



Texas Education Agency and Austin Community College

Biotechnology Online Continuing Education Project

Module 1. Biotechnology Basics Resource Page

This introductory instruction in biotechnology is part of a curriculum designed to help high school teachers to bring to their courses a biotechnology perspective on biosciences, math, health sciences, and agriculture. These online instructional modules are self-paced and free to all Texas high school teachers to participate. Information updates about these online course modules are available at www.austincc.edu/biotech/teaproject and teachers may register for CPE credit at <http://teabiotech.globalclassroom.us/cirrus> until August 15, 2010. The following animations, videos, and online resources are used during the first module of a series of three modules in this course, listed here for teachers who may wish to incorporate them in their high school courses.

| Module 1. Biotechnology Basics | Resources Used |
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| 1. Overview of Biotechnology | <p>“Biotechnology: Making the Connection”, a video from Austin Community College that introduces students to the scope of the field of biotechnology. www.austincc.edu/biotech/Files/K-12/Biotechnology.ram (requires Real Player software)</p> |
| 2. Cell Structure and Function | |
| 3. DNA Structure and Function | <p>“DNA Zoom”, an animation that shows the relative size of organisms, cells, and biomolecules from Biotechnology Australia (see more below under “Supplemental Resources”). http://www.biotechnologyonline.gov.au/popups/int_dnazoom.html</p> <p>Replication Animation from Wiley Higher Education, <i>Concepts in Biochemistry</i>, (3rd Ed.) by Rodney F. Boyer (2006) ISBN 978-0-471-66179-5 www.wiley.com/legacy/college/boyer/0470003790/animations/replication/replication.htm</p> |
| 4. Protein Synthesis | <p>Transcription animation from McGraw-Hill Higher Education, <i>Biology</i> (8th edition, 2008) by Peter H Raven, George B. Johnson, Kenneth A. Mason, Jonathan Losos, and Susan Singer (see more below under “Supplemental Resources”). ISBN-13 9780073227399 http://highered.mcgraw-hill.com/olc/dl/120077/bio25.swf</p> <p>Central Dogma animation from McGraw-Hill Higher Education, <i>Biology</i> (8th edition, 2008) by Peter H Raven, George B. Johnson, Kenneth A. Mason, Jonathan Losos, and Susan Singer (see more below under “Supplemental Resources”). ISBN-13 9780073227399 http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072965819&alaid=ala_1032396&showSelfStudyTree=true</p> <p>Transcription & Translation animation from the <u>Genetics Learning Center</u> at the University of Utah (see more below under “Supplemental Resources”). http://learn.genetics.utah.edu/content/begin/dna/transcribe/</p> <p>Translation animation from http://www.youtube.com/watch?v=5bLEDd-PSTQ&feature=related</p> <p>The lac Operon animation from McGraw-Hill Higher Education, <i>Biology</i> (8th edition, 2008) by Peter H Raven, George B. Johnson, Kenneth A. Mason, Jonathan Losos, and Susan Singer (see more below under “Supplemental Resources”). ISBN-13 9780073227399</p> |

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| | http://highered.mcgraw-hill.com/classware/ala.do?isbn=0072965819&alaid=ala_1032422&showSelfStudyTree=true |
| 5. Math Skills | The <u>Dilutions</u> animation from the Chemistry Collaborative (see more below in "Supplemental Resources") http://www.chemcollective.org/stoich/dilution.php |
| 6. Lab Overview | <p>BIOTECHNIQUES VIDEOS from Austin Community College.</p> <p>http://www.austincc.edu/biotech/teaproject/vid_pipet.html How to Pipet</p> <p>http://www.austincc.edu/biotech/teaproject/vid_micropipetting.html How to Micropipet</p> <p>http://www.austincc.edu/biotech/teaproject/vid_weighing.html How to Weigh with an Electronic Balance</p> <p>http://www.austincc.edu/biotech/teaproject/vid_phmeter.html How to Adjust pH with a pH Meter</p> <p>http://www.austincc.edu/biotech/teaproject/vid_centrifuge.html How to Use Centrifuges</p> <p>http://www.austincc.edu/biotech/teaproject/vid_agarose.html Preparation of the Agarose Gel</p> <p>http://www.austincc.edu/biotech/teaproject/vid_pouring.html Pouring Agarose Gel</p> |
| Project | <p>2. Myth or fact??</p> <ul style="list-style-type: none"> • http://www.whybiotech.com/resources/myths_plantbiotech.asp#1 (a website maintained by the Council for Biotechnology Information) • http://www.bio.org/foodag/facts.asp#2 (a website maintained by the Biotechnology Industry Organization) • http://ific.org/publications/other/biotechmythsom.cfm (a website maintained by the International Food Information Council) <hr/> <p>3. Can You Give Me a Current Event in Biotechnology?</p> <ul style="list-style-type: none"> • www.sciencedaily.com (a daily source of research news, with a searchable archive) • www.gene.com/gene/products/profiles (profiles of patients who are taking or have taken Genentech biopharmaceutical medicines) • http://www.genome.gov/15515061 (a news release from the National Human Genome Research Institute of the National Institutes of Health in Bethesda MD) • www.eurekalert.org/pub_releases/2005-01/euhs-mdm011405.php (from a searchable index of research news releases of the governmental agencies of the United States) • http://www.sciencedaily.com/releases/2005/01/050111182645.htm (from the Science Daily, a source of research news releases, with a searchable archive) |

SUPPLEMENTAL RESOURCES FOR MODULE 1: BIOTECHNOLOGY BASICS

There are many excellent online tutorials, animations, videos, and interactive activities that can be used to learn concepts important in biotechnology education. These are our favorite sites that are entertaining, yet comprehensive and cutting-edge.

Description

To brush up on chemistry and teach your biology students just the amount of chemistry that is necessary to understand biology, the Online Tutorials prepared by The University of Arizona (<http://www.biology.arizona.edu/biochemistry/tutorials/chemistry/main.html>) are comprehensive and engaging. As a part of The Biology Project, an interactive online resource for learning biology, their tutorials are fun, richly illustrated, and have been tested on 1000s of students. Designed for biology students at the college and high school level, teachers can assign problems sets for reviews before exams, or may want to assign an activity before students cover that topic in their laboratory.

Another good site for updating or reviewing your chemistry skills is at the website of the **Chemistry Collective** (<http://www.chemcollective.org/>), which has a collection of virtual labs, scenario-based learning activities, and concepts tests which can be incorporated into a variety of teaching approaches as pre-labs, alternatives to textbook homework, and in-class activities for individuals or teams. It is organized by a group of faculty and staff at Carnegie Mellon University for college and high school teachers who are interested in using, assessing, and/or creating engaging online activities for chemistry education.

The Dolan DNA Learning Center website (www.dnalc.org) at the Cold Springs Harbor Laboratory has won the “Science Website of the Year” from *Scientific American* for years in a row for its tutorials, animations, interactive activities, videos, lectures, and classroom laboratory exercises. Their curricular offerings in modern genetics & molecular biology are geared for the high school and community college level.

Their Resources directory (<http://www.dnalc.org/ddnalc/resources/>) lists these tutorials:

“DNA from the Beginning” about classical and modern genetics

“DNA Interactive” about DNA replication, mRNA transcription, protein translation, biotechnology applications, genomic studies, and the history of eugenics. This tutorial includes over 200 video clips and animations and has 15 lesson plans that can be downloaded for use in high school and community college classrooms.

“Inside Cancer”, a multimedia guide to cancer biology that explores modern concepts from molecular and cellular biology that help with cancer diagnosis, prevention, and treatment. An instructors’ wiki is available for exchange of lesson plans that use this site. Content alignment to local and national standards is also available.

“Your Genes, Your Health” offers animations on genetic disorders, their causes, their inheritance patterns, their diagnosis, their treatments, and their exact pathology.

The Dolan DNA Learning Center Resources directory also offers laboratory exercises:

“Genetic Origins” provides laboratory for isolating DNA sequences for analysis of mitochondrial point mutations and a VNTR insertion sequence analysis. Followup exercises in bioinformatics can be used to determine our relationship to the extinct Neandertal man and the patterns of human migrations in prehistoric times.

“Greenomes” provides laboratory and bioinformatics exercises to introduce students to modern plant genetics and genome research.

“Silencing Genomes” provides a laboratory project that contributes to research studies in RNAi gene silencing in the roundworm, *C. elegans*.

“Dynamic Gene” provides bioinformatics exercises in locating and annotating gene sequences.

The Dolan DNA Learning Center Resources directory is also the gateway to their **Biology Animations Library**. (<http://www.dnalc.org/dnalc/resources/animations.html>)

The Howard Hughes Medical Institute offers a science education site (<http://www.hhmi.org/resources/educators/>) that offers excellent educational resources for health & biosciences, modern genetics & molecular biology that includes:

“Biointeractive” (<http://www.hhmi.org/biointeractive/click/index.html>)

Virtual labs, animations, and other interactive resources, including DNA Replication and Transcription & RNA translation animations (<http://www.hhmi.org/biointeractive/dna/animations.html>)

Lectures on Science (<http://www.hhmi.org/biointeractive/lectures/>)

Includes topics on infectious and genetic diseases, neurobiology, molecular biology, and evolution

Ask a Scientist (www.askascientist.org/)

If you've got a question about medicine, human biology, animals, biochemistry, microbiology, genetics, or evolution, you can pose your question and some of the top scientists in the country will provide you with an answer. Also offered is guidance in science fair projects and careers in science.

The Public Broadcasting Station funds **Nova science education** television programs

(<http://www.pbs.org/wgbh/nova/sciencenow/>) and a website where teachers can access these programs. In addition to these videos, lesson plans for teaching modern genetics, molecular biology, and health sciences are available, including one featuring an RNAi gene silencing video (<http://www.pbs.org/wgbh/nova/sciencenow/3210/02.html>)

The **Genetics Learning Center at the University of Utah** (<http://teach.genetics.utah.edu/gslc/>) delivers educational materials on genetics, bioscience and health topics, providing resources for K-12 teachers and higher education faculty. In addition to their animations and interactive activities, lesson plans and materials are also available that meet national and many states' education standards for science and health. Their Learn Genetics website (<http://learn.genetics.utah.edu>) is one of the most widely-disseminated education sites in the world. In 2007, it received over 7.1 million unique visits from over 180 countries.

McGraw Hill Higher Education (www.mhhe.com) publishes some of the most popular college-level freshman biology textbooks, as well as more advanced textbooks in genetics and molecular biology. They generously provide their Online Learning Center animations,

The animations that support biotechnology education best comes from *Biology* (8th edition, 2008) by Peter H Raven, George B. Johnson, Kenneth A. Mason, Jonathan Losos, and Susan Singer (ISBN-13 9780073227399). Featuring the latest in cutting edge content reflective of the rapid advances in biology, this textbook serves biotechnology education well. The animations that cover the topics that are the most relevant to biotechnology education can be found in the quizzes from Chapters 14 – 17 (www.mhhe.com/raven8).

Biotechnology Australia is an Australian Government agency that has produced a **Biotechnology Online School Resource** (<http://www.biotechnologyonline.gov.au/>) to provide balanced and factual information about biotechnology. It enables schools to supplement their current educational resources with an online resource that contains informational text, case studies, worksheets, online and off-line activities for students, a biotechnology glossary, and advice to teachers to enable them to become familiar with applications of modern biotechnology. The resource should enable teachers and students to understand the differing points of view on current practices, and the ethical and moral questions that form a part of present debate on biotechnology.