

An abstract graphic design featuring three blue circles of varying sizes. Each circle is composed of three concentric layers: a dark blue inner circle, a light blue middle ring, and a medium blue outer ring. The circles are connected by thin, light blue lines. One line connects the top-left edge of the smallest circle to the top-left edge of the largest circle. Another line connects the top-right edge of the smallest circle to the top-right edge of the medium-sized circle. A third line connects the top-right edge of the medium-sized circle to the top-right edge of the largest circle. The circles are arranged in a roughly triangular pattern, with the largest circle at the top right, the medium circle at the bottom center, and the smallest circle at the top left.

A Schmahl Science Workshop
Biology Workshops Catalogue

Anatomy and Physiology

- **"Just think of that!" Neurobiology Series** What are you thinking? Find out what makes you tick! Wiggle your finger, remember a phone number, and recognize a friend -- these all go on in your head! Sure, we'll see real brains, but the fun is finding out how they work. Learn the parts of the brain like countries on a map - where are they, what do they do, what happens if they're gone? Along with activities, you'll hear about people who no longer recognize faces, see motion, remember facts, speak in sentences or do mental math...but are otherwise somewhat normal.
- **Balance In Movement** You may know the feeling: as you start a long car trip, you feel nauseated, maybe to the point of vomiting. You may also have a headache, loss of appetite, upset stomach and a generally sick feeling. You're car sick, and it's no fun. Motion sickness can take place just about anywhere; people get seasick, airsick and yes, even space sick. When astronauts face motion sickness, especially at critical points in a mission, it can jeopardize an operation, so they have to be able to cope. But how? The vestibular system is key to our senses of balance and equilibrium. Students observe the importance of acceleration and deceleration in producing movement of hairs suspended in fluid in the inner ear and perform various investigations to understand the vestibular-ocular reflex and learn about the importance of visual cues in maintaining balance.
- **Cow Eye Dissection** Students will learn about how their eyes work as they dissect a cow's eye.
- **Food Pyramid** What is really in your lunch box? Is that bologna in your sandwich as nutritious as cheese? Students learn about healthy fuel for their body, the food pyramid; becoming a salt and sugar detective, the basics of digestion, watch out for advertising, and the importance of water.
- **Honeybees** Compare your community to that of a bee while learning the role of each bee in the hive. How do bees communicate? Investigate the many different ways that honeybees help humans.
- **Human Body: Digestive System 2 -To the Intestines and Beyond!** The story we're about to tell is of stormy seas, acid rains, and dry, desert-like conditions. It's an arduous journey that traverses long distances and can take several days. It's one in which nothing comes through unchanged. It's the story of your digestive system whose purpose is turn the food you eat into something useful -- for

your body!

- **Human Body: Bones**

Students observe the movements of the body while jumping rope. They work in groups to determine the number of bones in their own bodies. By studying skeleton photos and diagrams, students find over 200 bones. They assemble a paper articulated skeleton. Finally they compare the bones of a human to those of other mammals.
- **Human Body: Cardiovascular System**

From the moment it begins beating until the moment it stops, the human heart works tirelessly. In an average lifetime, the heart beats more than two and a half billion times, without ever pausing to rest. Like a pumping machine, the heart provides the power needed for life. This life-sustaining power has, throughout time, caused an air of mystery to surround the heart. Modern technology has removed much of the mystery, but there is still an air of fascination and curiosity. Through hands-on activities we explore the heart and discover the complexities of its structure. We will follow the blood through the blood vessels. We will learn how to have a healthy heart and how to monitor your heart's health.
- **Human Body: Circulatory System**

How does exercise affect your heart? How does smoking damage your lungs? How do your muscles work? A practical investigation of breathing, circulation and movement. Study the relevance of pulse rate and blood pressure to human fitness.
- **Human Body: Digestion**

What happens to the food we eat? We will take a look at the anatomy and chemistry involved in digestion. We investigate what food is made of and the many chemical reactions the body uses to break food down. We also explore how food gives us energy to grow and why vitamins are so important. Students act out the different components of the digestion system to learn how each section of the digestion system plays a distinct role in getting the nutrients in the food we eat into our bodies.
- **Human Body: Excretory System**

What does your urinary system do? Huh? Are you asking yourself what's a system, anyway? A body system is a set of body parts that do a particular job. In this case, it's filtering out excess fluid and other substances from your bloodstream. Some fluid gets reabsorbed by your body but most gets expelled as urine. If your body wasn't clever enough to get rid of some of this stuff, you'd get sick!
- **Human Body: Integration of Systems 1 - Tour of Human Body**

Students tour the human body for an overview of the major body systems, stopping frequently along the way to delve more deeply into each system's individual parts. Students will discover how each body system works and find out how each body part contributes to the functioning of the whole body.

- **Human Body: Integumentary System** What would you look like without your skin? Did you know that without the skin all of your delicate insides would spill right out? The answer is, quite simply, a big squishy mess! Your skin is like a very large container. It's the largest organ of your body, and without it, all your delicate insides would spill right out. Explore the integumentary system and discover some gross facts about the skin.
- **Human Body: Joints** Students investigate the articulated skeleton by immobilizing certain hand joints and then performing everyday tasks. Students categorize the types of joints in the body and compare the movement of mechanical devices to the function of human joints.
- **Human Body: Joints, Twister and Programming** Students play and focus on the joints that make it possible to assume some of the interesting Twister positions. Students write Twister cards that describe the positions for other players to match.
- **Human Body: Lung Capacity** Each day in your life you breathe in and out approximately 20,000 times, usually without thinking about it. Here is a chance to discover how breathing works.
- **Human Body: Making A Model Thumb** Students build operational models thumbs and then compare the muscle/bone functions of a model thumb to a human thumb.
- **Human Body: Organs** Embark on a journey inside the human body as we examine our internal composition by taking part in an actual organ dissection
- **Human Body: Stimulus/Response** Students discover some of the characteristics of their nervous system by measuring the time needed to respond to a quick impulse. They compare reaction time of small muscle groups versus large, and reaction time with visual, auditory, touch, and static electrical impulses. This relates to three of the five senses, and voluntary and involuntary motion.
- **Human Body: The Brain** The brain is a marvelously complex and intricate organ of the body that neurologists are learning new things about its workings every day. However, there are some things that we do already know about the brain's structure and function. This workshop will be a brief introduction to this amazing control center of our bodies

- Human Body: The Immune System**

The immune system, which is made up of special cells, proteins, tissues, and organs, defends people against germs and microorganisms every day. In most cases, the immune system does a great job of keeping people healthy and preventing infections. But sometimes problems with the immune system can lead to illness and infection.
- Human Body: The Muscular System**

Students observe the action of muscles that cause the body to move. Given a number of facts about muscles, students build operational models to demonstrate how muscles move legs, thumbs, and arms.
- Human Body: The Nervous System Ow!! That hurts!**

What is the nervous system? Made up of your brain, your spinal cord, and an enormous network of nerves that thread throughout your body, it's the control center for your entire body. Your brain uses information it receives from your nerves to coordinate all of your actions and reactions. Without it, you couldn't exist.
- Human Body: The Respiratory System**

Every part of your body needs oxygen from the air you breathe in order to survive. The lungs are designed to absorb oxygen from the air and transfer it into the bloodstream. Besides teaching the physiology of the respiratory system and the damage caused by smoking, we discuss asthma, tuberculosis and other types of lung disease, as well as indoor and outdoor air pollution and its effects on the lungs. A highlight of the workshop is the use of actual samples of respiratory parts, both diseased and healthy. This is a unique opportunity for children to be able to see and touch these specimens.
- Human Body: The Skeletal System**

What would happen if humans didn't have bones? You'd be floppy like a beanbag. Could you stand up? Forget it. Could you walk? No way. Without bones you'd be just a puddle of skin and guts on the floor.
- Human Body: Reflexes**

Concepts include components of nervous system, structure and function of neurons. Students build a model neuron and a model brain, act out transmission of nerve impulse, test skin sensitivity and reflexes, create data tables and interpret results.
- Human Senses**

How do we find out about the world about us? Tantalize your taste buds, harness your hearing, stimulate your sense of smell, trick your touch and astound your eyes in this hands-nose-tongue-eyes-and-ears-on experience.
- Knee Dissection of a Pig Joint**

A discussion of the human knee joint is followed by a guided dissection of a pig joint.

- **Modeling Kidney Function Lab Investigation: Osmosis**
Students work with a selectively permeable membrane to learn about osmosis, diffusion, and water potential of cells with one comprehensive lab activity.
- **Modeling The Nervous System**
Students learn the locations and functions of the Central Nervous System (brain and spinal cord) and the Peripheral Nervous System. Our giant model of a neuron illustrates the properties of chemical transmission and the action potential.
- **Pig Heart Dissection**
A discussion of the Human Heart using normal and pathological specimens followed by pig heart dissection.
- **Sheep Brain Dissection - Anatomy of Memory**
Curious about how your brain works? Ever wanted to peek inside your head and see what's going on? In this class, you'll learn about different brain structures and some of their functions. After learning some basics, you'll participate with a partner in dissecting a sheep brain (similar to the human brain). Come and learn how these remarkable biological computers work!
- **Skin Mapping**
Students predict and then measure a person's ability to discriminate one versus two points touching various places on the skin, record and graph their data, discuss the implications of having different sensitivities in different skin areas, describe the "sensory homunculus" and how it helps us understand sensory information processing in the brain, and design and conduct experiments to extend the study of the sense of touch.
- **Zena the Cow Warrior**
What do you get when you mix students, a teacher and a pile of bleached bones? You get Zena, Warrior Cow.

Botany

- **Algae Recycling System** Algae can be as one-celled plants, and they usually live in water. You are going to use algae to look at the rate of photosynthesis. The algae are tiny and are difficult to work with directly in the water so the first part of this workshop involves 'immobilizing' the algae. This effectively traps large numbers of algal cells in 'jelly like' balls so that we can keep them in one place and not lose them. We use sodium alginate to help make the jelly. When these algae are 'wrapped up' in the jelly balls they are excellent to use in experiments on photosynthesis.
- **Bats and Figs** Students are treated to a special presentation by the "Bat Lady", Ms. Monique Smith Lee! Ms. Lee, a biologist from the California Bat Conservation Fund, visits hundreds of schools, libraries, museums, and community centers to teach approximately 40,000 children, and their teachers and care givers, the truth about bats and their benefits to the human population. Her presentation consisted of a short lecture, accompanied by a slide show. Best of all, she brings variety of live bats that could be seen and enjoyed up close!
- **Biochemical Analysis of Plant Enzymes** This experiment demonstrates specific plant enzymes which have important functions in biotechnology. Students perform tissue prints of seeds to examine what happens during malting. An additional experiment allows students to quantify the activity of amylase.
- **Dates and Olives** I confess: I love olives and dates! I can't eat pizza without olives, and I will make a date shake at every opportunity. I am often teased by my friends about this. In order to teach students a few things about olives and dates, I have put together this workshop.
- **Flowers for Freddy Forensics** Who murdered Freddy? Was it the florist in the flowerbed, the vegetable supplier in the garden, or the fruit grower in the orchard? Students learn flower structure and how to use a dichotomous key as they pinpoint the murder site and narrow the list of suspects.
- **Leaf Shape** Students describe and classify leaves by their shapes, size, and arrangement on the twig and leaf margin.

- Leaf and Tree ID**

Participants will learn how to construct and use a simple dichotomous identification key. Given a map and a simplified tree and leaves key, participants will travel between trees and attempt to identify them correctly. Temperate and tropical forests will be compared and participants will learn about species diversity. Participants will receive a tropical forest tree seed to plant and to learn the value of maintaining biodiversity.
- Nature By The Numbers**

Is Mother Nature a math genius? Series, patterns, and repetition are found everywhere in nature, and many of these patterns are based on mathematical relationships. Students explore math in a beautiful setting and investigate how plants and their parts can be used to extend their understanding of simple arithmetic, geometry, and number series.
- Plant Defenses**

Are some plants eaten more than others? Why do some plants or parts of plants have more signs of being eaten than others? Do plants have characteristics that attract or deter insects? Why don't we see many insects on some plants but lots on others? Does time of day or year change how much herbivory occurs? Join us as we explore all of these questions and more!
- Plant Population Studies**

Students practice identifying and counting plants at our Workshop Garden using quadrants made by bending a wire hanger into the shape of a square. Later, they will travel to the study sites to collect "real" data. Students also use timed meanders to determine changing levels of biodiversity as the levee waters return to a wetland state.
- Plants up Close**

How do leaves and stems look on the inside? In this workshop, students review the structure and role of major plant parts they introduced to basic microscopy techniques. By assembling and viewing microscope slides, students compare and contrast their magnified images of stems, leaves, and seeds.
- Pollination Partners**

Pollination- the movement of pollen- is key to the transformation of flowers into seeds. Students dissect a flower to learn more about the process of pollination. They explore the relationship between flowers and their pollinators through a field investigation of pollinators in action.
- Pomegranates, Kepler and Tangrams**

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- Predator-Prey Population Game**

Students play a fun game that introduces basic ecological and wildlife topics. The game teaches players about animals' diets, foraging or hunting techniques, food storage, and winter survival. Students learn about special instincts and adaptations that help animals avoid danger from predators and harsh weather.

- **Preparation and Fusion of Protoplasts** Protoplast isolation and fusion is utilized in plant biotechnology to obtain and culture hybrid cells. This workshop introduced students to the protocols used to obtain fused hybrid cells.
- **Seeds** Students observe, compare, and describe the properties of seeds, fruits and vegetables. They organize their observations through sorting; they organize and analyze data from cause and effect experiments, and relate laboratory studies to natural systems.
- **Seed ID** Students learn to identify and classify real seeds by size, shape, color, type, means of transport and texture.
- **Square Foot Gardening** Students create garden beds that are divided into square foot areas. Students grow relatively large numbers of plants together in one square, following the given spacing guides. Row planting was mainly developed for modern agriculture; this isn't needed in backyard gardens.
- **Survive on Science - Edible Plants** After having solved the problems of finding water, shelter, and animal food, you will have to consider the use of plants you can eat. In a survival situation you should always be on the lookout for familiar wild foods and live off the land whenever possible. You must not count on being able to go for days without food as some sources would suggest. Even in the most static survival situation, maintaining health through a complete and nutritious diet is essential to maintaining strength and peace of mind. Nature can provide you with food that will let you survive any ordeal, if you don't eat the wrong plant. You must therefore learn as much as possible beforehand about the flora of the region where you will be operating. Plants can provide you with medicines in a survival situation. Plants can supply you with weapons and raw materials to construct shelters and build fires. Plants can even provide you with chemicals for poisoning fish, preserving animal hides, and for camouflaging yourself and your equipment.
- **The Art of Plants** What does art have to do with science? Students discover the similarities between art and science and explore how botanical illustration is an artistic form that requires scientific understanding. Through observation and investigation, students create their own works of art using plants as their inspiration.
- **Tissue Printing: Detection of Brassica Phloem Cells** When the surface of a freshly cut plant is placed on a charged membrane, whole cells, proteins and nucleic acids bind to it. This technique, known as tissue printing, is simple and yields detailed information about cell identification and biomolecule localization within cells. This workshop used a monoclonal antibody to detect *Brassica* phloem cells. Examples of *Brassica* family members include broccoli, Brussels sprouts, and cauliflower. The membrane with the tissue print was sequentially

treated with the primary monoclonal antibody that is specific for *Brassica* phloem cells, followed by the enzyme linked secondary antibody and the enzyme specific substrate. Phloem cells were clearly identified as bright red.

- **Traveling Seeds**

Millions of seeds are produced from a variety of plants. The seeds are the beginning of life for future species of the same plant. The challenge to plant survival is moving the seed to a suitable germination site. Many plants disperse the seeds through wind, water, or unique vectors (animals that carry the seeds and pollen). Some plants are unique in their means of regenerating. Through hands-on activities, students will become familiar with methods of seed dispersal.

Cell and Cancer Biology, Genetics

- **Analysis and Comparison of Various Mammalian Cell Types** Students fix and stain cells on a microscopic slide. Four different cell types provided an exciting direct microscopic comparison of different cell types. Morphological differences between normal and transformed cells are observed.
- **Cell Biology: Microscopy Staining Techniques** When students begin a unit in Life Science in school, they often are confronted with facts about cells; what they are, what is inside of them, how they reproduce, and the two basic types - animal and plant. What they most often do not receive is enough first-hand experience viewing living, working cells to relate what they have studied with what they have seen and know to be true. The students' environment is full of such cells, which can readily be seen and examined, with the light microscope. This workshop introduces our students to the design and use of the light microscope, and demonstrates cellular biology staining techniques.
- **Corn Snake Genetics** Students learn about corn snake color genetics and practice Punnett squares.
- **Differentiation of Fat Cells** This workshop demonstrates the morphology of the brain. Students were able to distinguish between astrocytes and neurons and gained an appreciation of the architecture and composition of brain cells
- **Differentiation of Human Cells by Retonic Acid** The effect of retinoic acid on cells are examined in this workshop. The concept that cells are differentiated during which unspecialized cells or tissues become specialized for a particular function is emphasized.
- **Effect of Toxic Substances on Mammalian Cells** Mammalian cells are grown in culture and are pre-exposed to a toxin such as colchicine. The effect of this treatment on cell morphology was examined by comparing treated with untreated control samples. Students examined the differences microscopically. This type of experiment has direct and practical applications in basic toxicology for the screening of suspected toxic chemicals.
- **Mad Mad Fly Lab: A wild romp through Mendelian genetics** You too can be a mad scientist and play with strange mutant beasts! Enter the world of the common fruit fly, which you may think of as just a common household pest, but NO! It is also one of the most studied lab organisms with weird mutations popping up every year! With mutant traits ranging from white eyes to purple eyes to no eyes at all to wrinkly wings to ebony bodies . . . well, need I go on? Needless to say, you'll learn more than you ever though possible about genetics and science in a crazy, hands on way while you take care of your own

personal mutant fly colonies!

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Forensics

- **Blood Typing**

You are watching ER and, once again, the doctor yells out for some "O neg". A patient is bleeding on the gurney. You can actually see what happens if you mix the wrong types of blood together. Many life-threatening conditions can be treated by giving the patient blood, but scientists and doctors must understand the problems that can be caused. Besides the complications from getting the "wrong blood type", serious diseases can be spread through blood transfusions. Blood tests can indicate blood type, and also what diseases might be carried in the blood.
- **Fingerprint Analysis**

Students explore the characteristics of fingerprints in these "fingers-on" activities, devising their own classification categories and applying their skills to solve a "crime".
- **Footwear Impression**

Can you identify the suspect by his or her footprints? This workshop introduces students to the techniques of footwear impression analysis. Using the same casting material that professional forensic scientists use, our students cast 12 classmates' shoes to see which matches the shoe print left at the scene of the crime.
- **Forensic Dissection**

Students conduct a pig dissection by modeling the protocols used by a pathologist for a human autopsy and carefully record external features and use a typical Y incision to open the body cavity for a detailed examination before removing all of the organ systems. Upon completion of the forensic dissection, students return the organs to the body cavity and suture the incisions.
- **His Hair, Her Hair, Whose Hair?**

Students examine a set of hairs and cloth fibers. Using their observational and critical thinking skills, they will develop a procedure to identify hairs and fibers collected from crime scenes.
- **Where's The Shooter**

Using the same techniques as a real forensic scientist, students calculate bullet trajectory and determine the location of the shooter in a mock crime scene, and will test for exposure to gunshot residue.

- **Who Done It?**

In this workshop, students play the role of a police scientist who must examine the clues found at the scene of the crime. Your job is to find out who did the crime. After all your tests, you must present your data/evidence and the name of your suspect to the prosecuting attorney, Mrs. Paris, to see if the evidence is strong enough to prosecute the suspect. The crime was very serious; someone was stealing food from the Schmahl School cafeteria and selling it to a catering service. School officials are very worried about the sanity (cleanliness) of the criminal and about the health of the people served by the catering service.

Microbiology

- **A Microbial Detective Story** Students become field epidemiologists as they search for the source of an artificial epidemic. Our instructors hide the commonly used, non-pathogenic yeasts in workshop. Our students, knowing that yeasts produce catalase (which breaks down hydrogen peroxide into oxygen and water), sample various locations as they attempt to track down the source of the microorganisms. This lab lends itself to an almost infinite number of variations, and helps students appreciate the work of public health officials.
- **Antibiotic Sensitivity** Antibiotics are chemicals produced by one microbe that inhibit other microbes. Students study the effect of different antibiotics on a Gram-positive bacterium and a Gram-negative bacterium.
- **Battling Germs With Disinfectants** Find out if those advertised claims for disinfectants are true. Do they really kill bacteria on surfaces? Investigate the effectiveness of household disinfectants on the growth of a Gram-positive bacterium and a Gram-negative bacterium
- **Bioremediation - Oil Eating Bacteria** Students simulate bioremediation of marine oil spills using microbes that consume oil. These microbes have specialized metabolic pathways that enable them to use oil as food while converting it into nontoxic byproducts. In a controlled experiment, students work in pairs to apply a suspension of oil-degrading microbes to a small amount of oil and chemical indicator in a culture tube. A change in indicator color signifies breakdown of the oil. Students also perform the experiment without indicator and over time observe visible changes in the appearance of the oil.
- **Epidemic** The ease with which pathogens can spread through a population is very relevant today as we cope the possibility of a flu epidemic. Using diluted acids and bases as "body fluids," students participate in a classroom simulation of a spreading epidemic. Students then figured out who the original "carrier" was.

- Fermentation- Making Homemade Ginger Ale**

Fermentation has been used by mankind for thousands of years for raising bread, fermenting wine and brewing beer. The products of the fermentation of sugar by baker's yeast *Saccharomyces cerevisiae* (a fungus) are ethyl alcohol and carbon dioxide. During our workshop we will study the chemical reactions involved in glycolysis and fermentation. Carbon dioxide causes bread to rise and gives effervescent drinks their bubbles. This action of yeast on sugar is used to 'carbonate' beverages, as in the addition of bubbles to champagne). We set up fermentation in a closed system and capture the generated carbon dioxide to carbonate our home made ginger ale.
- Fun with Fomites**

Fomites?! What are fomites? They are inanimate objects that can carry disease-causing organisms. Your cutting board, kitchen sink, and even that pen you keep putting in your mouth are all fomites. But can you do anything to affect the number of organisms on a fomite? Join us as we investigate strategies for reducing bacteria on object surfaces.
- Hand Soap Evaluation**

Do those antibacterial hand soaps work as well as the advertisements promise? Are they as effective as the old standby soaps in killing the bacteria on our hands? Students collect bacteria from their hands and then test various hand soaps for their effectiveness in killing these bacteria.
- Handwashing Counting Bacteria**

In this role-playing game, students learn about bioaccumulation and how pesticides move through the food chain in a rainforest habitat.
- Handwashing GloGerm and Plates**

In this age of concern over infectious diseases, security, and liability, Glo Germ™ is an effective tool to demonstrate hand washing, surface cleaning, hygiene, and containment techniques.
- Handwashing with Glow Germ**

Students experiment in order to determine proper ways to disinfect hands to prevent the spread of infection.
- How Long Will It Be Blue?**

Students estimate the rate of fermentation using the time needed for yeast to produce enough carbon dioxide to acidify the medium. This change in acidity causes an indicator to change from blue to green

- **Making Yogurt - Ancient Chinese Secret?**

Humans began to realize the benefits of food biotechnology long ago. In fact, as far back as 6000 B.C. the Sumerians and Babylonians utilized yeast in beer-making. Today on the supermarket shelves we have the option to buy yogurt with dinosaurs on the label or colored sprinkles neatly packaged atop the lid. One would hardly guess that this seemingly modern product has been around for thousands of years! Hold onto your hat! We are traveling back in time to where we will harness some bacterial power and make yogurt! This workshop takes two workshop periods.
- **Microbe Secret Message**

Our students write short secret messages to each other. Students "write" (inoculate) a brief message on photobacterium agar dishes using the bioluminescent bacterium, *Vibrio fischeri*.
- **Microbes and You**

The workshop begins with a brief introduction to the origins and characteristics of bacteria, followed by activities and discussions that involve the students directly with common practices performed by microbiologists in their labs daily. The students review the scientific method, learned about bio-safety, collected samples, streaked plates, analyzed and identified different types of bacteria, and even explored the cause and effect relationship associated with epidemiology. This workshop requires two days for completion - one for the students to streak their plates, and another for them to read the incubated plates and discuss the results. We also introduce the role of microbiologists in the modern workforce.
- **Mythbusters: Mayo Food Poisoning**

Over the years we have all heard advice related to food safety. Some of this advice rings true, while other guidance is just plain wrong. To help you protect yourself and your family from foodborne illness, we will occasionally be debunking these food safety "myths". Students brush up on safe food handling advice and learn about the causes of foodborne illnesses.
- **Nuts & Bolts**

Certain metals exert an inhibitory action on microorganisms. This oligodynamic effect of metals on microbes has been utilized in the manufacture of ointments, bandages, medications, and in water purification. Students examine the inhibitory effect of heavy metals on bacteria and gain an understanding of where heavy metals are found in common household objects

- Pasteur's Experiment**

Prior to the 17th century, it was generally believed that living things could arise from nonliving materials, a process called "spontaneous generation". Using an S-shaped flask of his own design, Louis Pasteur was able to disprove this "theory" once and for all. In this brilliant lab, developed by teacher Patricia Herzberg, students recreate Pasteur's famous experiment, putting the scientific method into practice, and determining if Pasteur's experiment was valid.
- Pond Water Tour**

Using microscopes, students explore the different types of protozoa, and their microhabitats. Students learn how to prepare wet mounts for microscopic examination; how to prepare hay infusions and cultured protozoa; how to stain specimens.
- Rotting Logs: Lessons in Decomposition**

When dead matter decomposes it does not disappear, but is recycled through living things and the physical environment. (The atoms are recycled.) Students learn that when dead matter decomposes it breaks down into its basic elements, some of which are nutrients. The nutrients from dead matter are put back into the surrounding physical environment (soil, water, air) by decomposers.
- Slick Oil Lab**

How do environmentally friendly, green drain cleaners work without hurting our ecosystem? Students will investigate the roles bacteria play in breaking down almost every carbon-based substance through studying a variety of oils and commercial drain cleaners
- Soil Microbiology**

This workshop addresses students' tendency to consider only the most obvious causes of an effect. It helps students to see that non-obvious microbes are the primary decomposers, that things don't "fall apart" on their own, and that detritivores that we can see, such as earthworms and sow bugs, are responsible for only a small percentage of decomposition. Students will learn how to isolate and identify soil microorganisms.
- Spicy Inhibitors**

For centuries, spices have been used to preserve foods. Marco Polo's trip to China was partly to locate a source of spices. Some spices contain natural inhibitors to food spoilage microbes. Students grow 5 food spoilage microbes on black pepper, cloves, and chili powder agars and observe the inhibition of some of the microbes. Application to food spoilage prevention and the history of the spice trade is discussed.

- Spicy Inhibitors - Identifying Bacteria**

Hans Christian Gram was originally looking for a stain for all bacteria to make them more easily visible in a microscope field. In the process of looking for a universal stain, he stumbled upon a fundamental difference between two distantly related groups of bacteria - those that retained the stain (Gram-positive) and those that did not (Gram-negative). Thus, today the Gram stain is one of the first steps in identifying an unknown bacterial culture. Gram reaction is important in medicine because some antibiotics are effective against only Gram-negative bacteria (e.g. erythromycin) and some against only Gram-positive ones (e.g. penicillin, actinomycin). This workshop incorporates a number of laboratory techniques, including the use of microscope, Gram's Stain, and a basic understanding of bacteria morphology.
- Symbiosis**

Discover the microbial world within! Students will learn about the diverse ways that bacteria and protozoa evolve and symbiotically interact with insects. Students will study the protozoans found in the digestive tract of termites.
- Using Physical Agents To Control Microorganisms**

Students learn about the inhibition, destruction, and removal of microorganisms. Control of microorganisms is essential in order to prevent the transmission of diseases and infection, stop decomposition and spoilage, and prevent unwanted microbial contamination. Microorganisms are controlled by means of physical agents and chemical agents. Physical agents include such methods of control as high or low temperature, desiccation, osmotic pressure, radiation, and filtration. Control by chemical agents refers to the use of disinfectants, antiseptics, antibiotics, and chemotherapeutic antimicrobial chemicals.
- Vaccination Readiness**

During this workshop, a simulated ELISA test is used to determine the degree of immunity from individuals that are unimmunized, recently immunized, distantly immunized, or distantly immunized with a recent booster. The results demonstrate the concepts of vaccination and immunologic memory.
- Vermicomposting- Soil Organisms - Berlese Funnel**

Learn how to make a Berlese funnel and how to use it to find small invertebrates in leaf litter, a structured outdoor activity.
- Vinegar Bacteria**

Acetic acid bacteria are used in the commercial production of vinegar (acetic acid). The bacteria oxidize ethanol to form acetic acid. Students culture 2 acetic acid bacteria on bromocresol green agar containing ethanol. As the ethanol is oxidized, a color change in the agar is observed.

- **Watch The Screen - Testing Natural Products For Biological Activity**

Students explain and carry out a simple process for screening natural products for biological activity. Students infer why organisms such as sessile marine invertebrates appear to be promising sources of new drugs.

- **Yeast on the Rise - Bread Dough**

All breads are not created equal. Why are some flat and others fluffy? What is the difference between tortillas and sandwich bread? Are all breads made of the same ingredients? What happens if you change the ingredients in bread dough? Students investigate variables that affect the energy and carbon dioxide production of yeast in bread dough.

Molecular Biology

- **A Twist of Lyme**

In a case that strikes close to home for residents in Connecticut, students utilize ELISAs (Enzyme-Linked ImmunoSorbent Assays) to detect the tick-borne illness called Lyme disease. Shortly after infection by *Borrelia burgdorferi*, the spiral-shaped bacterium responsible for the collection of symptoms known as Lyme disease, humans produce antibodies. The ELISA test uses specific antigens found on the surface of the bacterium to detect the presence of antibodies. If antibodies are detected, the student medical experts diagnose the patient with Lyme disease. Lyme disease was first observed in Connecticut in the early 1970s when an unusually large number of children in and around Lyme, CT were diagnosed with juvenile rheumatoid arthritis. In 1975, Yale University researchers discovered *Borrelia burgdorferi* was responsible. Since then, more than 170,000 cases have been diagnosed nationwide. In 2002, 23763 cases were reported to the CDC with 95% of them found in Connecticut, Delaware, Rhode Island, Maine, Maryland, Massachusetts, Minnesota, New Jersey, New Hampshire, New York, Pennsylvania and Wisconsin.
- **Biochemical Analysis of Plant Enzymes**

This experiment demonstrates specific plant enzymes which have important functions in biotechnology. Students perform tissue prints of seeds to examine what happens during malting. An additional experiment allows students to quantify the activity of amylase.
- **Case Of The Crown Jewels**

In 1985, the first forensic use of DNA occurred in England. Scotland Yard was looking for the murders of two young girls in the English Midlands. Every male between the ages of 13 and 34 (almost 4000 men) living in the nearby villages was required to donate a blood sample for analysis. They were able to identify a man by the name of Colin Pitchfork as responsible for the murders.
- **Cheek to Cheek**

"Cheek To Cheek" is an experiment designed for advanced biology classes targeting students interested in a career in bioscience. For the experiment students will extract DNA from buccal (cheek) cells and amplify it using polymerase chain reaction technique. Students then run their DNA samples through gel electrophoresis and determine how many repeats they have for D1S80, a VNTR (variable number tandem repeat) on chromosome 1. Students then graph the class distribution of D1S80 and compare it to the U.S. Population distribution of D1S80. D1S80 is a genetic marker used for DNA profiling internationally.

- DNA Report Card**

The importance of DNA manipulation is a major news item as is evident by the enormous media attention devoted to the subject. In order to work with and study DNA, you must first isolate it from the source. Students actually precipitate their own DNA from solution! The first step involved swabbing cheek cells and then adding various chemicals to lyse the cells. Next, the DNA is precipitated from solution by an alcohol overlay. Finally, the DNA is stained with safe methylene and transferred to the DNA Report Card™. Students have a permanent record of their DNA for safekeeping.
- Lighting The Magic Lantern**

Science is literally illuminated for students in this experiment where they learn about genetic transformation, which is the insertion of a gene or genes into an organism. Genetic transformation plays an important role in providing therapeutic proteins for humans and animals. It is also used to develop pest-, frost- and drought-resistant plants and even for bioremediation. Students use biotechnology techniques to insert the gene for Green Fluorescent Protein, which naturally occurs in jellyfish, into the bacterium *E. coli*. By viewing the *E. coli* under an ultraviolet lamp, students can determine if that the genetic transformation was successful and track the expression of the foreign gene by watching the bacteria glow.
- Microbiology: Basic Techniques**

Sterile technique, plating, streaking, staining, microscopy..... everything you need to know for the practical side of microbiology.
- Micropipeting Basics**

Pipetting is a critical skill necessary for the accuracy that is essential in scientific experiments. This workshop demonstrated the use of micropipets as students prepare various dye mixtures and deliver their mixture to the Pipet Card™. Additionally, students practice their new pipetting skills as they load their samples on an agarose gel.
- Microscale Enzyme Catalysis Using a Recombinant Enzyme**

Genetically engineered microorganisms can produce increased amounts or improved enzyme products. In this experiment, recombinant B-galactosidase is used in colorimetric microscale reactions carried out in microtiter wells. The enzyme reactions are rapid and can be visually quantitated. This workshop is useful as an introductory enzymology experiment for our biochemistry workshops.
- Mitochondrial DNA Analysis Using PCR**

Amplification of DNA for Fingerprinting: In this workshop, PCR is performed on a hair (not from the victim) obtained from a murder scene. The instructor runs this DNA sample on a gel and compares the preamplified DNA from two possible suspects to determine whether either suspect was present at the crime scene.

- Off To The Races**

What molecule will be first to the finish line? To study highly purified materials and molecules that are similar in size and electric charge, scientists use gel electrophoresis. This is a technique also used to separate DNA for genetic testing, determine susceptibility to disease, and conduct DNA fingerprinting to solve crimes. In this experiment, students make, pour and load their own gel with six food coloring samples. The smaller the molecule and the more negative its charge, the closer it gets to the finish line. By determining where it finishes its "race", scientists can make a determination about the identity of the molecule.
- Principles and Practice of Gel Filtration Chromatography:**

This workshop introduced gel exclusion chromatographic separation of dyes of different colors on the basis of their size and shape. This workshop contains materials for dye separation which include dye sample, elution buffer and plastic disposables.
- Principles of DNA Sequencing**

DNA sequencing is used to determine the primary structure of DNA. This information is essential for understanding the structure and function of genes. This experiment is a dry lab that explains DNA sequencing and analysis. Actual autoradiograms from DNA sequencing experiments are provided for identification of mutated nucleotides.
- Purification and Size Determination of the Green (GFP) Fluorescent Protein:**

Green fluorescent protein (gfp) was isolated and cloned from the jellyfish *Aequorea victoria*. This protein gives a characteristic green fluorescent glow under long UV light. It has effectively been used as a tag to follow the localization and function of proteins in cells. In this workshop, the unique fluorescent property of GFP was used as an assay during its purification from an *E. coli* extract. Column fractions which contain GFP were identified by green fluorescence.
- Strawberry DNA Extraction**

Have you ever wondered what a forensic scientist has to do to analyze DNA evidence? DNA (the building blocks of life) is present in the cells of all living organisms. In forensic science DNA is usually extracted from human cells to identify unknown parentage, crime scene suspects, missing victims and to investigate genetic diseases. Since 1985, "DNA fingerprinting" has been used in legal cases around the world to link suspects to the scene of a crime. Students extract DNA from fruit to see what it looks and feels like. This is similar to what a scientist has to do before they can then use the information contained in this DNA to solve crimes, although they don't use the same protocol.

- **The Art Of Forgery**

In this experiment, students become forensic scientists using DNA fingerprinting to determine which of four similar paintings is a masterpiece that recently was stolen from an art museum. Students perform gel electrophoresis on paint samples from the artwork and compare them to a paint sample similar to the original masterpiece. By making, pouring, and loading their own gel, students can observe the rate at which colors migrate through the gel and compare them to the original paint sample to determine which three paintings are forgeries.

- **The Magic Lantern Revealed**

Students purify *Green Fluorescent Protein* from *E. coli*. *Green Fluorescent Protein* naturally occurs in jellyfish (*Aequorea victoria*), and is responsible for the jellyfish's ability to "glow". Not only will the students be able to perform this technique but they will also be able to track the location of the protein by the use of UV lamps.

- **The Mystery of the Crooked Cell**

Sickle Cell Anemia is a genetically inherited disease that affects the hemoglobin molecule of red blood cells. The hemoglobin molecule is comprised of four polypeptide chains. The most common type of hemoglobin, hemoglobin A, consists of two alpha chains and two beta chains. In sickle cell anemia, a single amino acid substitution in the beta chain from glutamate to valine that causes the molecule to form insoluble chains when the oxygen concentration in the blood is low. These insoluble chains distort the cell, giving it the characteristic sickle shape. *Sickle Cell Anemia* is a co-dominant trait diagnosed through gel electrophoresis. In this activity, students use their knowledge of sickle cell anemia and gel electrophoresis to diagnose an unknown patient sample.

Taxonomy

- **Sorting By Attributes**

Our young scientists practice sorting and classifying in this activity that uses a variety of easily found objects: caps, fabric scraps, plastic or foam shapes, marbles. Scientists classify and sort objects and phenomena to help analyze commonalities and differences and increase understanding. For example, zoologists and biologists classified animals by form and traits (e.g. - hot or cold-blooded). Today, scientists use DNA analysis (specifically, mitochondrial DNA) and other methods to create "trees of life" that illustrate interrelations amongst species. Object classification requires active decision-making and observation skills. As with other skills, ability increases with practice. Providing multiple opportunities to sort and classify varieties of objects will help students become more comfortable with the process.
- **Exploration: Latin Jeopardy**

Students are first given an overview of how the science of taxonomy evolved. That is, how and why did scientists develop the current system of binomial nomenclature? After this brief discussion, students are asked to classify seashells using a classification system of their own design. For example, one group might categorize shells according the size, texture, and color; other groups might describe shells by weight and acoustical properties. Students are then asked to "name" their shells. Students are given Latin name cards, which were used to translate their "common" shell names into Latin "scientific" names. In this way they become familiar with Latin roots, prefixes and suffixes. Lastly, students compete in Latin Jeopardy Game Show.
- **Living/Nonliving**

Students learn how to observe and describe similarities and differences in the appearance and behavior of plants and of animals (e.g., seed-bearing plants, birds, fish, insects, etc.).

Zoology and Ecosystems

- **All About Rodents** Participants will learn characteristics of some of the small mammals of northern California. By traveling through various habitats, searching for small mammal signs, they will learn the role these small creatures play in the environment.
- **Amphibians** Students learn about sound, osmosis, fluid dynamics, fresh water ecology, bone; amphibian muscle structure, evolution and anatomy.
- **Animal Senses** Animals use their senses everyday to find food, stay safe and even to find a boyfriend or girlfriend! Sometimes animals use different body parts for their senses, for example the snake uses its tongue to smell the air. The Animal Senses workshop is an opportunity for your students to explore how animals rely on their senses to survive.
- **Animal Teeth and What They Eat** A skull is a machine — one designed by nature nearly 500 million years ago to protect the brain and sensory organs in vertebrate animals. A model of mechanical efficiency, each of the skull's features is built to support specific functions, including food procurement and processing, optimal sensory intake, and impact absorption. Based on the architecture of an animal's skull, scientists can deduce many of its dietary and social patterns. Students will be given a case of 14 mammal skulls in which they will make inferences about the animal's natural history based on the skull and tooth characteristics and then identify the skull using a dichotomous key.
- **Animal Tracking** Our Animal Tracking Workshop helps students become familiar with animal tracks and sign. Participants will learn, by tracking animals out of doors, the variety of evidence left behind by animals and what we can learn about them from that evidence.
- **Bees, Hives, and Honey** Compare your community to that of a bee while learning the role of each bee in the hive. How do bees communicate? Investigate the many different ways that honeybees help humans, and the complex social behavior, communication, and hive environment of the honeybee through activities that mix art, literature, role-play, and drama.
- **Biological Illustrations** Illustration can be a most useful and beautiful method of recording information. Become familiar with basic techniques of biological illustration, while examining the structure, anatomy and functions of local organisms. This course will also touch upon how biological illustrations are applied to science today.

- **Bird Adaptations – Beaks** Children are given the opportunity to experiment using tools that are similar to various birds' beaks to accomplish the challenge of picking up different types of food. They learn about the shapes, sizes, and operations of bird beaks and how they are adapted to their environments.
- **Bird Dissection** For aquatic vertebrates, the characteristics of water, as a substrate, have shaped nearly every anatomical system. In contrast, life for terrestrial vertebrates is dominated by the lack of water, the threat of desiccation. Birds, because they swim through the air, have additional constraints on their anatomy. Some of which are similar to those of fish. During this workshop students will be dissecting a pigeon and learning which characteristics are adaptations for life on land and which characteristics are adaptations for flight.
- **Bird Nests** Students use recycled materials to build "bird nests" for protection and comfort. Since birds mainly use their beaks for this survival activity, students use only a model "beak" for building. Who will make the best nest and have the best chances of having their baby birds survive?
- **Bugs Life** What makes a "bug" an insect? Meet, touch and examine live insects and find out why these six-legged creatures are so important to us.
- **Butterflies and Monarch Cage Habitats** They are the Ugly Ducklings of the insect world—tiny caterpillars transforming into beautiful adult butterflies. Students watch with wonder and disbelief as they observe this dramatic example of an insect's life cycle. Each student feeds and cares for a butterfly, from larval stage through metamorphosis. The workshop helps students develop skill in observing details, recording and communicating their observations, and understanding the needs of living things.
- **Butterfly Camouflage** Camouflage comes from the French word *camouflager*, which means to "blind or veil". Some insects and animals use camouflage as an effective way to protect themselves from natural enemies. Birds, bats, moles, frogs and other animals consider some insects to be a very tasty treat. Insects protect themselves in many ways. One of these ways is by disguising themselves so that they blend into their surroundings. Some caterpillars and walking stick insects are camouflaged to look like twigs. Some insects are patterned to look like the background where they live. They may look like the bark of a tree, the leaves of a plant, some even look like soil! This week our students will pick a habitat and design a butterfly or moth that will display camouflage or mimicry in that habitat.
- **Dinosaur Biophysics** Explore the wonderful world of dinosaurs. Learn about how a dinosaur lived by studying its anatomy. be amazed by the variety of dinosaur lifestyles and how a dinosaur digested its food. Discover the two main types of dinosaurs, and their great variety in size.

- Dinosaur Tracking**

We will practice measuring tracks, length, width and stride. We will use dinosaur tracks and human (kid) tracks and then put the measurements on a chart. The literature states that the length of a dinosaur track may be 1/5 of the length from foot to hip so we will see how big our dinosaur might have been! If the weather permits, we will use finger paint on some 'volunteering' feet and put our human tracks on butcher paper to measure. We will also test the difference in stride between a walking trail and a running trail--what would you guess the difference in measurements might be?
- Earthworm Dissection**

This workshop introduces the anatomical structures and functions of the common earthworm; the perfect start to an understanding of invertebrate anatomy.
- Eye to Eye With Garden Snails**

This workshop encourages students to explore the external characteristics and behavior of snails. It effectively gets students past the "ugh, slime" reaction to recognizing individual differences in snails and challenges students to learn enough about the snail to be able to predict their behavior under a variety of conditions. Detailed observations are requested as are preparation and testing of hypotheses.
- For Goodness Snake**

This workshop will give children an in-depth, up-close, in-your-face look at those much maligned creepy, crawly creatures! This program will include a hands-on snake dissection, and animal handling.
- Fur, Feathers, and Scales**

Animals have fascinating features! Fur, Tails, Feathers, and Scales examines animals and their unique skin coverings, including feathers, scales, fur, and shells.
- Habitats: Rocky Shores - Marine Science Institute**

Rocky Intertidal Habitat - This program focuses on how tidepool animals move, eat and protect themselves.
- How Do Animals Grow? - Eggs**

We introduce young children to the wonders of eggs of all kinds, developing age-appropriate concepts in biology and life science.
- How Do Animals Move?**

By studying and comparing animal skeletons students investigate ways in which animals move, and identify animal body parts that help animals get food, such as wings, legs, or fins.
- Immigrant Animals - Hominids**

By comparing human, hominid and primate skeletons and skulls, students better understand how natural selection may have favored bipedal locomotion in the hominid lineage.
- Immigrant Animals - Humpback Whales**

There she blows! You'll have a whale of a time learning about these giants of the deep!

- Immigrant Animals - Spiders**

Spider species that are found in many places are often good travelers. Many of these spiders get around by behavior called ballooning. Young spiders, and even small adults of some species, put out silk threads which are caught by the wind, carrying them up and away. Many land close by, sometimes swathing the landscape in gossamer silk; but others may travel long distances across land or sea. Ballooning helps maintain and extend the distributions of these spiders. Spiders as different as orb weavers and wolf spiders disperse by ballooning. Through hands-on activity, children learn about the basic types of spider webs and how the designs of these webs affect their functions. We discuss what spiders eat (insects and sometimes other spiders) and how they catch their prey. Show the children the different types of spider webs - these can all be found in the Garden Spider Web Frame activity.
- Insect Adaptations**

Insects are everywhere in the world around us. Insects live in more different kinds of places than any other group of animals. They live in deserts, in forests, on tops of mountains, in rainforests, in water, in caves, and even in frozen places like Antarctica. They live in books and in clothes, under tree bark, in pools of petroleum, and even inside other animals. They come in many sizes, shapes, and colors. Through our fun, hands-on activities students learn: Insect bodies are divided into three parts: the head, the thorax, and the abdomen; Most insects have compound eyes that are made up of hundreds of tiny lenses; There are four kinds of insect mouths: chewing (like a grasshopper), piercing (like a mosquito), sucking (like a butterfly), and sponging (like a fly); Insects do not have regular ears. Sounds are really just vibrations in the air. Most insects detect sounds by hairs on their bodies that can pick up these vibrations. Some insects use their antennae to pick up vibrations.
- Insect Discovery Lab**

Giant millipedes, hissing cockroaches and whip scorpions may inspire fear and loathing in many adults, but kids find them enthralling, provided they are presented in an agreeable and nonthreatening fashion. So that's what staffers at San Francisco's Insect Discovery Lab do. During road shows to schools around the Bay Area, they like nothing more than to provide placid - - if exceedingly large -- bugs for young students to cosset and pet.
- Introduction to Reptiles & Amphibians**

We discuss how to choose the right pet for you (pro's and con's), which reptiles or amphibians are the easiest to take care of, and which are the most difficult to maintain in captivity. Live lizards, snakes, turtles, and frogs, will attend.
- Lady Beetle Life Cycle and Habitat**

This popular workshop uses the charm of ladybugs to present key science and math concepts relating to animal adaptation, ecology, and interdependence. Children learn about ladybug body structure, symmetry, life cycle, defensive behavior, and foods.

- **Owl Pellets - Owls** This hands-on experiment allows students to investigate the food web, identify animal skeletons, and practice dissecting skills. Each student dissects an owl pellet and classifies the remains using a bone-sorting chart.
- **Parrots, Macaws and Cockatiels** Students learn about parrots as captive wild animals, rain forest destruction and its impact on wild parrot populations, domesticated versus wild animals as pets and the thoughts that should go into making a responsible decision when choosing a pet bird.
- **Penguins** Students learn about buoyancy, heat capacity, fluid dynamics, ocean ecology, and bird anatomy. Students know that different animals inhabit different environments and have external features that help them thrive in different kinds of places.
- **Preschool: Insect Adaptations** Insects are everywhere in the world around us. Insects live in more different kinds of places than any other group of animals. They live in deserts, in forests, on tops of mountains, in rainforests, in water, in caves, and even in frozen places like Antarctica. They live in books and in clothes, under tree bark, in pools of petroleum, and even inside other animals. They come in many sizes, shapes, and colors. Through our fun, hands-on activities students learn: Insect bodies are divided into three parts: the head, the thorax, and the abdomen; Most insects have compound eyes that are made up of hundreds of tiny lenses; There are four kinds of insect mouths: chewing (like a grasshopper), piercing (like a mosquito), sucking (like a butterfly), and sponging (like a fly); Insects do not have regular ears. Sounds are really just vibrations in the air. Most insects detect sounds by hairs on their bodies that can pick up these vibrations. Some insects use their antennae to pick up vibrations.
- **Rainforest - Earth Balloon** Earth Balloon travels to schools across the country providing science and geography based programs that engage students, enhance classroom curriculum, and assist in meeting education standards.
- **Rainforest - Perilous Poisons in the Food Chain** In this role-playing game, students learn about bioaccumulation and how pesticides move through the food chain in a rainforest habitat.
- **Redworm Bioassay** Students use red worms as a biological indicator of pesticides in soil samples. This test is simple, inexpensive, adaptable to a variety of situations, and lead to interesting discussions in the classroom and the community in general. Areas of focus include: the effects of non-point source pollution, the significance of eco-toxicology, use of standardized laboratory microcosm tests, the importance of red worms to soils and humans, and red worm ecology and natural and social history of Santa Clara County

- **Reptile Adaptations** From the ancient turtles to the relatively recent evolution of snakes, reptiles are a varied class of vertebrates. Live specimens observations will be used to learn about the anatomy, adaptations and behavior of these scaly, cold-blooded animals.
- **Seafood Surgery** Students will learn about physical characteristics and how scientists can use structure to classify animals. In the crayfish (an invertebrate), students will observe and describe an exoskeleton, walking legs and gills. In the perch (a vertebrate), students will observe and describe a backbone, a swim bladder and gills. This fun activity also helps the students realize that they really could become surgeons or scientists!
- **Shark Adaptations** We will dispel common misconceptions as students discover the characteristics that have helped sharks survive for millions of years.
- **Shark Dissection** Compare bony fish anatomy to the anatomy of a shark during dissections, a slimy hands-on experience.
- **Shark Key** All sharks and batoids belong to a group of fishes called the Chondrichthyes. To help learn about them, students will divide them into groups called families. All the sharks in one family usually will look more like each other than sharks in other families. To find out which family a shark is in, students examine the shark carefully. They count the gill slits on the sides of the shark's head. You look at the shark's paired pectoral fins and paired pelvic fins, its one or two dorsal fins, and its anal fin (if it has one—not all sharks do). And they look at the shark's tail, called a caudal fin. Students create a useful tool for listing characteristics and identifying a shark's family - a dichotomous key.
- **Shells** Amazing and diverse, shells represent a dynamic solution for survival in nature and its greatest architectural achievement. Although seashells have long been sought by collectors as objects of beauty, you will also learn of a shelled mollusk famous for sinking ships. Understand why architects have long studied shells as models of stupendous strength and amazing design. Students will design their own shell dichotomous keys.
- **Silkworm Observations** Students experience the wonder and magic of silk production with during our fascinating lifecycle workshop! Students watch and learn as three silkworm larvae eat, grow, spin cocoons and emerge as lovable, touchable adult moths.
- **Silkworms** Students study some of the diversity of forms in insects. They observe and compare the differences in life cycles and behaviors of insects.

- **Skates and Rays** Children learn about the characteristics of Skates and Rays, how they are related to sharks, and the environment in which they live.
- **Sky Hunters** An introduction to Raptor Biology - Have you ever wondered what makes a raptor different from other birds? This introduction to the basic biology of birds of prey provides an overview of how these birds fit into their environment (backyards and neighborhoods) and why they are important to us. Besides being excellent barometers of the health of their environment, birds have an amazing power to inspire people and motivate action. Students are introduced to two different live, non-releasable, species of raptors: a diurnal (daytime) hunter and a nocturnal (nighttime) hunter. Information is provided on physical description, adaptations, habitat use, nesting and rearing of young. These birds are ambassadors for the wild, enriching their lives with daily lessons on the balance needed in nature.
- **Spiders** This workshop will help students to appreciate the place spiders have in the world and will lessen the fear of spiders caused by misunderstandings. There are more than 30,000 different types of spiders known to scientists! Most of them are very tiny animals that help people by eating insects. Spiders are not insects. Students will learn the physical differences between insects and arachnids and also study other distinct characteristics of spiders. Students will know different spiders inhabit different environments and have external features that help them thrive in different kinds of places. Students investigate how spiders perceive the world. Students learn to differentiate among different scents; and learn to interpret shapes from the sense of touch.
- **Squid Dissection** Students learn basic dissection techniques as they do a step-by-step exploration of the interior and exterior of the squid. They also learn about a squid's habitat, life cycle, and its place in the food chain.
- **Star Fish Dissection** This workshop provides an overview of this spiny-skinned marine inhabitant. Students discover its use of hydraulics in capturing and devouring prey. Students learn about the structure and function of the organs and systems in this representative of the phylum Echinodermata.
- **Tadpole Metamorphosis** Caring for a few tadpoles and watching them turn into frogs (metamorphose) is a fascinating and rewarding activity for young and old alike. It is also becoming more useful for scientific reasons, too, because much is still not known about frogs. and many species are declining before our eyes. In this workshop, students get an opportunity to examine the metamorphosis of a frog from egg to adult. They examine 10 viewing cavities to investigate the structural characteristics for adult and embryo frogs.

- **Them Bones**

This workshop is one kids can really sink their teeth into! Children will learn about the life history of various species of animals by studying skulls and skeletons.
- **Vermicomposting**

Students conduct experiments related to the behaviors and adaptations that earthworms have developed for survival in the environment. Students create their own ecosystems with sand, soil, live earthworms, and real plants in a 2-litre pop bottle. Everyone also learns the components of soil. Students learn how to culture soil microbes.
- **Whales**

We will bring whales to life with hands-on projects like using tuning forks and water bags to understand echolocation; and looking at bubbles and vortices using tornado tubes to understand how whales eat using their baleen. If your child has an interest in whales this is one workshop you won't want to miss.
- **Wolves**

What do students know about wolves? They huff and puff and blow houses down? They disguise themselves as *Grandma* in order to trick people? They appear during a full moon and attack? This workshop explores the reality of the gray wolf—not its mythical or fairy tale cousin—and its relationships with animals, humans, and the environment. Students learn about the past and current wolf situation in North America, the wolf's role in biodiversity, wolf biology, and wolf social characteristics.