

Biology: DNA as the Genetic Material

Essential Understanding: DNA is the genetic material that provides instructions for building and maintaining your body.

THE CHEMICAL STRUCTURE OF DNA

DNA (deoxyribonucleic acid) carries genetic information in all multicellular forms of life. It carries instructions for the creation of proteins, which carry out a wide range of roles in the body.

THE SUGAR PHOSPHATE 'BACKBONE'

DNA is a polymer made up of units called nucleotides. The nucleotides are made of three different components: a sugar group, a phosphate group, and a base. There are four different bases: adenine, thymine, guanine & cytosine.

A ADENINE

T THYMINE

G GUANINE

C CYTOSINE

WHAT HOLDS DNA STRANDS TOGETHER?

DNA strands are held together by hydrogen bonds between bases on adjacent strands. Adenine (A) always pairs with thymine (T), whilst guanine (G) always pairs with cytosine (C).

FROM DNA TO PROTEINS

DNA → TRANSCRIPTION → RNA → TRANSLATION → PROTEIN

The bases along a single strand of DNA act as a code. The letters form three letter 'words', or codons, which code for different amino acids - the building blocks of proteins.

An enzyme, RNA polymerase, transcribes DNA into mRNA (messenger ribonucleic acid). It does this by splitting apart the two strands that form the double helix, then reading a strand and copying the sequence of nucleotides. The only difference between the RNA and the original DNA is that in the place of thymine (T), another base with a similar structure is used: uracil (U).

DNA SEQUENCE	T	T	C	C	T	G	A	A	C	C	G	T	T	A
mRNA SEQUENCE	U	U	C	C	U	G	A	A	C	C	G	U	U	A
AMINO ACID	Phenylalanine	Leucine	Asparagine	Proline	Leucine									

In multicellular organisms, the mRNA carries genetic code out of the nucleus, to the cell's cytoplasm. Here, protein synthesis takes place. 'Translation' is the process of converting turning the mRNA's 'code' into proteins. Molecules called ribosomes carry out this process, building up proteins from the amino acids coded for.

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“If, for example, all the codons are triplets, then in addition to the correct reading of the message, there are two incorrect readings which we shall obtain if we do not start the grouping into sets of three at the right place.” -Francis Crick

Overview

This unit is designed to help students become familiar with DNA. Students will learn how this polymer is made from only four monomers, which serves as the genetic material for all living organisms. We will explore the discovery, structure, and synthesis of DNA.

Guiding question 1: How does a gene in your DNA provide instructions for building a protein?

Individual work

_____ Read Study Guide (01/31)

_____ Participate in the lesson “DNA as Genetic Material”

_____ Nucleic Acid (01/31)

_____ Discovery of DNA (02/03)

_____ DNA replication (02/07)

_____ Central Dogma/Genetic code (02/14)

_____ Transcription & Translation (02/17)

_____ Reflect on the answer to Guiding Question 1 (02/17)

_____ Make vocabulary cards for the vocabulary in your Vocabulary List (as needed, vocabulary card will not be allowed on quizzes or tests)

Group work/ Lab Work

Labs will be done in groups of 4 or 5.

Lab Handouts: There will be a pre-lab for students to complete before the lab experiment, during the lab the students will gather the necessary data to complete the lab and answer the questions associated with the topic. After the necessary data is collected students will work on completing their lab notebook.

Lab Notebook: Every student is required to keep a lab notebook. The lab notebook will be each student’s personal “copy”. **You will receive specific instructions on the lab notebook requirements.**

This notebook will be graded on proper usage and completeness. *The lab notebook will be checked once a unit on the day of the assessment.*

Formal Laboratory Report: Each quarter students will put together a formally written laboratory report. This laboratory report is done individually (plagiarisms is not allowed). The report must be typed and include; Title, Purpose, Procedure, Materials, Observations, Data, Results, Conclusion and Citations.

How do I put it altogether?

Students will be completing a group project for the **DNA as Genetic Material** section. As a group the students are to design a model for double helix DNA. They must include every part of the double helix. The project can not be a PowerPoint, Prezzi, or slide. Your project should include a poster board explaining each part that makes up DNA & its function. You will have time during class to work on this, but may require work outside of class (02/24)

_____ Take the vocabulary test you must show mastery to be complete. Students may use previously assigned vocabulary card assignment. (02/17)

_____ Review for your self-assessment.

_____ Participate in STEM competition along with Ms. Irias. This is mandatory, the competition is until March, but this month will be used for preparation.

Assessment

1. Testing your Knowledge - "DNA as Genetic Material" (02/24)
Assessment will include all material covered in class (paper assessment)
2. Reflection on STEM competition