Ininary Toby, Ph.D. Teacher Resource Page

**Gene Ed Genetics, Education, Discovery**

GeneEd Web, developed and maintained by the National Library of Medicine (NLM) and the National Human Genome Institute (NHGRI), National Institutes of Health (NIH), is a safe and useful resource for students and teachers in grades 9 - 12 to learn genetics. The Web site allows the user to explore topics such as Cell Biology, DNA, Genes, Chromosomes, Heredity/Inheritance Patterns, Epigenetics/Inheritance and the Environment, Genetic Conditions, Evolution, Biostatistics, Biotechnology, DNA Forensics, and Top Issues in Genetics.

**Human Genome Project Information Website**

Project by Dept. of Energy and NIH to identify all 30,000 genes in human DNA; determine sequences of base pairs in human DNA; and address related ethical, legal, and social issues

**Kimball's Online Text: The Human Genome Project**

A section of an online text covering the findings of the HGP - gene density and diversity, repetitive elements, novel genes; and what remains to be done.

**Using the Human Genome to Understand and Treat Cancer**

The AAMC website has Hill Briefings consisting of a webcast, summary, and related fact sheets.

**X or Y: Does It Make a Difference?**

Students describe the functional differences of X and Y chromosomes, and explain the significance of these differences within the human genome.

**Body Bacteria: Exploring the Skin’s Microbial Metropolis**

This issue of Findings introduces Elizabeth Grice, a postdoctoral fellow studying the skin microbiome. She wants to learn how and why bacteria colonize certain places on the body, and she’s particularly interested in determining differences between bacterial communities on healthy and diseased skin. Grice hopes her work will lead to new insights for treating chronic wounds that are common in people who have diabetes or limited mobility.

**Darwin’s Pigeons: Learning About Evolution From Bird Traits**

In the lesson plan in the NY Times, students read about a study that sheds new light on Charles Darwin’s hobby of breeding pigeons. They learn about the origins of genes responsible for certain traits in pigeons, explore how scientists unravel the connections between genes and physical characteristics, and create their own selective breeding program.

**Form and Function in DNA Through Strands of a String – “String Me Up”**

The coiling structure found in DNA has evolved because it provides advantages to the function of DNA. String provides a simple model in which the advantages of coiling can be understood. Most string is composed of three strands that are twisted/coiled. Twisted string maximizes mass while making efficient use of space, an important ingredient of DNA. Super coiling, as the students do in this activity, enhances this efficiency with the additional benefit of being stronger.
Geneticist-Educator Network of Alliances (GENA) Lesson Plan Database
The lessons in this database were developed by Geneticist-Educator Network of Alliances (GENA) teams and have been further adapted by the American Society of Human Genetics for use in high school (or advanced middle school) life sciences classrooms. These lessons are intended to follow the BSCS’s 5E instructional model (Bybee, RW, et al., 2006) and to address specific concepts in genetics (Dougherty, MJ, et al., 2011).

Genetics and Probability
This is a lab for middle school or high school students exploring how probability applies to genetics. Students collect data using beads and a coin as examples of alleles. The analysis questions walk students through the steps of expressing probabilities as a fraction or as a decimal. The students are also asked to draw a Punnett square which relates probability to offspring of a particular cross.

Hoo Eats Who and What is What in Your Own Backyard? A Lesson on Ecology
The purpose of this activity is for students to learn to appreciate nature through bird and animal identification and recognition of adaptations for survival in their habitat. This teaching resource was developed by a K-12 science teacher in the American Physiological Society’s 2010 Frontiers in Physiology Program. For more information on this program, please visit www.frontiersinphys.org.

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Inquiry-based activities for the 12 principles of plant biology
These activities invite middle grade students to dig in to the 12 principles of plant biology. Each lab provides: a concept summary for one of the principles, tips for setting up and conducting student-driven investigations, teachers guidelines for sourcing materials, streamlining the process and using additional research.

Intergenerational Relationships: My Older Friends Lifeline - Student Lifeline
Age/Year Conversion Worksheet
Multidisciplinary aging/health science curriculum targeted for middle and high school students

Lifelines Episode 19: Genetics of Exercise
This is a free audio podcast from The American Physiological Society. Discussion questions, related research, and other teaching resources are available by clicking the collection tab in the left-hand column. Have you ever had an experience like this: You and a friend start jogging together. Neither of you have been exercising much, but after a few days, your friend is easily striding along as you wheeze, gasp and hold onto your aching side. Do not feel bad about your performance; it may be your genes. Scientists have identified about 200 genes that play a role in our body’s ability to become fitter, referred to as “adaptation to exercise.” In this episode, we talk to Mark Ofert of the University of California at San Diego and Claude Bouchard of the Pennington Biomedical Research Center. They have organized a symposium on the genetics of adaptation to exercise, to take place at the Experimental Biology conference in New Orleans in April. They will give us a flavor for the research in this field by telling us a bit about their own work. (Begins at 3:51) In the Buzz in Physiology (Begins at 1:21) University of Illinois researchers are developing a program to train people to avoid falls. This research could be particularly valuable for the elderly, for whom falling can be an especially dangerous proposition. Read the press release here, or the study here. And a study from the University College London Medical School sheds light on why patients...
with cirrhosis may have a more regular heart rhythm than is normal, and why they develop hepatic encephalopathy, a neurological disorder. The body’s inflammatory response may be the common thread behind the development of these conditions. To find the related study and press release, refer to the collection button on the left.

**Lifelines Episode 19: The Genetics of Exercise Q&A Sheet**
This question and answer sheet is designed to be used in conjunction with Lifelines, a free audio podcast from the American Physiological Society. The Lifelines podcast, related research, and other teaching resources are available by clicking on the "collection" tab in the left hand column.

**Macrophages: The "Defense" Cells That Help Throughout the Body**
Press Release on research from David Mosser, Professor of Cell Biology and Molecular Genetics at the University of Maryland’s College of Chemical and Life Sciences, about the three primary duties of macrophages. His work was presented at the 2010 American Physiological Society conference, Inflammation, Immunity, and Cardiovascular Disease, in Westminster Colorado, August 25-28. The full conference program can be found at http://the-aps.org/meetings/aps/inflammation/.

**Milestones in Microbiology**
Students read about six milestones in the history of microbiology, create a timeline, and learn that scientific advances often depend on the development of appropriate tools and techniques.

**Molecular Basis of Heredity: Part 1. Nucleic Acids**
Discover the fundamentals of DNA, RNA, nucleic acids and their roles within cells, with Raye Lynn Alford, PhD.

**Molecular Basis of Heredity: Part 2. Genomes**
Raye Lynn Alford, PhD, explains the structures and functions of genomes, and discusses how chromosomal changes lead to certain genetic disorders.

**Molecular Basis of Heredity: Part 3. Genetic Variation**
Join Raye Lynn Alford, PhD, as she explains the molecular basis of genetic variation, including mechanisms and types of DNA sequence variations, and patterns of inheritance of genetic disorders.

**Molecular Basis of Heredity: Part 4. Gene Identification and Tests**
Raye Lynn Alford, PhD, discusses processes of gene identification for purposes of disease research through specialized technologies and tests.

**New Insights into Autism (Part 1)**
Arthur L. Beaudet, MD, gives a research presentation on the causes, prevalence, impacts and treatment of autism.

**New Insights into Autism (Part 2)**
Sakira U. Peters, PhD, explains the traits and diagnosis of autism, and the current research being conducted to learn more about this disorder.
The Pathway to Genomic Medicine
Richard Gibbs, PhD, explains genomic medicine and its role in and relationship to genetic research, and outlines how cutting-edge technologies and the study of genetics in human and in different species is transforming our understanding and treatment of human disease.

PlantingScience
PlantingScience is a collaboration of international scientific societies, scientists, educators, and education research organizations that work together to tackle our nation’s declining levels of science understanding and interest. This partnership to make scientists accessible to the classroom is a direct response to the call for action from The National Academies.

Problem Solving, Persistence, and Patience: The Three P’s of Science Research
This inquiry-based lesson teaches students problem-solving skills as they build a Rube Goldberg type machine.

Reebops: A “Model” Organism for Teaching Genetic Concepts
Students create imaginary creatures, called “Reebops,” to explore the relationships between genes and inherited traits.

Savior Siblings
This case is about whether Pre-implantation Genetic Diagnosis (PGD) should be used to choose a genetically “matched” sibling to serve as an organ donor for a living sibling.

Should Genetically Modified salmon be part of the Human Food Chain?
This case study is about whether or not we should eat genetically modified (GMO) salmon.

Talking Glossary of Genetic Terms
A biological glossary with audio pronunciation and explanations of the terms.

To Tell or not to Tell?
This case study is about whether a woman should honor her spouse’s dying wish not to tell his family about his hereditary cancer.

A Trip to the Zoo
This is a case study about using primate models to study genetic diseases like Huntington’s.

Zebrafish K-12
Facts and information for K-12 classes about “zebrafish,” the organism, and “zebrafish (Danio rerio),” the popular model used for developmental and genetics research.