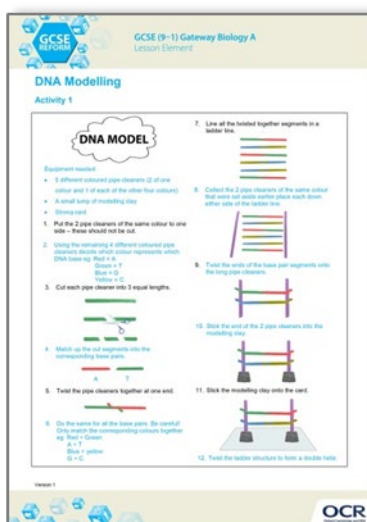




DNA Modelling

Instructions and answers for teachers

These instructions should accompany the OCR resource ‘GCSE (9–1) Gateway Biology A DNA Modelling’ learner activity which supports OCR GCSE (9–1) Gateway Biology A



The Activity:

Learning outcomes

- Describe DNA as a polymer that is made up of two strands forming a double helix.
- Recall that DNA is made from four different nucleotides; each nucleotide consisting of a common sugar and phosphate group.



This activity offers an opportunity for English skills development.

Associated materials:

GCSE (9–1) Gateway Biology A ‘DNA Modelling’ Lesson Element learner activity sheet.



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Prior Preparation

Equipment will need to be ordered in advance: different coloured pipe cleaners (students will need 2 pipecleaners of the same colour and 4 pipecleaners in other colours), a small lump of modelling clay and a 5cm² of strong card for each learner.

Learners need to have covered the basic structure of DNA before attempting this model.

Introduction

This activity is designed to consolidate the idea of the basic structure of DNA and complimentary base pairing. It can therefore be used as a foundation teaching resource and for higher ability learners to build on.

Prior knowledge required

Learners will need to have been taught the basic structure of DNA. All learners must be aware that DNA is arranged in base pairs (A-T, G-C) and that DNA is a double helix structure.

Some learners can find it difficult to understand the arrangement of base pairs; this activity provides a visual illustration for them. Some learners can find it difficult to picture not just how the bases pair together but also their arrangement along the sugar phosphate backbone.

Notes for teachers

Depending on the group teachers could either lead the activity step by step, explaining what each part of the model represents or learners could be given an instruction sheet and build the model for themselves.



The basic activity

Using the instruction sheet learners should decide which coloured pipe cleaner represents each DNA base and also keep in mind its correlating pair. Any cuts that need to be made should then be done. Once cut to shape the pairs of colours should be matched and the ends twisted together.

Learners should then arrange these in a ladder formation on their work bench. *This is when the teacher can reinforce that the arrangement of the base pairs is different depending on the gene and their individual alleles. Depending on the ability of the group additional time could be built into the activity for additional help/discussion.*

Using the two (same coloured) pipe cleaners that remain (uncut) learners should place one either side of the ladder arrangement and carefully twist each end of the base pairs (paired) to the backbone pipe cleaner. Once the ladder structure is made modelling clay can be used to attach the ladder to the small piece of thick card. Learners can then twist the structure to form the double helix.

Extension Activities:

There are many opportunities to extend this activity.

- Learners could cut the purines (A and G) and pyrimidine nucleotides (C and T) to different lengths (longer and shorter respectively).
- The sugar phosphate backbone could be made from alternating two different coloured pipe cleaners (remembering that the nitrogenous bases will only bind to the sugar residues). This will require an additional coloured pipe cleaner.
- Learners could twist the G and Cs round three times, the A and T twice to indicate the number of hydrogen bonds between the complementary bases.

Task 1

Higher level learners could use sticky labels to annotate with explanations of coding for proteins and amino acids if desired by the teacher.

Task 2 - Questions on triplet code

Answers:

20 different amino acids make the many thousands of proteins that are found in all living organisms. The instructions to build all these proteins must be coded within the DNA molecule.

If you read the bases in threes along a gene, it is possible to predict the amino acids that will be made and the order they will be made in. This is the triplet code. Each triplet, a group of three bases, codes for a specific amino acid.

Here are the triplet codes for four different amino acids:

alanine GCA methionine ATG glutamine CAA serine TCA isoleucine ATA

- Write down the order of the amino acids in the protein coded for by this length of DNA:
CAAATGATAGCATCA.

Glutamine Methionine Isoleucine Alanine Serine

- Write down the sequence of bases which would code for this chain of amino acids:
serine-methionine–isoleucine–glutamine–alanine.

TCA –ATG – ATA – CAA – GCA



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