Schmahl Science Summer Camps

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Grades 1-2

Week	Dates	Title
		Description
1	**6/17 – 6/21**	**Physical World – Exploring Engineering**
From building skyscrapers to launching rockets into space, we are constantly seeking to reach new heights and push technology to do more. Students will be introduced to the process of engineering design while building roller coasters, gear trains, skyscraper structures, cars and rockets. Students will learn how to overcome all kinds of engineering challenges while venturing into the history of human achievement, feats and failures.		
2	**6/25 – 6/29**	**Life Science Explorations**
What do humans, penguins, whales, fruits and seeds have in common? They all contain and use the four molecules of life! Students will experience the physical properties of these molecules and explore some well-known biological features (fur, scales, hair) that are built from them. Students will evaluate food for carbohydrates, explore how fat in the form of blubber helps arctic animals survive the extreme cold, investigate the structure of their bones, and extract DNA from strawberries! Students will investigate the role of protein in making sticky adhesives and the impact of varying concentrations of protein on a gelatin dessert. Thermoplastics will be used to demonstrate the utility of large molecules.		
3	**7/15 – 7/19**	**Nature's Energy**
Sunlight is the bright, warming glow that heats and powers the Earth. Its energy moves the air (wind), fuels our weather (water cycle) and moves landscapes (erosion). Unique rainbows serve as signatures and can reveal the elements in the sun from which this sunlight originates (astrophysics). In this camp, our young scientists will explore how energy from the sun moves air and water using a flow density chamber to investigate conduction. They will use stream tables to model the process of erosion and use bubbles and		

spectroscopes to study rainbows. Employing the techniques of chromatography, they will extract pigments from flowers to learn how plants capture the sunlight.

4	7/22 – 7/26	All Creatures Great and Small

As you already know, good things come in small packages and the size of a person or animal does not determine their importance. Using a microscope, students will explore the contents of pond water and the cells of plants. They will learn about the activities of insects, snails, millipedes and more. Why are the insects needed by the plants and why are the plants important to the insects? How do much smaller organisms like yeast and bacteria affect your health and contribute to making some of the food you eat?

The vast majority of the world's existing animal species are snail sized or smaller. Snails and earthworms live symbiotically with microbes to create soil. Plants and algae create oxygen. It's almost as if, the smaller the organism, the more critical its role on earth. Students will learn that while larger animals are more familiar to them (they garner most of the attention in early elementary science education) there are so many more organisms of great importance to discover and examine.

5	7/29 – 8/2	Science Investigations – Mysteries and Answers

The desire to observe and understand the natural world is strong in elementary school age children. So it is important to show them how not only science but the process of science can impact their lives every day. Forensics is the use of scientific knowledge or methods in solving crimes.
We will use the umbrella of forensics to teach biology, physics and chemistry concepts such as chemical reactions (Pancake Forensics), morphology (animal teeth and what they eat), anatomy (Zena the Cow Warrior), genetic variation (fingerprint analysis), separation of mixtures (chromatography), "trace fossils" (animal tracking), and material science (footwear analysis).

The differences between an observation, inference and a hypothesis will be emphasized.

6	8/5 – 8/9	The World of Humans – How Your Body Works

Our young scientists will begin the week investigating the curvy, mushy, and aromatic digestive system. Understanding how the human body obtains the nutrients required for survival will provide the students with a foundation to explore the skeletal, muscular, and nervous systems.

Using their bodies and creating models, they will discover how muscles function with the skeleton to make our bodies move and how the systems respond to injuries. Students "map" locations of various taste sensations on their tongues; investigate olfactory fatigue and recovery; map sections of their own skin and differentiate various receptors for heat, cold, pressure, and pain; perform experiments to study the visual blind spot, dominant eye, accommodation, visual near point and afterimages; and examine reflex actions. They will also be investigating how the kidney functions via osmosis and the efficiency and importance of human breathing patterns.

The role of adaptation will be considered. All living things are the result of successful adaptation some of which are physical and some behavioral. These adaptations make each living thing unique. Investigating and exploring the anatomical adaptations of other animals will provide students with the opportunity to dig deeper into the relationship between the body systems.

Grades 3-5

Week	Dates	Title
Description		
1	**6/17 – 6/21**	**Physical World – DaVinci, Galileo, Newton – Physics of Motion**
Motion is one of the key topics in physics. Everything in the universe moves. It might only be a small amount of movement and very slow, but movement does happen. Even if you appear to be standing still, the Earth is moving around the Sun, and the Sun is moving around our galaxy. The movement never stops. Motion is one part of what physicists call mechanics. Over the years, scientists have discovered several rules or laws that explain motion and the causes of changes in motion. The physics of motion is all about forces. Forces need to act upon an object to get it moving, or to change its motion. In the tradition of Leonardo da Vinci, Galileo and Newton, students will explore forces as they build gliders and airplanes, design submarines, build rockets, learn about lenses and light, construct trebuchets, drop parachutes, make rollercoasters, and build bridges.		
2	**6/25 – 6/29**	**Molecules of Life**
All life on Earth is built from four different types of molecules. These four types of molecules are often referred to as the molecules of life. The four molecules of life are proteins, carbohydrates, lipids and nucleic acids. Each of the four groups is vital for every single organism on Earth. Without any of these four molecules, a cell and organism would not be able to live. All of the four molecules of life are important either structurally or functionally for cells and, in most cases, they are important in both ways. In this camp, students will gain hands-on experience with these biological molecules, experimenting with them in a way that will give them a feel for how to work with proteins, nucleic acids, carbohydrates, and lipids and how they behave and interact with each other. Students will also experience some of the physical properties of compounds built from the molecules of life, and examine biological components manifested from the molecules of life.		
3	**7/15 – 7/19**	**Energy – Good Vibrations**
Everything around us vibrates, from the smallest atoms to the tallest buildings. Students will discover what vibration is by exploring mechanical systems that vibrate. Learn how to measure the natural frequency of vibration of a pendulum, a car, a guitar string, and an organ pipe. Build your own musical instruments that utilize the vibration of strings. In this camp, students will also explore resonance in earthquakes and mechanical adjustments in building that will enhance resilience. Resonance patterns are studied via oobleck and chladni patterns on bi-directional vibrating plates. Other topics that will be covered are refraction, interference and lasers.		
4	**7/22 – 7/26**	**All Creatures – Microbes and the role of plants**
Finding healing powers in plants is an ancient idea. People on all continents have long applied poultices and imbibed infusions of hundreds, if not thousands, of indigenous plants, dating back to prehistory. There is evidence that Neanderthals living 60,000 years ago in present-day Iraq used plants such as hollyhock. These plants are still widely used		

in ethno-medicine around the world. The study of the pharmacology of plants slowed after the discovery of antibiotics such as penicillin. The pace is picking up again as scientists realize that the effective life span of any antibiotic is limited. In other words, we're running out of effective antibiotics.

Students will have a mini-foray into real research that gives them the opportunity to choose a plant, spice or soil to test for antibiotics. They will then learn the techniques (Aseptic Technique, Colony Counting, Kirby-Bauer, and Gram Staining) to evaluate those choices.

Students will also learn about plant biology as a context of this antibiotic investigation. Most flowers reward pollinators for their service via access to their nectar as a source of sugar. However, microorganisms such as bacteria and yeast compete with other organisms such as bees for the same food source. Microbes may hijack plant nectar for their own energy needs through fermentation or aerobic respiration. Students will investigate how the plants, pollinators, and microbes interact with each other through experiments in fermentation and pollination.

5	**7/29 – 8/2**	**Science Investigation and Problem Solving**

The desire to observe and understand the natural world is strong in elementary school age children. So it is important to show them how not only science but the process of science can impact their lives every day. Forensics is the use of scientific knowledge or methods in solving crimes.

We will use the umbrella of forensics to teach biology, physics and chemistry concepts such as immunology (blood typing), protein analysis (keratin: hair, scales, fur, feathers), epidemiology (culturing bacteria), static electricity (Indented Writing Detection), genetic variation (fingerprint analysis), separation of mixtures (chromatography) and material science (footwear analysis). The differences between an observation, inference and a hypothesis will be emphasized.

6	**8/5 – 8/9**	**The World of Humans – Process of Adaptation**

All living things are the result of successful adaptation. Some of these adaptations are physical and some are behavioral. Together, these adaptations make each living thing unique. Students will look into the past to study the Earth's first creatures to learn about adaptations, evolution, and paleontology. By comparing human, hominid and primate skeletons, skulls, and footprints students will better understand how natural selection may have favored bipedal locomotion in the hominid lineage.

Narrowing our focus in the afternoon, everyone is interested in their health and body. Observing and asking questions about the human body allows young scientists to explore such science concepts as diversity, variation and how certain structures have certain functions. How does my wrist move, and what can I do because my wrist moves like that? And how are my toes similar to and different from my fingers?

Beginning with a brief history of medicine and a peek into cells, students will explore the body systems: skeletal, muscular, respiratory, digestive, cardiovascular, and nervous! They'll study nutrition and health, and how their immune system protects them.

Our Approach

The nature of science, the process of science and the practice of science are taught in our camps. The nature of science deals with issues in the philosophy, sociology, and history of science. It includes concerns, such as the nature or attributes of scientific knowledge itself -- e.g., that scientific knowledge is durable, but is always inherently subject to change. The process of science addresses what scientists do in order to develop that knowledge. When students utilize observation, modeling or controlled testing of a hypothesis in our workshops, our instructors are highlighting and naming the process so that in addition to the specific concept they are learning, they also discover how to apply scientific thinking. The practice of science explores how science and engineering concepts can be applied to the real world. Our students experience that as they look through microscopes at pond water or initiate erosion in trays of sand.

We train young scientists to be careful and thoughtful observers. We work hard to strengthen our students' communities, adding support, encouragement, and a new perspective on science that can propel them to explore the world around them and grow.

Our camps are designed to provide students with an opportunity to build on an interest in science and engineering to develop knowledge and analytics critical to success. Students will learn the eight essential practices of science and engineering.

- Asking questions (for science) and defining problems (for engineering). Through carefully crafted series of workshops our students learn how to take a good question, make it a great question, and ultimately find a researchable question.
- Developing and using models
- Planning and carrying out investigations
- Analyzing and interpreting data
- Using mathematics and computational thinking
- Constructing explanations (for science) and designing solutions (for engineering)
- Engaging in argument from evidence
- Obtaining, evaluating, and communicating information

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