Matt Zimmerman, Ph.D. Teacher Resource Page

Brain Week!
This week-long exploration of brain structure and function through hands-on experiments and web Treasure Hunts ends with an open inquiry on the brain designed by students. Exploration topics include brain parts and their functions, surface area, optic nerve activity, touch receptors, muscle spindle fibers, motor learning, neuroscientists, and the effects of drugs on the brain. This teaching resource was developed by a K-12 science teacher in the American Physiological Society’s 2004 Frontiers in Physiology Program. For more information on this program, please visit www.frontiersinphys.org.

Burn Baby Burn! A Lesson on Muscle Fatigue
This teaching resource was developed by a K-12 science teacher in the American Physiological Society's 2006 Frontiers in Physiology Program. For more information on this program, please visit www.frontiersinphys.org. The purpose of this lesson is to teach students about the function of skeletal muscle and the effects of fatigue on these muscles. This unit should be used as an introduction of the skeletal and muscular systems. Upon completion of this activity, students should be able to: infer how muscle fatigue affects skeletal muscle and understand the conditions and effects of atrophy.

Cardiac Circulation
This simple Flash™ animation depicts blood flow through the great vessels and chambers of the mature heart. Clicking brings up labels. A second click brings up arrows defining venous flow. A third click brings up arrows tracing the arterial flow.

Communication is key
From our What A Year! series: Recent estimates place the number of cells in the human body at over thirty trillion cells (that’s 3 x 10¹³ or 30,000,000,000,000). Each of these cells contains tens of millions of molecules—organelles and proteins, among others—that collectively enable the cell to function. This means that just to continue existing, the human body depends on lots and lots of moving parts. The key to our existence is communication. The brain must communicate with other parts of the body; the cells in one part of the brain must communicate with the cells in other parts of the brain; and the molecules within each cell must communicate with each other to make further communication possible.

Drugs, Risks and the Nervous System
Students estimate the risks associated with different events and compare their estimates to the real probabilities. This activity is from the Brain Chemistry Teacher's Guide. Lessons in the guide are most appropriate for students in grades 5-10.

Exercise is the Real Polypill - Table 1
This table shows the exercise "vademecum": characteristics of the main myokines that are candidates to be ingredients of the exercise polypill (stem cells are also listed).

Got Wings- A Lesson on Motion and Mechanics
This teaching resource was developed by a K-12 science teacher in the American Physiological Society’s 2008 Frontiers in Physiology Program. For more information on this program, please visit www.frontiersinphys.org. This is an inquiry based student investigation of the mechanics of movement. Students will build levers to investigate the relationship between size, strength, and leverage. Then they
will research wing function, develop hypothesis about the function of chicken wings, design a way to test this hypothesis, and design an exercise program to improve a specific motion. This activity should follow a unit on the skeletal system as used and an entry activity to a unit on the muscular system. Upon completion of this activity, students will be able to: understand the how muscles, tendons, bones, joints, and ligaments work together to produce movement, describe relationship between bone length and muscle size, and explain the benefit of antagonistic pairing of muscles.

How Do You See?-2014 APS Video Contest
The video, "How do you see?" by Stephanie McQuaid, demonstrates how the visual system functions. The video is intended for children between the ages of eight to eleven. This is the equivalent for children in second to fifth grade. The visual system is one of the most vital systems for survival. The eye needs light to see and object or dangers ahead of it. Once the light hits the object that light bounces off the object and into the eye. The light passes through the cornea; the clear part, the pupil; the hole to the eye, which its size is controlled by the iris; the colored part of the eye. Once the light passes through the pupil it hits the lens and is reflected on the back of the eye upside down. The eye sees the image upside down but the brain corrects this image as right side up. On the back of the eye the photoreceptors, the rods and cones, are stimulated by the light energy and that light energy is converted into an electrical impulse. Once the cells are excited the impulse travels down the optic nerve and to the visual cortex, or occipital lobe; this is the part of the brain that interprets what the eyes see. The brain sorts through the pieces that it receives from the photoreceptors and creates an image. The final image is then interpreted and categorized for future encounters. This is how an individual can see.

Intoxicated Love at Altitude-2014 APS Video Contest
Alcohol, a known respiratory depressant, has been found to cause hypoventilation in acutely intoxicated subjects (Langhan, 2013). At high altitudes, the partial pressure of O2 is reduced and exposure to this can lead to low levels of oxygen in the blood, known as hypoxemia. Normally, the human body can adapt to the low oxygen content by breathing more. The sensory receptors in the body detect the low oxygen concentration in the blood and respond by increasing ventilatory response. However, the hypoventilation, which is caused by alcohol, reduces the body’s ability to adjust to the low oxygen environment, which could lead to a decreased amount of oxygen delivered to the brain. Hypoxemia combined with respiratory depression from alcohol consumption may lead to loss of consciousness. Many people like Lauren, a twenty-six year old alcoholic, are not aware of the adverse effects of alcohol at high altitudes. Jason, her boyfriend, is an active male in his twenties and is madly in love with Lauren. As Jason gets ready to propose to Lauren as they hike to the top of Mt. Hamilton, an elevation of 4,360 ft., Lauren loses consciousness because of the reduced oxygen levels to the brain caused by the combination of alcohol and low barometric pressures. This video will demonstrate the effects of alcohol as a respiratory depressant at high altitudes. The objective of this educational video is to educate the audience about how our body responds to high altitude or hypoxic environments.

Kids Health: How the Body Works - Nervous System
How the Body Works is an interactive website for children to explore the systems of the body and learn basic anatomy and physiology. In particular this link provides students and teachers to animations, videos and activities related to the nervous system.

Learning & Experiencing the Function of the Heart -PhUn Week Poster
Session EB 2014
One Kinesiology faculty member and four undergraduate Kinesiology students from California State University, Northridge visited Cedar Creek Elementary School in Canyon Country, CA. On the day of the
PhUn week activities, 57 first and second grade children participated. The morning began with a short interactive introduction about the general function of the heart as a pump. The children then split up into four groups of about 14 each. The groups rotated through four different 10-minute hands-on learning activities. Activity 1 was “Exercise and the Heart”, in which the children learned about the function of the heart during exercise, how to take their pulse, and the benefits of exercise on the heart. Students participated in fun physical activities to increase their heart rate, felt their pulses again, and briefly discussed the change in heart rate during exercise. Activity 2 was “The Heart and Brain”, in which children learned about the interactions between the heart and brain. At this station, the children viewed diagrams of the heart and brain, stomped heart beats with their feet, and squeezed foam hearts to experience the amount of work involved in pumping blood through the heart. Activity 3 was “The Impact of Food on Your Heart”, in which the children talked about foods that are good and bad for the heart. The children were asked to come up with examples of good and bad foods and create two lists. The children also acted out the effects of narrowed arteries by forming artery walls with two lines of children and trying to walk through the lines as they got closer together (as the artery narrowed). Activity 4 was “The Anatomy of the Heart”, in which the children each received a heart diagram and crayons and were guided through drawing colored arrows representing blood flow through the heart to the lungs and aorta. The morning concluded after the entire group came back together for a short discussion about schooling and careers in Physiology and Exercise Physiology.

**Lifelines Episode 12: The Accidental Mind’ and Fetal Alcohol Syndrome 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.

**Physiology of a Dunk - 2011 APS Video Contest**

A video entry for the 2011 APS Video Contest. This video describes the muscles involved in dunking a basketball.

**Active Ingredient In Common Chinese Herb Shown To Reduce Hypertension**

Press release explains findings that could aid in creating alternative treatments for those with high blood pressure.

**Controlling Hypertension: A Research Success Story**

In the past 2 decades, deaths from stroke have decreased by 59% and deaths from heart attack by 53%. An important component of this dramatic change has been the increased use of antihypertensive drugs. This remarkable success resulted from broad-based and diverse research programs supported by the federal government, pharmaceutical companies, voluntary health agencies, and private foundations. It included basic research, drug development programs, and epidemiologic studies, health surveys of US citizens, clinical research, and large-scale drug trials. Four of the categories of antihypertensive drugs in wide use—diuretics, beta-blockers, calcium antagonists, and angiotensin-converting enzyme inhibitors—emerged from widely different areas of investigation. In the beginning, the major breakthroughs that led to the development of these drugs were impossible to forecast, and their ultimate applications were impossible to predict. Although decreases in hypertension-related mortality are impressive, enthusiasm must be tempered because the mechanisms of hypertension are still incompletely understood and prevention is not yet possible. Continued research is needed to extend these advances. This article provided by FASEB's Breakthroughs in Bioscience series.
Don't stress out
A monthly installment of our "What A Year!" website project, introducing life science breakthroughs to middle and high school students and their teachers. In cases of prolonged stress, physiological changes can actually become permanent, resulting in a variety of adverse consequences including reduced immune function and mental illness. This month we look at new work that is investigating two of the most stressful situations imaginable: training to be an Army Ranger and traveling in space.

Eugene M. Landis and the physiology of the microcirculation
Essay APS Classic papers by Landis and Landis

Virtual Cardiology Lab: How is a pedigree useful in diagnosing heart disease?
This lesson is designed for upper level high school, undergraduate and graduate students learning about the cardiovascular system.

Work of the Heart
An introduction to cardiac physiology that demonstrates the work performed by the heart.