
Interactive Learning Objects

Biology

Nucleic Acids Lesson Plan

TVOntario



Nucleic Acids

Learning object description

The animations in this learning object allow students to explore the molecular structure of nucleotides. By examining the models, they can see similarities and differences between RNA and DNA nucleotides and learn how nucleotides are bonded together to form strands. They can compare single-stranded RNA with double-stranded DNA.

Students learn that the two strands of DNA are complementary due to the nature of the bonding between the four nitrogenous bases (adenine bonds with thymine; cytosine bonds with guanine). They can test their understanding of DNA structure through interactive pages that allow students to label the components and create a complementary DNA strand.

Learning objective

The students will be able to:

- Differentiate between RNA and DNA nucleotides on the basis of their molecular structure;
- Describe the bonding and arrangement of nucleotides in a double-stranded DNA molecule;
- Identify the components of a nucleotide.

Correlation to the Ontario Curriculum

Grade 11 Biology – SBI3U Academic:

- Outline the scientific findings and some of the technological advances that led to the modern concept of the gene and to genetic technology, and demonstrate an awareness of some of the social and political issues raised by genetic research and reproductive technology
- Research genetic technologies using sources from print and electronic media, and synthesize the information gained

(e.g., describe the Human Genome Project, transgenics, or the process of genetic screening; list the advantages and disadvantages of cloning or the genetic manipulation of plants).

Grade 12 Biology – SBI4U Academic:

- Compare the structure and function of RNA and DNA, and explain their roles in protein synthesis
- Illustrate the genetic code by examining/analysing a segment of DNA (e.g., compare base sequences of DNA for an enzyme in humans and another animal; compare base sequences in DNA in order to recognize an anomaly).

Vocabulary

- Nucleotide
- RNA
- DNA

Pre-viewing

- Initiate a class discussion to introduce students to nucleic acids by asking if anyone has seen any movies or television programs about forensic science. (A popular program at the time of writing is *CSI: Crime Scene Investigation*).
- Ask students to describe how the forensic investigators use DNA profiling/finger printing to determine an individual's potential involvement with a crime.
- Tell students that DNA profiling/finger-printing is based on matching particular sequences of nucleic acids within an individual's DNA, and therefore, it is important for forensic scientists to understand the molecular composition of DNA.

While viewing

- Have the class work either individually or in pairs, depending on your and their preference and access to computers.
- Students should carefully compare the models of an RNA and a DNA nucleotide and make a Venn diagram to note the similarities and differences between the nucleotides and the strands of RNA and DNA shown in the illustrations.
- Have students make a labeled diagram to show the bonding in a double-stranded DNA molecule.
- Diagrams should indicate positions where covalent bonds are required (i.e., within the sugar-phosphate backbone and nitrogenous base), and where hydrogen bonds are required (between nucleotide bases).
- Tell students to look at the model very carefully to notice the anti-parallel nature of the two complementary DNA strands, and that A and T form two hydrogen bonds, while C and G form three. These details should be reflected in their diagrams.

Post viewing

- Have students exchange diagrams with a partner to peer assess their content using the checklist shown below.

Follow-up activity

- Modern DNA technologies that are based on DNA sequence analysis allow us to determine information that is relevant in a number of contexts: for example: genetic screening, forensic profiling, and paternity determination. While these applications have their benefits, they remain controversial. Have students research the use of technology in one of these contexts, then write a letter to the editor to defend a position on whether or not the application is justified.

Assessment

- Students' letters to the editor: for Application-analysis of social and economic issues involving science and technology; for Communication-communication of information and ideas, and use of scientific terminology, symbols, conventions, and standard (SI) units.
- Diagrams can be assessed for Knowledge and Understanding: understanding of concepts, principles, laws, and theories (e.g., identifying assumptions; eliminating misconceptions; providing explanations); knowledge of facts and terms; understanding of relationships between concepts, using the following checklist:
 - double stranded DNA is shown
 - strands are anti-parallel
 - complementarity is shown
 - A/T bonded through 2 hydrogen bonds
 - C/G bonded through 3 hydrogen bonds
 - bonding within nucleotides is covalent
 - bonding of phospho-sugar backbone between nucleotides is covalent
 - diagram is clearly and concisely labeled