History SJ Science Camp Laboratory Research - Summer 2018

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 four weeks of camp. Students will be able to choose the following sessions:

Week 1 Sessions (June 11 – June 15)

Morning Session (9:30 -12:00pm)	Molecular Biology 1
Mid-Day Session (12:30 am – 3:00pm)	Microbiology
Afternoon Session (3:00 – 5:30 pm)	Circuits / Arduino

Week 2 Sessions (June 18 – June 22)

Morning Session (9:30 -12:00pm	Molecular Biology 2
Mid-Day Session (12:30 am – 3:00pm)	Arduino Practical
Afternoon Session (3:00 – 5:30 pm)	The Search for New Antibiotics

Week 3 Sessions (June 25 – June 29)

Morning Session (9:30 -12:00pm)	Comparative Anatomy
Mid-Day Session (12:30 am – 3:00pm)	Molecular Biology 3
Afternoon Session (3:00 – 5:30 pm)	Organisms for Biological Study

Week 4 Sessions (July 9 – July 13)

Morning Session (9:30 -12:00pm)	Molecular Biology 1
Mid-Day Session (12:30 am – 3:00pm)	Circuits / Arduino
Afternoon Session (3:00 – 5:30 pm)	Microbiology

SIGN-UP NOW for Summer Camp!

Days: Monday thru Friday – 5 day course

Grades: 5-8

Fees: $330 per weeklong session
Register for three sessions and receive a $100 discount

Location: History San Jose at Kelley Park
History San Jose at Kelley Park,
651 Phelan Ave San Jose, CA 95112

Registration Opens: February 1, 2018

HOW TO REGISTER:

Complete Registration Form: Use the attached form or print one out: at www.schmahlscience.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, 171 Branham Lane Suite 10-223, San Jose, CA 95136 **OR**
2) If using a credit card, completed form can be scanned & emailed to customerservice@schmahlscience.org **OR**
3) Pay online. Go to www.schmahlscience.org select the "Camps" tab and click on "Active Programs". Once payment is made, mail or email registration form as above.

SESSION DESCRIPTIONS:

The Search for New Antibiotics

As you know, the lack of still-effective antibiotics is quickly becoming a global crisis. In fact, researchers say in the absence of new therapies, mortality rates due to untreatable infections are predicted to rise more than tenfold by 2050.
So where might researchers discover these new "drugs"? A starting point for answering this question is to look at how researchers discovered new treatments in the past ... by looking in good old-fashioned soil!

Indeed, the very first group of antibiotics ever discovered, penicillin, comes from a fungal decomposer found in forest soils across the world. In the mid-20th century, many other well-known antibiotics, including vancomycin, were isolated from soil bacteria. Nearly a century after scientists dug up penicillin, researchers are turning once more to the soil for new pharmaceuticals. The search will be enhanced by the use of powerful new technologies such as DNA sequencing.

If social media feels overwhelming these days, it's nothing compared to the chatter going on beneath your feet. Pick up a handful of soil and you'll be holding five times as many microbes (tiny, living organisms such as bacteria) in the palm of your hand as there are people on Twitter. Like Twitter users, soil microbes have a lot to say about the world around them. Microbes talk to each other by dropping small molecules (e.g. hormones) into the soil around them.
Soil is the most biodiverse habitat on the planet, containing upwards of 10 billion bacteria and fungi in a single gram. It's also a vicious battlefield, where microbes are engaged in an endless chemical arms race, exuding all sorts of antibiotics and toxins as they compete for resources.

Plants living in soil can interpret the messages in the "intermicrobial twitter-sphere" as signals to grow out their root system, germinate seeds, or grow their stalks faster. The way soil microbes interact with each other has a huge impact on how plants grow. In fact, microbes can protect plants from disease and prevent plants from drying out during extended droughts.
While studying the scope and importance of soil microbiology, students will learn that the broader soil-plant-animal ecosystem must considered while examining specific bacteria and growth inhibiting interactions.
This camp takes students beyond the tendency to consider only the most obvious causes of an effect. Students realize that non-obvious microbes are the primary decomposers, that things don't "fall apart" on their own, and that visible detritivores, such as earthworms and sow bugs, are responsible for only a small percentage of decomposition.

Lab Protocols

- Isolate, identify and test soil micro-organisms
- Elective culture methods
- Selective culture and media
- Non-selective media and methods
- API and Microgen identification methods

Room: SSW Laboratory Max 10 students

Microbiology

The Microbiology Summer Science Camp will challenge your child 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!
Room: SSW Laboratory Max 10 students

Molecular Biology 1 – *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.

Molecular Biology 2 – *Protein Purification*

(Molecular Biology 1 recommended)
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.

Room: SSW Laboratory Max 10 students

Molecular Bio 3 – *PCR Amplification : Segment of Bacteriophage Lambda DNA*

(Molecular Biology 1 and 2 recommended)

In 1983, a biochemist at a small biotechnology company near San Francisco hit upon an idea for replicating DNA in a test tube. It didn't require an elaborate mix of enzymes. It didn't require fancy or expensive equipment. It could amplify just a small amount of DNA to over a million fold. It could be used to solve a vast number of biological problems from narrowing down the location of a particular gene within the 3 billion base pairs of the human genome to determining who left a spot of blood on a sidewalk at the scene of a murder. It was so simple, so elegant, so obvious that half the molecular biologists at the time could be heard cursing to themselves, "Now why didn't I think of that!" Its inventor, Kary Mullis, won a Nobel Prize. The technique is called PCR (for the polymerase chain reaction).

In this camp, a DNA segment of a bacteriophage called lambda will be amplified by PCR. A bacteriophage is a virus that infects bacteria. Lambda (λ), one of the most extensively studied bacteriophages, infects the common intestinal bacterium Escherichia coli. The lambda genome is 48,502 base pairs (bp) in length. You will amplify a 500 bp section of the virus' genome. PCR is such a powerful technique because of its capacity to amplify very small amounts of DNA.

Room: SSW Laboratory Max 10 students

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.

Room: SSW Classroom Max 10 students

Organisms for Biological Study

Environmental bioassays are one method of assessing the presence of potentially harmful compounds. In this bioassay seminar, students will:

- Use bioassay investigations to develop students' understanding of the effects of chemical concentration on survival of living organisms
- Make the connection between the survival of simple organisms and human survival
- Understand the role that model organisms play in informing humans about the effects of toxicants

Bioassays use organisms that show particular sensitivity to possible pollutants. The four organisms that will be examined in this seminar are:

- Daphnia are small, planktonic crustaceans with bodies that are transparent. Under a microscope, the beating heart of Daphnia can be observed. Using this feature, students can monitor Daphnia heart rates under different environmental conditions.
- Brine shrimp are tiny aquatic crustaceans that can be easily observed.
- Planaria
- Algae

Students will learn about each specific organism and conduct several prescribed assay protocols. As part of this seminar, students will use microscopes to both observe and act on the tiny organisms. Students require practice to do this successfully and need to become proficient before undertaking the next step in toxicology and bioassay investigations.

Room: SSW Laboratory Max 10 students

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.

Room: SSW Classroom Max 10 students

Arduino Practical *(pre-req Circuits/Arduino camp)*

Having opened the door to the digital/analog circuit combination, the imagination runs wild with possible solutions to the challenges of everyday life. Progress is made quickly as each new idea is built on a combination of innovative thinking and inspired borrowing from previous solutions. The Arduino Practical camp builds on the topics explored in the Circuits/Arduino camp and progresses to the next level of functionality that can be achieved with the combined solutions of analog, digital and software.

Room: SSW Classroom Max 10 students

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.

OFFICE USE
RECEIVED:
❑ CONF ❑ SRF ❑ RL ❑ ACCTNG

HSJ Science Camp Laboratory Research Summer 2018 Registration Form - 1

Submit Registration Forms directly to Schmahl Science Workshops.

Date:
Student's First and Last Name: _____ Grade 2018-19: _____

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@schmahlscience.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 2018 Registration Form - 2

Workshop Selections

Week	Sessions	Time	Session Cost	Amount Due
June 11 – June 15	Molecular Biology 1	9:30am -12:00pm	$330	
June 11 – June 15	Microbiology	12:30pm - 3:00pm	$330	
June 11 – June 15	Circuits / Arduino	3:00pm - 5:30pm	$330	
June 18 – June 22	Molecular Biology 2	9:30am -12:00pm	$330	
June 18 – June 22	Arduino Practical	12:30pm - 3:00pm	$330	
June 18 – June 22	The Search for New Antibiotics	3:00pm - 5:30pm	$330	
June 25 – June 29	Comparative Anatomy	9:30am -12:00pm	$330	
June 25 – June 29	Molecular Biology 3	12:30pm - 3:00pm	$330	
June 25 – June 29	Biological Organisms	3:00pm - 5:30pm	$330	
July 9 – July 13	Molecular Biology 1	9:30am -12:00pm	$330	
July 9 – July 13	Microbiology	12:30pm - 3:00pm	$330	
July 9 – July 13	Circuits / Arduino	3:00pm - 5:30pm	$330	
		*3 sessions	Discount *	<$100.00>
			Total Due	

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