

The β -Globin Gene Exercise

Introduction

DNA can be explored from two very different perspectives.

- From the structural perspective the focus is on the double-helical structure deduced by Watson and Crick and the complementary AT and GC base pairs. (3DMD's DNA Discovery Kit© focuses on the structure of DNA.)
- From the information perspective the focus is on the way in which a sequence of As, Ts, Gs and Cs encodes the information needed by cells to make proteins.

Bioinformatics is a computer-based discipline that focuses on the information DNA encodes. Bioinformatics software consists of various algorithms that sift through incredibly long sequences of nucleotides, searching for patterns that allow us to identify genes and deduce the amino acid sequence of the encoded proteins. The **3DMD β -Globin Gene Exercise©** focuses on DNA from the information perspective.

It uses a hands-on, inquiry-driven approach to introduce bioinformatics. Using the map of the nucleotide sequence of the human β -globin gene on chromosome 11, your students will manually search for the nucleotide sequence that can be **translated** into the amino acid sequence of the β -globin protein. Your students will discover:

- Template and non-template DNA strands
- Stop codons
- Translation reading frames
- Introns and exons
- Non-overlapping triplet codons

By manually searching through nucleotide sequence data your students will appreciate the power of computer algorithms that make bioinformatics an invaluable tool of the molecular biosciences. We encourage you to let them work through the exercise **before** introducing the topics listed above, which will give them an opportunity to discover the concepts in a challenging and memorable way.

We updated the **Map of the β -Globin Gene©** in response to teachers who want to introduce the concepts of gene regulation to their students. Version 2.0 contains sequences located upstream and downstream of the coding regions featured on the original maps. On the Teacher's Map, the TATA box located at position -25, the CAAT box at -75 and two erythroid specific promoter elements are highlighted. Sequences that comprise the polyadenylation signal are downstream from the translation stop codon.

A more detailed **Teacher Notes** section is included on the CD that comes with the **Teacher's Copy** of the **Map of the β -Globin Gene©**. Please send questions or comments to Tim Herman at herman@msoe.edu or Margaret Franzen at franzen@msoe.edu.

