

# **GROW 2007 Summer Workshop Activities**

## **Dr. Sean Lawton**

### **“Adding Snowflake-Symmetry”**

We learn early about the arithmetic of numbers: addition, subtraction, etc. However, we do not know what numbers are. This is a fascinating and deep fact. There are other kinds of arithmetic that do not involve numbers, but instead use geometric ideas. We explore an example of this with polygons.

## **Dr. Terry Beck**

### **“Airplanes Fly, Why Can’t I?”**

Students will be introduced to basic principles of flight and flight stability, which is especially important for gliders. These principles will be demonstrated using balsa gliders (provided). They will be instructed how to disassemble and re-assemble the balsa gliders to form a number of different airplane configurations, including a conventional glider, a canard, and a flying wing. They will learn how to determine from simple analysis if a given configuration will fly, and what appropriate modifications (if necessary) will make each configuration fly in a stable manner.

## **Dr. Sherry Fleming**

### **“Bacteria Wars”**

Bacteria! Where do they live and how do they grow? We will learn about the white blood cells that kill bacteria and discover how germs spread from one person to another.

## **Dr. Mary Cain, Ms. Rosemary Ha & Ms. Maggie Gill**

### **“Brain and Behavior”**

Environmental enrichment during development has many effects on both the brain and behavior of the rat. Enriched environments are created for rats by housing them in groups with toys that are changed daily. This activity will begin by examining some of the brain areas that change as a result of enrichment. You will then see an enriched environment for rats and learn how to set one up and change the toys. Our lab is interested in how enrichment during development decreases drug abuse. One of the most common methods used to examine drug abuse in rats is operant conditioning. Therefore, you will learn how to train a rat to lever press for a reward using operant conditioning to understand how we study drug abuse in enriched rats.

## **Dr. Chris Culbertson, Ms. Amanda Meyer & Ms. Amy Johnston**

### **“The Chemistry and Art Connection!”**

Most photography is based on the reaction between silver salts and sunlight. In this session students will explore another chemistry method to produce images using iron salts. The reaction of the iron and sunlight creates bright blue images on paper, and this is called a cyanotype. In the “old days” architects used this same process to produce images of their designs -- called blueprints! Before copiers and printers in the 1800s, a draftsman would make a drawing on translucent paper using india ink. These were then copied by placing the drawing directly on a piece of the iron-treated paper. When sunlight shone from above, it would penetrate the drawing paper (except where the ink was present) and expose it, creating a cyanotype. In this session, students will prepare blueprint papers, find creative items to place on their paper (i.e: flowers, leaves, sticks, stencils, film negatives, etc.), expose them to the UV light outside, and develop them to create their own cyanotypes to take home!

## **Ms. Susan Arnold Christian, Ms. Chelsea Renda & Ms. Laura Torres**

### **“CHOICES: A game of life decisions”**

Come play a game that is all about you and your life! What do you want to do in high school? College? Be prepared to make decisions about your future and get a visit or two from fate!

**Dr. Glenn Horton-Smith**

“Cloud Chambers”

What are the smallest indivisible bits of matter out of which everything else is composed? Particle physicists call them elementary particles. When they move at very high speeds, elementary particles make visible tracks in a device called a "cloud chamber". In this session, we will see a professional demonstration cloud chamber, then make our own cloud chambers, and use them to see naturally occurring fast elementary particles.

**Ms. Dyan McBride**

“Coaster Craze”

How do roller coasters stay on their tracks? Energy! We'll learn about the science behind the hills, loops, and barrel-rolls that make roller coasters so exciting. Then, we'll use computer simulations to test out our own roller coaster designs.

**Dr. Julie Thornton**

“Computer Game Development”

In this session, you will write your very own computer game using a programming language called Visual Basic. You will also learn the basics of computer programming, where you give commands to a computer using their language.

**Ms. Jessica Heier**

“Disaster Relief”

Many kinds of disasters leave people in need of food, water, medical supplies & other necessities. But the unpredictability of these disasters makes it very difficult for relief agencies to respond quickly. In this session, we will each become part of a relief supply chain model. We will explore the challenges of relief supply chains & the ways engineers & scientists can improve them.

**Dr. Takashi Ito & Ms. Helene Maire**

“DNA – Beyond Goo”

All living things contain DNA, which makes up the genes that determine their properties. In this activity you will extract DNA from bananas and use a special microscope to look at individual DNA molecules.

**Dr. Bill Schapaugh, Ms. Jianye Meng, Dr. Paul St. Amand**

“Don't bug me...when soybeans and aphids don't get along”

In this hands on lab experience students will be able to set up an experiment using soybeans, aphids and genetics. They will learn firsthand about working in a lab using the scientific method to research genetic resistance of soybean varieties to aphids.

**Dr. Bobb Stokes**

“Engineering Crash Free Highways”

In 2003, people died in highway crashes at the appalling rate of 116 per day. Motor vehicle crashes are the leading cause of death for people ages 16 to 20. Looking ahead, one in 90 children born in 2003 will die violently in a highway crash, and seven of ten will be injured in a crash, many of them more than once. There is a need for traffic engineers dedicated to improving the safety of our highways. This session will provide an opportunity for participants to gain an understanding of the responsibilities of traffic safety engineers. Participants will have the opportunity to test their understanding of the problem through an interactive (CD-ROM) highway safety challenge.

**Dr. Tami Epp**

“Equine Exercise Physiology”

This activity provides an introduction to the physiology of the equine athlete, the mechanisms that make the horse an elite athlete, and some of the problems the horse encounters during strenuous exercise. We will demonstrate a Thoroughbred horse exercising on the high-speed equine

treadmill, using a standard exercise test which includes a warm-up, a progressive increase in speed to over 20 mph, and a cool-down after the test. We will discuss the physiology of the horse and compare it to other domestic animals and the human athlete.

**Dr. Daniel Boyle**

“Exploring the Microscopic World”

In this activity, girls discover what might be found in their mouth or external ear using powerful microscopes capable of seeing proteins, lipids, viruses and cells. They will prepare samples from their own mouths and external ears and look at them at magnifications up to 450,000 times.

**Ms. Sarah Nuss-Warren**

“Fire it up!”

This session will investigate fuel combustion. The goal is to determine what happens during combustion, and to explore the factors that affect combustion. The session includes ample opportunity to conduct combustion experiments and determine when a fuel will and will not burn. Experiments will include the use of hydrogen to improve combustion. The attendees will prepare and present a PowerPoint presentation that describes the experiments, results, and conclusions.

**Ms. Bridget Kennedy, Ms. Jackie Thompson, Ms. Katherine Meinig, Mrs. Kathy Shirk & Mrs. Luci Kennedy**

“FIRST Robotics”

Take the FIRST opportunity. With this activity you will be learning about F.I.R.S.T., robotics competitions, the robots, and how F.I.R.S.T. has affected people's lives. You will also have a chance to work in groups to make your a competitive robot.

**Dr. Carolyn Ferguson**

“Flower Power”

In this session participants will explore the world of Botany! Come create botanical collages from pressed flowers and tour the Herbarium.

**Dr. Michael O’Shea**

“Fun with Magnetism”

We will begin by looking at the properties of permanent magnets (attraction and repulsion). We will then look at simple ways these properties can be used. We will also look at how electric currents can create magnets. Finally we will look at the Earth's magnetic field and play with some machines that use magnetic fields. This should be a fun experience where participants learn about magnetism. No previous knowledge of magnetism is required!

**Ms. DeAnn Presley**

“Getting Down & Dirty”

A rainfall simulator will be used to create runoff on two different soil textures (silty and clayey) and three different treatments (corn, grass, and bare). Students will be asked to use the scientific method, i.e., observe, hypothesize, test, and conclude. After the rainfall simulation, students will be taught how to perform texture analysis by feel. This is a very hands-on activity, and they might get pretty dirty! A discussion will follow on the importance of protecting our soil resource in both agricultural as well as urban environments.

**Ms. Julie Bergner**

“Geometry without shape”

Imagine what geometry would be like if you didn't worry about specific shape and size. What would be left? Features of "shapes" would then be dimension, number of holes, and whether they are twisted or not. In this session, we'll explore topology, or the study of such figures. Using dough or clay, we'll discover different kinds of shapes that are the same topologically but not geometrically. Then, we'll experiment with Mobius bands and other paper strip constructions to

better understand what kinds of shapes can still be different from one another from this point of view.

**Dr. Lisa Freeman**

“The Heart of the Matter: Learning How Creatures Go Pitter-Patter”

Your heart beats about once every second. A mouse heart beats 5 times faster than your heart, while a horse's heart beats 3 times slower. We will dissect hearts from different species to compare their size and structure. We will learn how electrical signals are carried from your brain to your heart, and we will measure the surface electrical activity of your hearts (ECG) and compare your ECG to the ECG of the mouse, dog, horse, and elephant.

**Ms. Kat Schmitt McCain & Dr. Gail Wilson**

“Home on the Range”

Students will examine differences in plant communities in grazed and ungrazed areas at Konza Prairie Biological Station. In small groups, the students will form hypotheses and conduct scientific experiments using ecological field equipment. The students will then discuss their results as a large group in order to see if their hypotheses were correct. The students will then have time to discuss how their findings can be relevant to broader concepts, such as global change.

**Ms. Sarah Grotheer**

“How Do Those Bridges & Buildings Stand?”

Many structures are made of concrete. Concrete is interesting because it can initially be formed into any shape, then it becomes a hardened, very strong building material. This session will consist of mixing concrete and making specimens, then the strength of the specimens will be tested.

**Dr. Ari Jumpponen**

“Humongous plant and fungus in the air and lungus”

Many people suffer from allergies – watery eyes, coughs, sneezes and chest congestion. The main culprits for the respiratory irritation and allergies are particles in the air. These particles are mainly plant pollen, mushroom spores and dead skin from pets. In this exercise, we will look at how to estimate the numbers of allergy-causing particles in the air. We will collect particles from air using a cyclone air sampler. With these samples, we will see what is in the air we breathe and how many of the different particles we can count. We will also estimate how many particles we end up breathing in an hour.

**Dr. Sundeep Rayat & Mr. Ola Alawode**

“It's All About Chemistry”

Come and determine the amount of vitamin C present in different fruit juices, find out how detectives are able to see fingerprints that help them solve criminal cases, and learn the chemistry of digestion.

**Dr. Maritza Muquira**

“Lemon Power”

Participants in this session will explore how to make a battery out of a lemon.

**Dr. Steve Thien & Ms. Meghan Buckley Zeimen**

“Life in the soil”

We will introduce students to the microscopic world of living organisms in soil using interesting software called “The Microbial Zoo”. Then students will set-up an experiment allowing them to test microbial activity levels in a variety of soil conditions by performing actual chemical analyses. The experiment would relate life in the soil to everyday environmental issues.

**Dr. Bimal Paul**

“Location, location, location”

This session will introduce students one of the five themes in geography. It aims at identifying position on the earth's surface. Using examples and hands on exercises, it will explore how to find out absolute and relative location of selected cities and countries.

**Dr. Xiang Fang**

“Math Behind Maps & Why Shapes Matter”

Did you know that mathematicians believe that you can color any map using no more than four colors and still have no two adjacent countries be the same color? We will test this idea and discuss the mathematical reasons why this may be true. We will also look at the kinds of patterns and shapes that allow you to cover a spherical surface, such as a soccer ball.

There is a reason for those distinctive patterns!

**Dr. Jim Lillich**

“Mending Broken Bones”

Girls will learn how veterinary surgeons repair broken bones in the sterile operating room using instruments that look like power tools!

**Dr. Michael Herman**

“Mutants”

How do animals develop? That is, how do they make skin, muscle, nerves and even guts? In 2002 the Nobel Prize for Medicine was awarded to a group who used *C. elegans* - a soil nematode (or roundworm) as their model organism for studying just how that happens. *C. elegans* is an excellent lab 'animal' to study how genes control development, and we use the worm in our lab to study cell division. Using a transparent worm is a little easier than using a large mammal to answer questions in cell science!

**Dr. Duy Hua, Angelo Aguilar & Sandeep Rana**

“Nanotechnology, Nanotubes & Alzheimer’s”

Come explore carbon nanotubes that are stronger than diamond and the toxic materials that lead to the nerve cell death of Alzheimer's disease. You will use some of the newest technology available to probe these materials and explore how they are structured.

**Dr. Megan Kennelly, Ms. Judy O'Mara & Ms. Marietta Ryba-White**

“Plants get sick, too! An introduction to plant pathology”

We will give a short presentation about what kinds of organisms cause plant disease and what the symptoms look like. Then, we will go into the lab for some hands-on observations of bacteria and fungi and the diseases they cause on plants. Finally, we will take a stroll on campus to see some diseases outside in the “real world.”

**Ms. Marina Pecar**

“Reinventing our homes”

What do you like about the home you live in? Can you imagine yourself in a new living space that can “grow” together with you? Learn what you can do to help improve our daily environments, and design new places for your resting, playing, learning, and more!

**Dr. Todd Easton**

“Shopping Spree”

The U.S. is in need of engineers to modernize and improve service and production systems. Industrial Engineering provides individuals with numerous tools to improve such systems. Participants in this game will be split into a team consisting of two girls and the team is the ultimate authority for ordering items for your store. The team with the most money after 10 rounds of selling and ordering items is declared the winner. During each of the ten rounds, the team must decide how many items to order for the upcoming round. Different ordering decisions will lead to different costs and can have a large impact on the profit. The team with the highest profit is declared the winner.

**Dr. Laura Moley**

"Soils, Roots, and Water"

Come explore the ways that soils hold and move water and nutrients to plant roots! You will get to do a little planting to take home!

**Dr. Marianne Korten & Dr. Charles Moore**

"Sunny day project: Measuring the circumference of the Earth"

We will measure the circumference of the Earth using a slightly improved version of an ancient idea of Eratosthenes (a Greek astronomer and mathematician that lived about 2300 years ago).

**Dr. Alexander Beeser**

"UV, Yeast, and You"

We all have heard that ultraviolet light (UV) from the sun can be harmful--it causes sunburns, skin cancers, and cataracts in the eye--here is a chance to learn why. We will learn why yeast is a good model for exploring the effects of UV on living cells and how yeast cells are related to your cells. We will use a special yeast strain to show what UV does to cells.

**Dr. Mark Hollingsworth**

"A View of Crystals"

In this session, you will learn about the properties of light, the structure of crystals, and how we can use microscopes and other instruments to investigate the properties of crystals.

**Ms. Kabita Ghimire, Mr. Clancy Jensen & Ms. Hannah Wilcox**

"Wayfinding with Satellites"

Workshop participants will be introduced to global positioning system (GPS) technology with a short lecture then learn how to use GPS by participating in a modern version of orienteering. Upon completion of an outdoor navigation course spanning the Kansas State University campus participants will then move to a computer lab and use geographic information system (GIS) software to recreate their experience by calculating their average foot speed and total distance traveled. In case of inclement weather, the outdoor course will be replaced a series of GIS-assisted computer mapping exercises that highlight the physical and cultural geography of Kansas.

**Ms. Sharnée Hudgins, Ms. Ashley Thomas, Ms. Christine Werle, Ms. Mikalya Beauchamp, Ms. Kaley Morris and Ms. Mary Ray**

"The World Reflected in You"

In this workshop you will create a collage from images, words, and art that you decide reflect who you are and how you imagine the "future" you. A short discussion period will follow.

**Dr. Doina Caragea**

"What makes blood red?"

In this session, we will talk about the hemoglobin protein and its role in a disease called sickle cell anemia. We will use a computer program to examine two variants of the human hemoglobin, normal and sickle cell, trying to see differences between them. Are there other organisms that have hemoglobin proteins? Do they get sick with anemia? How close are they to humans in a phylogenetic tree? We will find answers to these questions by running several computer programs!

**Dr. Bimal Paul**

"Where are all the people?"

Spatial distribution is an important topic in geography, which are analyzed by the elements such as: density, dispersion, and pattern. This session will introduce how to calculate different types of population density, their strengths and weaknesses. Types of dispersion and spatial patterns and their implications will be studied using examples and hands on exercises.