



History SJ Science Camp Laboratory Research - Summer 2019

Schmahl Science Workshops' EXPLODES the myth that science is dull. Our instructors are talented scientists and engineers who engage students' curiosity, imagination and creativity using a fun, hands-on approach. Students learn to apply the scientific process as well as core scientific principles, all the while making exciting new discoveries.

In the Bay Area, thousands of students participate in science fairs each year. Students struggle in project selection, lab techniques, instrumentation, model development, and project design. Our camp topics help students in sharpening skills and learning about project design while working with our experienced mentors.

We are offering three weeks of camp. Students will be able to choose the following sessions:

Week 1 Sessions (June 17 – June 21)

Drop-off Discussion (8:15 – 9:00am)	Schmahl Talk
Morning Session (9:00 -11:30am)	Comparative Anatomy
Morning Session (9:00 -11:30am)	Molecules of Life
Mid-Day Session (12:00 pm – 2:30pm)	Microbiology – Antibiotic Sensitivity
Afternoon Session (3:00 – 5:30 pm)	Recombinant DNA

Week 2 Sessions (July 8 – July 12)

Drop-off Discussion (8:15 – 9:00am)	Schmahl Talk
Morning Session (9:00 -11:30am)	Mechanics of Motion
Mid-Day Session (12:00 pm – 2:30pm)	Circuits / Arduino
Afternoon Session (3:00 – 5:30 pm)	Thermodynamics – Heat Transfer

Week 3 Sessions (July 29 – Aug 2)

Drop-off Discussion (8:15 – 9:00am)	Schmahl Talk
Morning Session (9:00 -11:30am)	Microbiology - Antibiotic Sensitivity
Morning Session (9:00 -11:30am)	Neurobiology
Mid-Day + Afternoon Session Combined (12:00 – 5:30 pm)	Recombinant DNA + DNA/Protein Purification

SIGN-UP NOW for Summer Camp!

Days: Monday thru Friday – 5 day course

Grades: 6 - 10

10 Students maximum per camp

Fees: \$330 per weeklong session

Register for three sessions and receive a \$100 discount

Location: History San Jose at Kelley Park

651 Phelan Ave San Jose, CA 95112

Room : Schmahl Science Lab

Registration Opens: February 1, 2019

HOW TO REGISTER:

Complete Registration Form: Use the attached form or print one out: at www.schmahlsience.org. Select the "Camps" tab and click on "Active Programs" to find the brochure & registration form for this series.

Payment Options:

- 1) Mail form and payment to Schmahl Science Workshops, 1650 Senter Road San Jose, CA 95112 **OR**
- 2) If using a credit card, completed form can be scanned & emailed to customerservice@schmahlsience.org **OR**
- 3) Pay online. Go to www.schmahlsience.org select the "Camps" tab and click on "Active Programs". Once payment is made, mail or email registration form as above.

SESSION DESCRIPTIONS:

Comparative Anatomy

At the end of this camp, students will have a better understanding of the anatomical design of animals in general, and how that design is related to each organ system's mechanical or physiological functions. Students will develop a "mental map" of animal design. In addition, students will acquire an understanding of current scientific ideas about the evolutionary relationships amongst these vertebrates, and will appreciate the amazing diversity of vertebrates, both living and in the fossil record. Laboratory includes systematic and topical dissection of representative organisms and demonstrations of living animal functions.

Molecules of Life

Do you examine "Nutrition Facts" labels for the food you eat? If so, and if you had a look at the food's protein, carbohydrate, or fat content, you may already be familiar with several types of large biological molecules we'll discuss in this camp. If you're wondering what something as weird-sounding as a "large biological molecule" is doing in your food, the answer is that it's providing you with the building blocks you need to maintain your body – because your body is also made of large biological molecules!

Just as you can be thought of as an assortment of atoms or a walking, talking bag of water, you can also be viewed as a collection of four major types of large biological molecules: carbohydrates (such as sugars), lipids (such as fats), proteins, and nucleic acids (such as DNA and RNA). That's not to say that these are the only molecules in your body, but rather, that the most important large molecules can be divided into these groups. Together, the four groups of large biological molecules make up the majority of the dry weight of a cell. (Water, a small molecule, makes up the majority of the wet weight).

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.

Microbiology – Antibiotic Sensitivity

The Microbiology Summer Science Camp will challenge your student to think, research and conduct experiments in microbiology. This camp is laboratory-based and will involve field work, which will require the students to actually collect samples from different sites at our location. The students will have the opportunity to explore **the 5 i's of microbiology; inoculating, incubation, isolation, inspection, and identification**. Students will become familiar with writing, recording, and tracking scientific data. Students should be interested in science, inquisitive, and willing to work hard!

Recombinant DNA

Scientists have taken advantage of plasmids to use them as tools to clone, transfer, and manipulate genes. Plasmids that are used experimentally for these purposes are called vectors. Researchers

can insert DNA fragments or genes into a plasmid vector, creating a so-called recombinant plasmid. This plasmid can be introduced into a bacterium by way of the process called transformation. Then, because bacteria divide rapidly, they can be used as factories to copy DNA fragments in large quantities.

To understand how the acquisition of a new gene changes the phenotype of a cell, students will investigate recombinant DNA techniques. This will require that they gain an understanding of how restriction enzymes work and how they are used to achieve sites specific cleavage of DNA; what technique is used to induce uptake of plasmid DNA by *E. coli* cells, resulting in a changing cellular phenotype; and how to isolate plasmid DNA from the *E. coli* cells that harbor it.

Students will learn about DNA configuration, chromosomes and plasmids, DNA properties and extraction, spectrophotometry and DNA quantification, recombinant DNA, restriction enzymes, restriction maps and other DNA reactions.

Students will learn important molecular biology techniques, including: Lab safety, aseptic techniques, bacterial isolation, and Gel Electrophoresis.

Protein Purification

Molecular Biology is literally illuminated for students in this seminar. Students begin this companion seminar with bacteria that has been genetically transformed using the plasmid, pGLO. Transformed bacteria which produce the genetically engineered Green Fluorescent Protein (GFP) are removed from their agar plates and allowed to multiply in liquid nutrient media. The bacterial cells are then broken open (lysed) to release the Green Fluorescent Protein. GFP is subsequently purified from the contaminating bacterial debris using the disposable chromatography columns. The unique fluorescent properties of GFP allow the entire process to be observed using a long wavelength UV. Students will learn important molecular biology techniques, including: Lab safety, chromatography, and protein isolation and analysis.

Neurobiology

Your ability to perceive your surroundings – to see, hear, and smell what's around you – depends on your nervous system. So does your ability to recognize where you are and to remember if you've been there before. In fact, your very capacity to wonder how you know where you are depends on your nervous system!

The Neurobiology camp is an introduction to the structure and function of the nervous system, including neuroanatomy, neurophysiology, and systems neurobiology. Topics include the properties of neurons and the mechanisms and organization underlying higher functions. Students will:

- 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.
- Learn about how the speed of their reactions play a large part in their everyday life. Fast reaction times can produce big rewards, for example, like saving a blistering soccer ball from entering the

goal. Slow reaction times may come with consequences. In this workshop, students are going to be introduced to what a reflex and reaction are and how scientists go about measuring them.

- Students observe and test their reflexes, including the (involuntary) pupillary response and (voluntary) reaction times using their dominant and non-dominant hands, as a way to further explore how reflexes occur in humans. They gain insights into how our bodies react to stimuli, and how some reactions and body movements are controlled automatically, without conscious thought.

Circuits / Arduino

The world we live in generates analog data and reacts to analog feedback. Tracking skin moisture or heart rate, detecting the human voice or other sound all require analog inputs to be processed. Computers are digital which allows for efficient processing of data and effective long term storage. Technology solutions build heavily on the complexity of logic that is possible in the digital world. This logic is supported by software programs and digital hardware designs. Solutions that seek to engage with the analog world require an understanding of analog circuits, their components and interfaces to the digital world. In this camp, the fundamentals of electricity and electronic circuits are explored while the student builds circuits to perform real world functions.

Mechanics of Motion

When students take the lead in exploring science topics of interest to them, they rapidly gain an understanding of good scientific practice. Mobile devices such as smartphones are sophisticated scientific instruments, with built-in cameras, accelerometers, voice recorders, and location sensors. Students will quickly become acquainted with how to use this technology as scientific instruments for their investigations. In our Mechanics of Motion Camp students will be using the accelerometer and distance locator to record the trajectory of water rockets, to measure momentum in our egg car crash dummies, and as photo-gates for measuring the rate of acceleration of parachutes and the potential and kinetic energy of marbles on a roller coaster.

Thermodynamics: Heat Transfer

This camp explores the concepts of heat and movement. Students will be introduced to the basic concepts of thermodynamics, including atomic structure, atomic and molecular motion, states of matter, heat transfer, thermal expansion, specific heat, and heats of fusion and vaporization.

The study of thermodynamics is the study of the amount of energy moving in and out of systems. Energy that is transferred is at an atomic level. Atoms and molecules are transmitting these tiny amounts of energy. When heat moves from one area to another, it's because millions of atoms and molecules are working together. Those millions of pieces become the energy flow throughout the entire planet.

Students will be able to:

- Construct a macroscopic model (based on temperature, density, and thermal conductivity) of how energy is transferred. (For higher level student(s), specific heat capacity can also be explored.)
- Explain how temperature is related to average kinetic energy if using the supplementary "What is Temperature?" demonstration.
- Explain how perception of hot or cold is related to heat and temperature.
- Use the particulate model of matter to explain how kinetic energy is demonstrated amongst the particles of a substance.
- Measuring instruments can be used to gather accurate information for making scientific comparisons of objects and events and for designing and constructing things that will work properly

Schmahl Talk

Students may arrive any time between 8:15 and 9AM. During this time, Mrs Schmahl will discuss recent developments in the scientific community as well as the science behind topics in the news. Students may ask questions of their own and suggest topics for discussion.

About Schmahl Science Workshops

Schmahl Science Workshops is a non-profit partnership of students, parents, teachers, scientists and engineers who come together to foster the innate curiosity and love of science that exists among children. Founded in 1996 by a group of four children and their parents, Schmahl Science Workshops provides pre-K through 12th grade children an unmatched breadth of hands-on science workshops spanning biology, chemistry, earth science, forensics, math and physics. Our mission is to prepare children of all backgrounds for a future in which science and technology will drive every industry and vocation. We believe that children are motivated to learn when their ideas are cultivated through the joy of designing and carrying out an experiment. Through these authentic research experiences, our workshops enable students to explore and invent what inspires them, and to develop the skills needed to achieve success in all areas of their lives.

HSJ Science Camp Laboratory Research Summer 2019 Registration Form - 1

Submit Registration Forms directly to Schmahl Science Workshops.

Date: _____
 Student's First and Last Name: _____ Grade 2019-20: _____
 Any Medical issues for student: Check NONE or list issues: _____
 Mother's First and Last Name: _____ Phone #: _____
 Father's First and Last Name: _____ Phone #: _____
 Email Address: _____ Home Phone #: _____
 Home Address: _____ City: _____ Zip: _____
 Emergency Contact First and Last Name: _____ Relationship To Child: _____
 Emergency Phone: Cell: _____ Home: _____ Work: _____

Please refer to page 5 to specify workshops/dates and calculate total due. Please be sure to include pages 4 and 5 with your registration.

Payment is due with registration. No refunds. No substitutions.

ENROLLMENT OPTIONS:

- Email registration to: customerservice@schmahlsience.org
- Mail registration to: Schmahl Science Workshops, 171 Branham Ln., Ste 10-223, San Jose, 95136

PAYMENT OPTIONS:

- Credit Card Payments: MasterCard, Visa, American Express
 Card #: _____
 CID: _____ Exp: _____ Sign Date: _____
 Signature: _____
 Name printed on card: _____
- Online Payment: Webcart /Invoice #: _____
- Check or Money Order made out to: Schmahl Science Workshops.
 Ck#: _____ Amt \$ _____

**This is Important to Us,
 Please Answer the Questions:**

- Check here to be added to our mailing list of future workshops: YES NO
- Check here for information via email:
 YES NO
- SSW may take workshop photos for use in SSW's publicity. Names and locations will not be published. Do we have your permission to take photos of your children during our workshop(s):
 YES NO
- How did you hear about us?

HSJ Science Camp Laboratory Research Summer 2019 Registration Form - 2

Workshop Selections

Week	Sessions	Time	Session Cost	Amount Due
June 17 – June 21	Schmahl Talk	8:15am -9:00am	\$0	
June 17 – June 21	Comparative Anatomy	9:00am -11:30am	\$330	
June 17 – June 21	Molecules of Life	9:00am -11:30am	\$330	
June 17 – June 21	Microbiology – Antibiotic Sensitivity	12:00pm - 2:30pm	\$330	
June 17 – June 21	Recombinant DNA	3:00pm - 5:30pm	\$330	
July 8 – July 12	Schmahl Talk	8:15am -9:00am	\$0	
July 8 – July 12	Mechanics of Motion	9:00am -11:30am	\$330	
July 8 – July 12	Circuits / Arduino	12:00pm - 2:30pm	\$330	
July 8 – July 12	Thermodynamics – Heat Transfer	3:00pm - 5:30pm	\$330	
July 29 – Aug 2	Schmahl Talk	8:15am -9:00am	\$0	
July 29 – Aug 2	Microbiology – Antibiotic Sensitivity	9:00am -11:30am	\$330	
July 29 – Aug 2	Neurobiology	9:00am -11:30am	\$330	
July 29 – Aug 2	Recombinant DNA + Protein Purification	12:30pm - 5:30pm	\$660	
		*3 sessions	Discount *	<\$100.00>
			Total Due	

Please be sure to include this page with page 4 when you submit your registration.