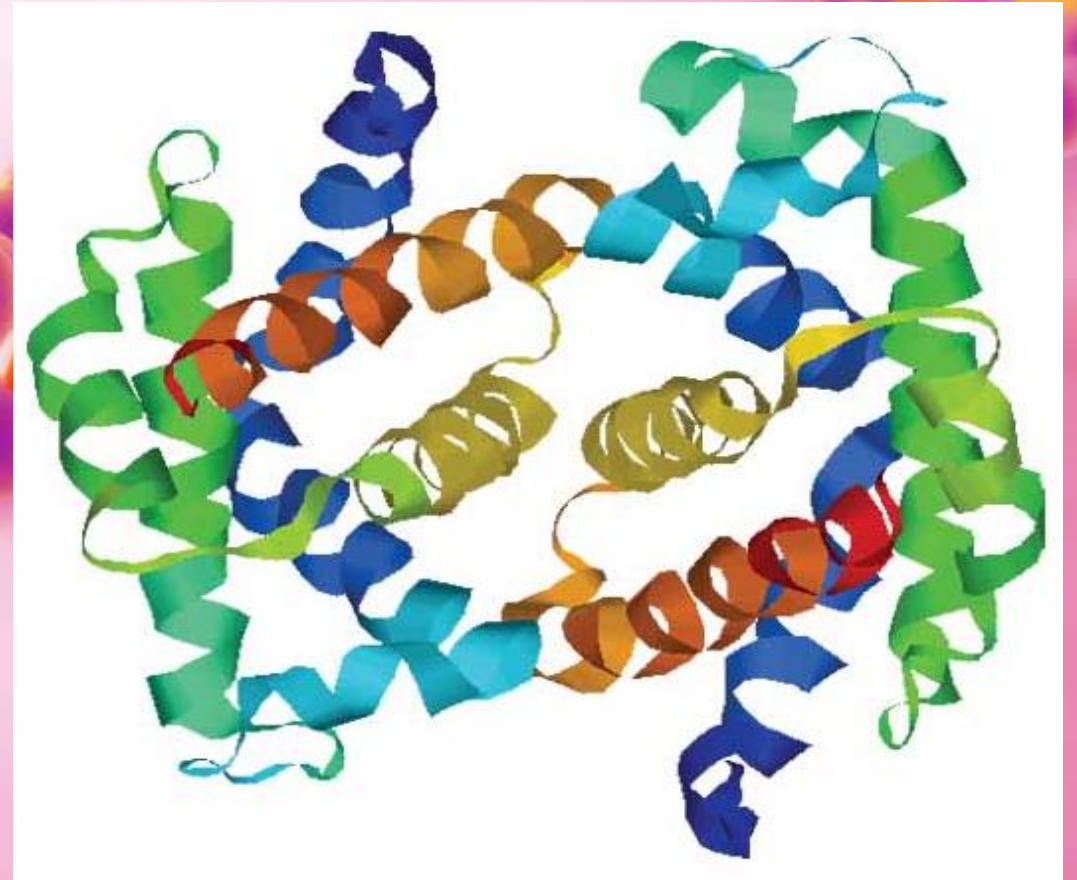
Replication is the process of copying DNA to make more DNA.



Making Proteins

Proteins are important for every cell process.

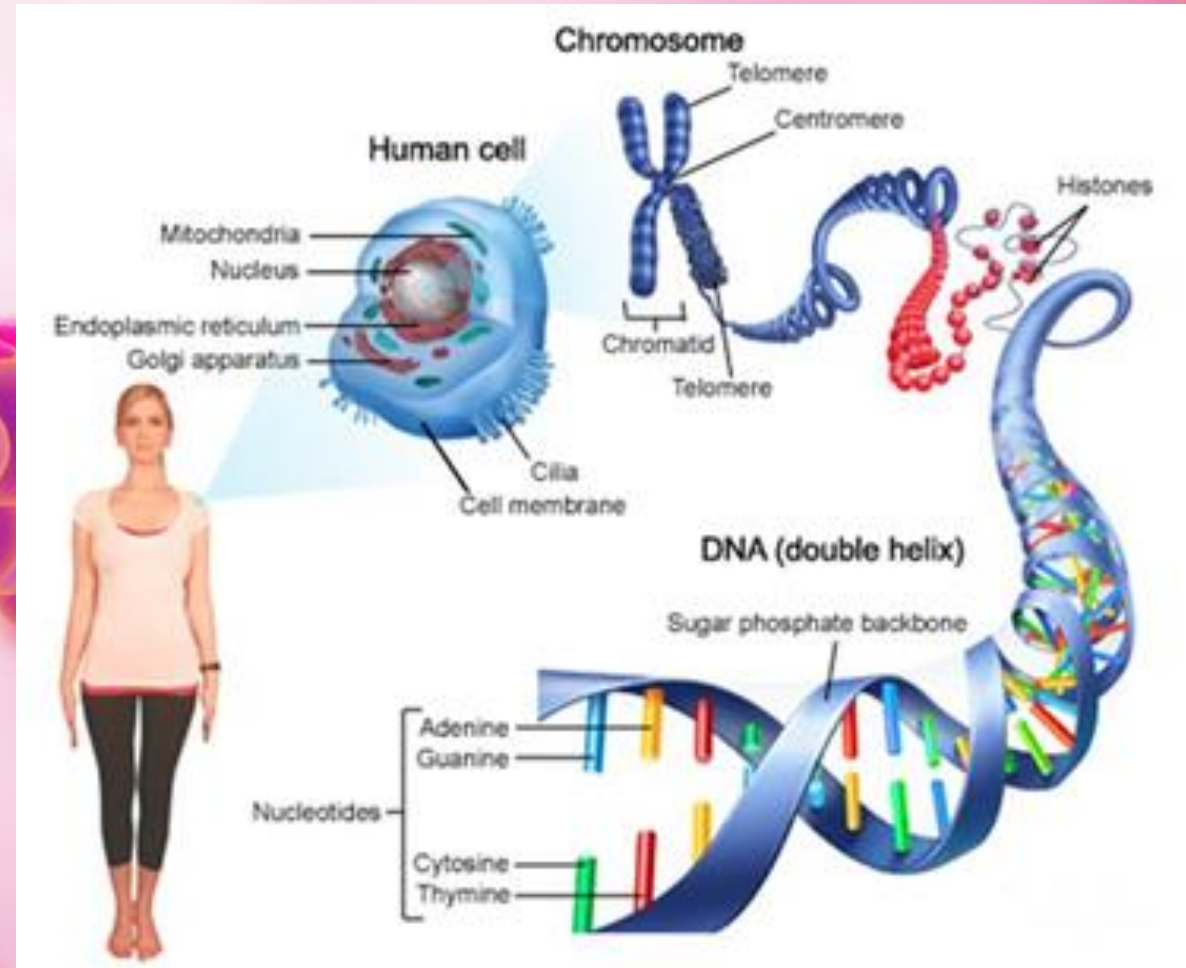
The DNA of each cell carries a complete set of genes that provides instructions for making all of the proteins a cell needs.



RNA Structure

How does a cell use the instructions in a gene to make proteins? By RNA!

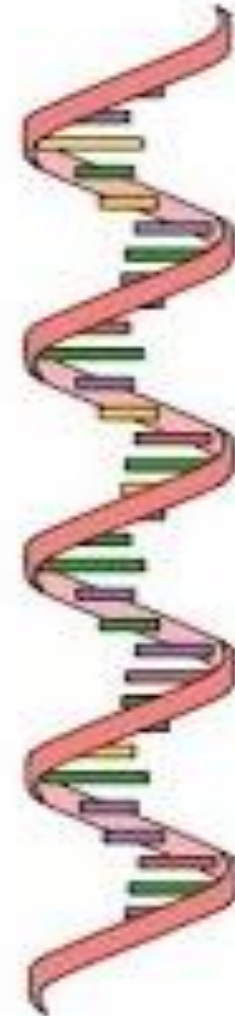
RNA is a type of nucleic acid that acts a messenger by carrying the code to make proteins from the nucleus to the cytoplasm.



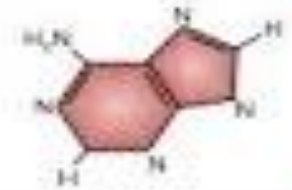
RNA Structure

RNA is single-stranded, nucleic acid and has the nitrogen base uracil (U) instead of thymine (T).

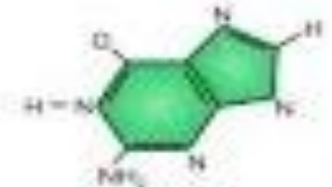
It also has the sugar **ribose**, RNA instead of **deoxyribose**, DNA.



Adenine



Guanine



Cytosine



Uracil

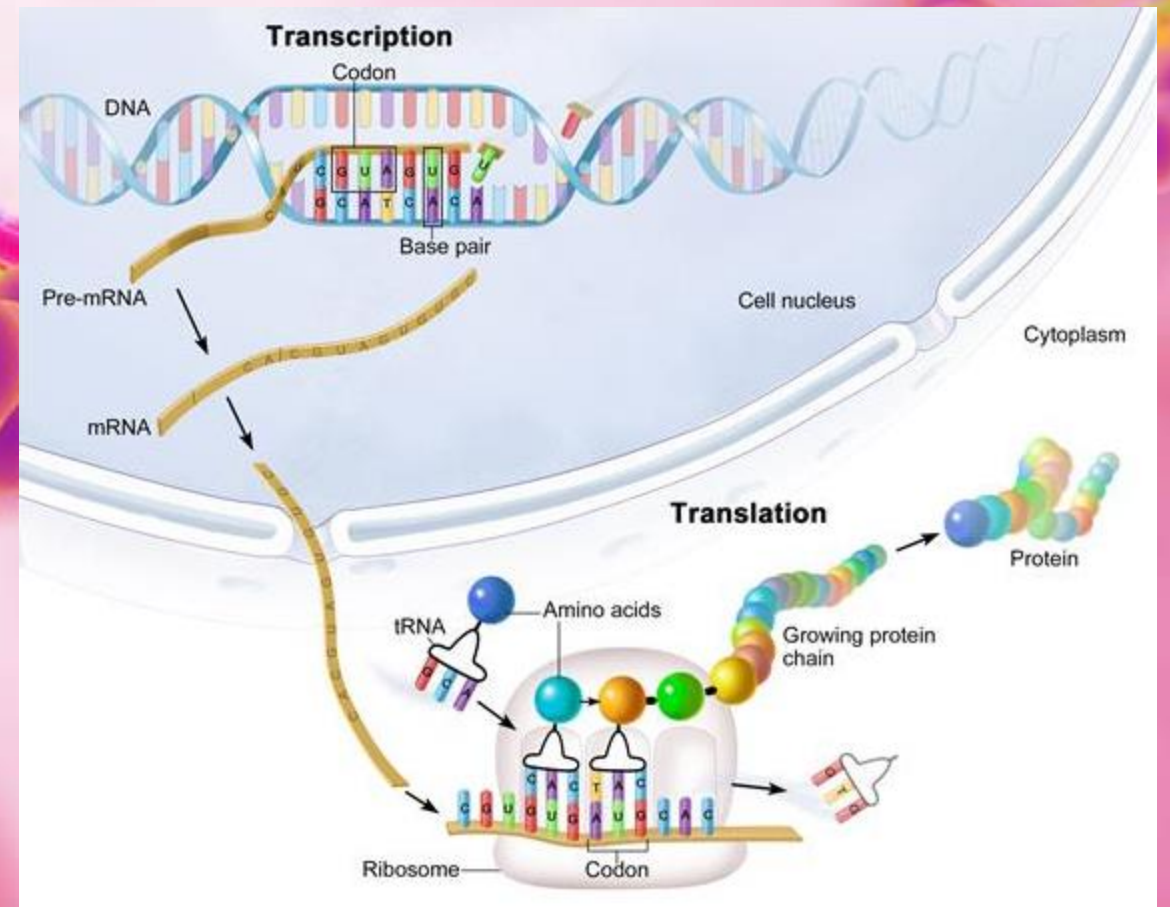


RNA

Transcription & Translation

Transcription is the first step in making a protein, where mRNA is created from DNA.

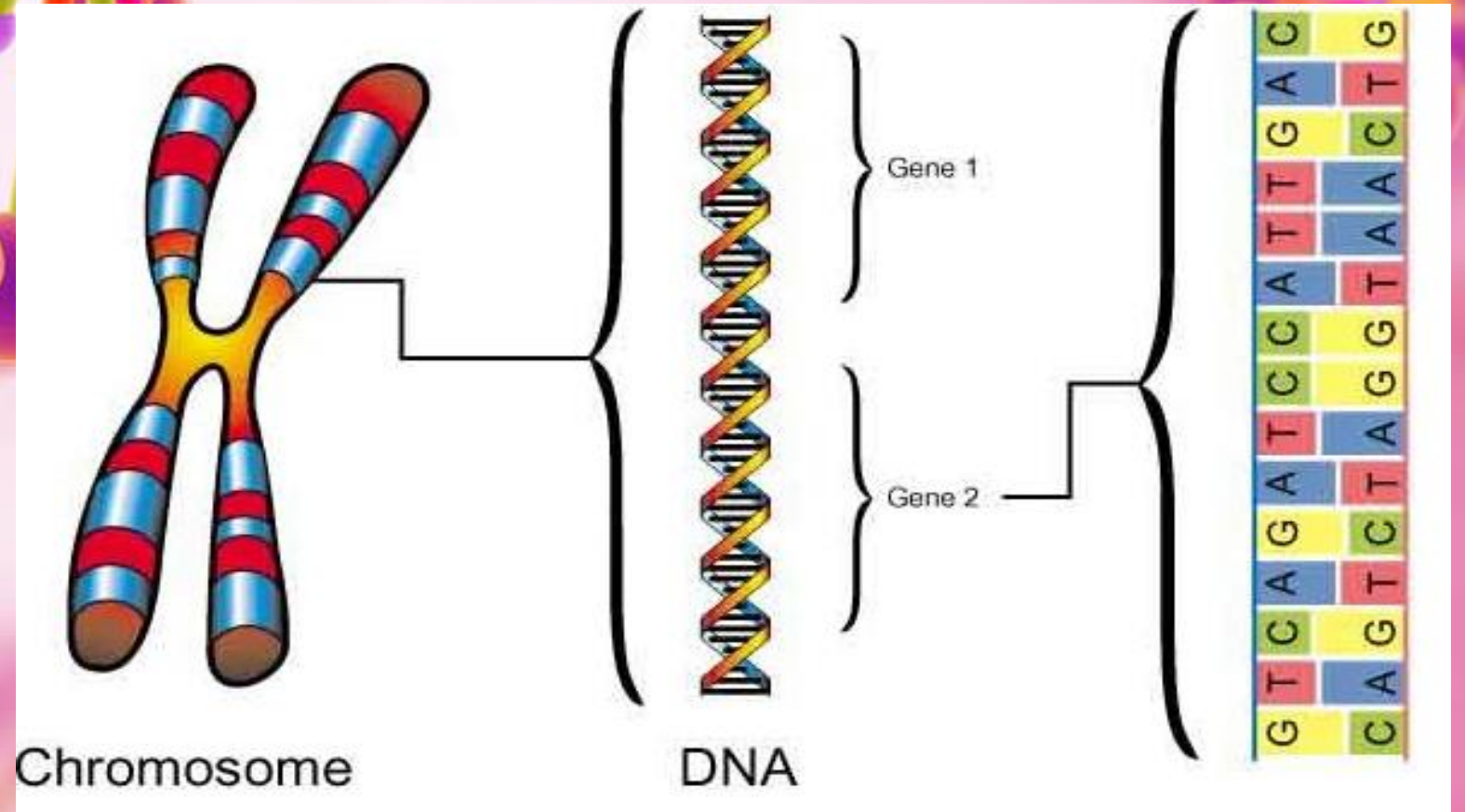
Translation is second step in making a protein from RNA.



Mutations

The 46 human chromosomes contain between 20,000 & 25,000 genes that are copied during DNA replication.

Sometimes, mistakes happen during replication.



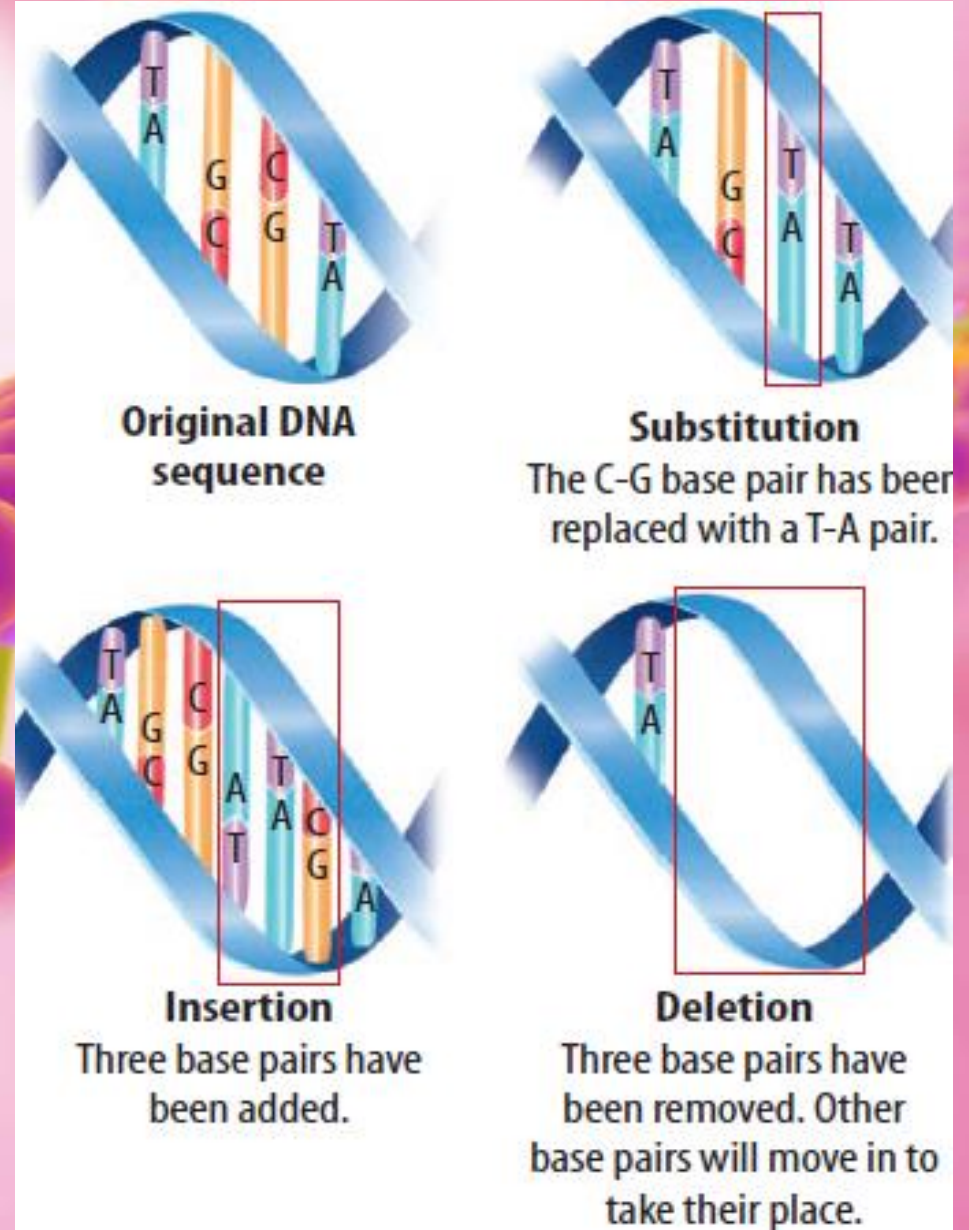
Mutations

Most mistakes are corrected before replication is completed.

A mutation is a mistake that is not corrected.

Mutations can be the result of a **change in DNA**.

There are 3 types of mutations as shown – substitution, insertion, and deletion.



Mutations

Mutations can be the result of a **change inside of cells**.

These types of mutations can be helpful (beneficial) or harmful (detrimental) to an organism.

If a mutation occurs in a body cell, such as skin cancer, the mutation will only affect the individual who carries it.

If a mutation occurs in a sex cell, the mutation can be passed on to offspring.



Viceroy Butterfly

Monarch Butterfly

One is poisonous and the other is pretending to be.



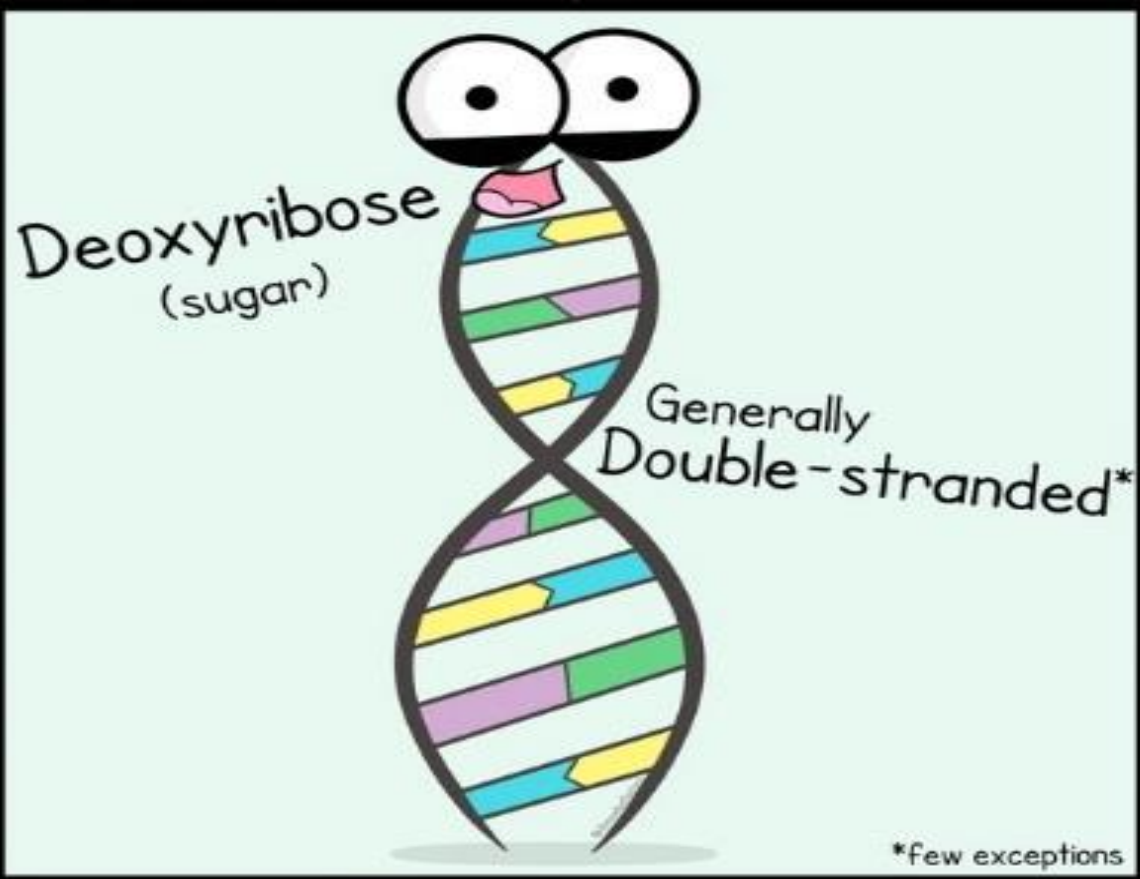
DNA vs. RNA

A good analogy to help you remember is to think of the DNA & RNA relationship like the relationship between Batman & Robin in *Lego Batman*.

Batman (DNA) wants to be in charge, and Robin (RNA) just wants to help Batman.

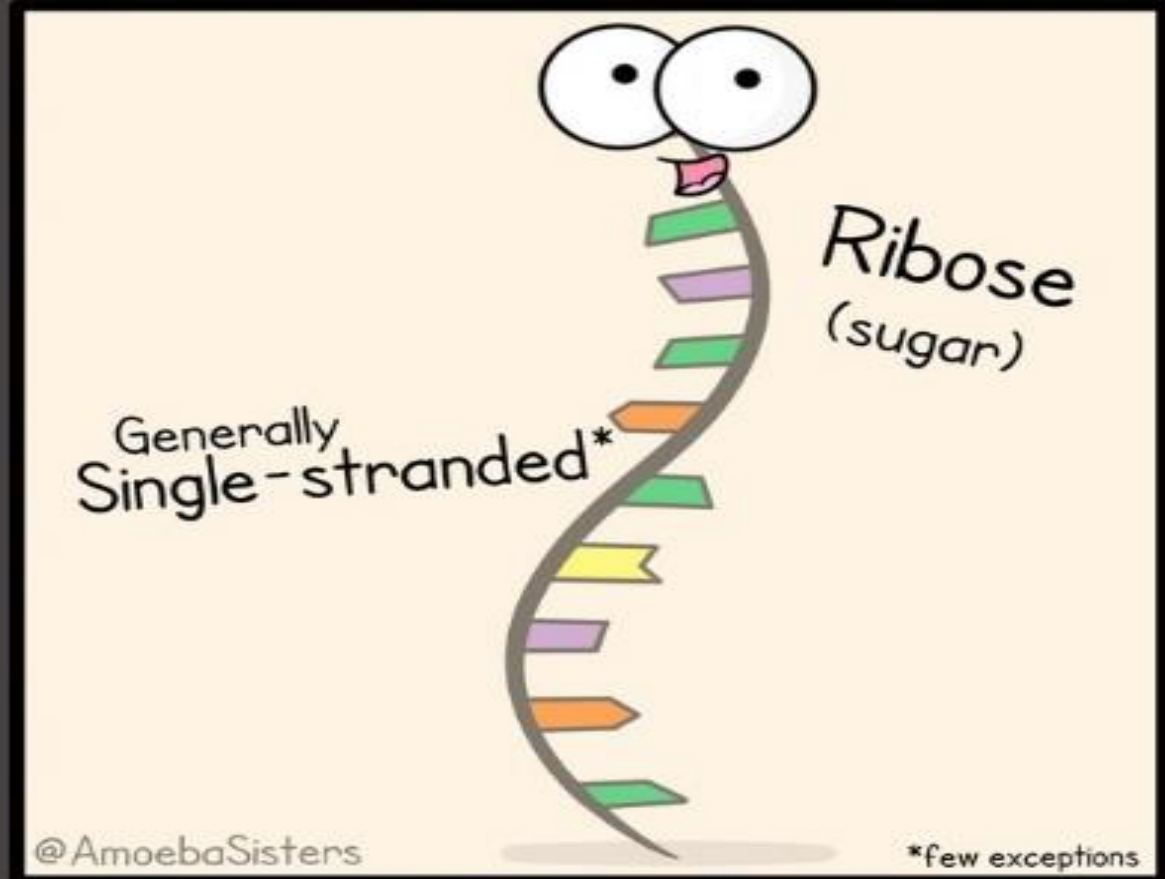


DNA (Deoxyribonucleic Acid)

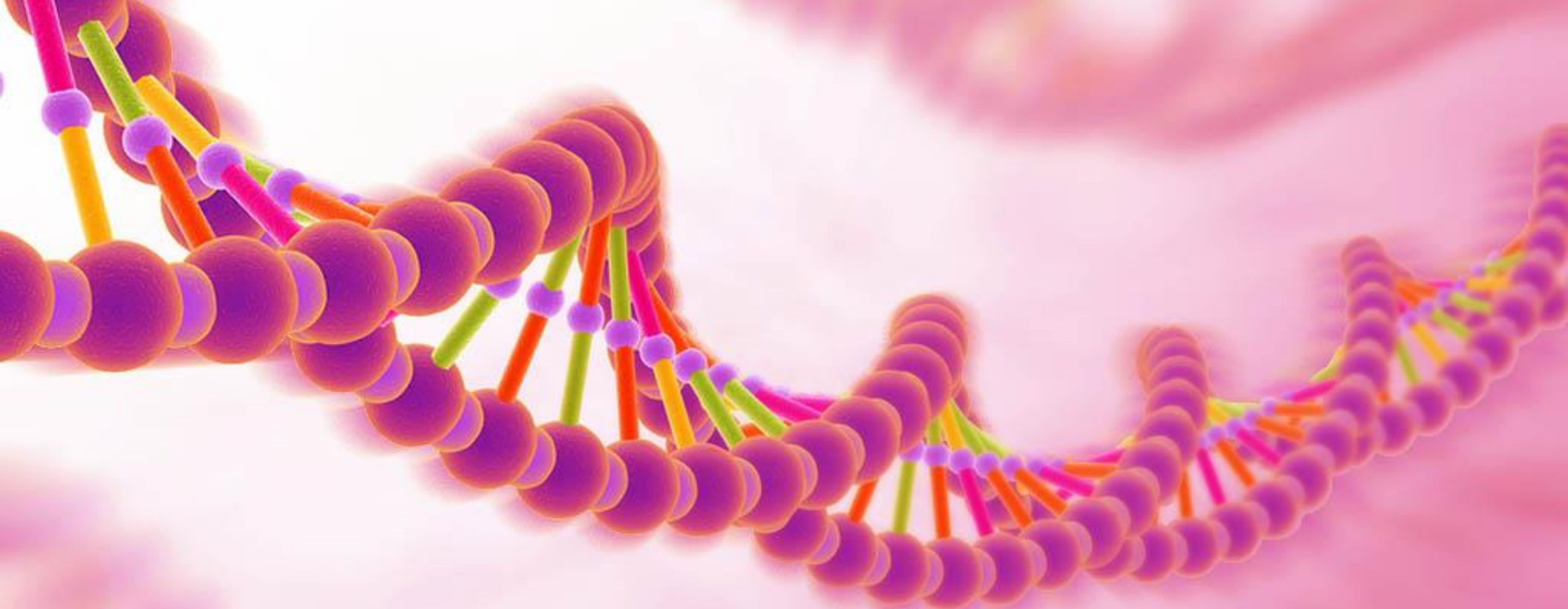


- Adenine
- Thymine
- Cytosine
- Guanine

RNA (Ribonucleic Acid)



- Adenine
- Uracil
- Cytosine
- Guanine



THE END