



#### 2018 Annual Report / Vol. 60

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- Take the member survey: <u>ssp.org/60thsurvey</u>
- Donate securely to the 2019 Annual Fund: <u>ssp.org/support</u>
- Join the Facebook group <u>facebook.com/</u> groups/sspalbum
- 60th Celebration videos: <u>facebook.com/groups/</u> <u>sspalum/</u>

 Read the campus blogs: <u>SSP2018NMT.wordpress.com</u> <u>SSP2018Purdue.wordpress.com</u> <u>SSP2018CUB.wordpress.com</u>

### A Tale of Two Teens

Adolescence is a time of rapid change and growth, maturation and choices. The Summer Science Program accelerates those processes in its teenage participants. They leave campus brimming with confidence and self-knowledge, eager to tackle bigger challenges in science—and in life—than they ever thought possible, working with their new global network of collaborators.

But you already know that.

What might be news to you is that SSP itself, as an independent nonprofit, is having its own transformative adolescence. In 1999, alumni and former faculty took over a venerable but static program in astronomy, operated by Thacher School in Ojai, California. Together, we've gradually grown it into a thriving organization, encompassing disparate fields of science on multiple campuses. This month, in fact, our nonprofit turns 19; it's a teen too ... with more growing to do.

Look at that familiar logo in the upper left of this page (designed by John Rabold '70 in 1999). Older alumni see an asteroid's orbit projected onto the sunset above the Ojai mountains. But to younger alumni it's more abstract: the arc of a life being lifted up over obstacles, a teenager in the sunrise of her adulthood, accelerated into a higher metaphorical orbit, to a life of more fulfillment and accomplishment than she would have achieved otherwise. "The educational experience of a lifetime" in a symbol.

Now you see that, too.



### Two Ways to Get In On the Action

This is SSP's 60th year, so you still have until December 31st to participate in two important initiatives (if you haven't already). First, alumni and former faculty can take the **60th Member Survey** online at <u>ssp.org/60thsurvey</u>, telling us about your own life path and personal perspectives on SSP's impact. Then, give or pledge to the **60th Endowment Fund** to strengthen the financial foundation underpinning SSP's continued growth. Visit <u>ssp.org/support</u> for info.

Please let us hear from you both ways!

### Is the SSP in Biochem Experience as Challenging? As Life-Changing?

Each summer, all participants take an exit survey just before they go home. Among other questions, we ask about the experience overall and its effects. Plotting their responses by program allows a direct comparison between campuses (New Mexico Tech, CU Boulder, and Purdue) and projects (Astrophysics, Biochemistry).

The 2018 results confirm, in dramatic fashion, the unity of the SSP experience. That was explicitly our goal when writing the Open Call for New Projects in 2014, and the data show clearly that our goal has been met with the Biochemistry project as developed and deployed at Purdue.

# Our challenge remains to continue to maintain the quality of the experience as we continue to open new programs in coming years.



My daughter says SSP changed her life. Not only did she enjoy being part of a very welcoming, enriching community, but she also felt challenged and deeply inspired by her Academic Directors. SSP has rekindled her curiosity and desire to learn.

-Dana and Alan Hong, parents of Jennifer Hong '18





SSP had so many positive effects on our daughter. One of her first comments to us was how supportive the people were and how happy she feels about being a part of this whole special organization. She was finally in a collaborative environment where everyone was always there to help. Because she was raised in a society not supportive of women in STEM, an encouraging program like SSP was essential. Seeing our daughter becoming more confident was priceless. - Hasan Uluegeci,

parent of Ecem Uluegeci '18

## An SSP in Metagenomics? by Dr. Amy Barr Mlinar '94, Chief Academic Officer







Unclassified Methylophilaceae = Thiobacillus Methylotenera
Other = Other Betaproteobacteria = Other Methylophilaceae
Unclassified Acidobacteriales = Unclassified Chloracidobacteria
Flavobacterium =Unclassified (gravibacteriaceae = Nitrospira

Metagenomics is an application of the exciting field of bioinformatics. (graphic from <u>peerj.com</u>)

The most rewarding experience I have had all year is watching new members of the SSP family become infected with enthusiasm for our program and its mission. Case in point: Indiana University Prof. Martha Oakley, having serving as Associate Academic Director at Purdue this summer, has enthusiastically offered to return. In Boulder, we welcomed our first female Academic Director in the 60-year history of SSP, Penn State Professor Agnes Kim. Dr. Kim first taught SSP at New Mexico in 2006, where she upgraded the classroom experience by introducing in-class group activities. Our other outstanding professors—Adam Rengstorf, Bill Andersen, Mike Dubson, and Mark Hall—continue to dedicate their summers to giving bright teens their first taste of collaborative research.

In 2018, big changes, expansion, and new initiatives continue at SSP. Next summer, we hope to clone the highly successful Biochemistry program at a second site. And thanks to a generous \$275,000 grant from an alum, we will continue to develop and test a new research project in the exciting field of metagenomics.

Metagenomics is the analysis of all of the genetic material found in an environmental sample: a swab off the human skin, a test tube full of sea water, a thimbleful of dirt (see Figure 1). One sequences all of the DNA (or RNA) in the sample to identify microbes, and determine their relative abundances and genetic relationships (https://tinyurl.com/NAS-Metagenomics). Metagenomics is ideally suited for research at SSP because it involves hands-on sample acquisition in the field, as well as heavy computational processing of the raw genetic sequence data.

Maybe you can help. We are looking for SSP-quality intellectual puzzles in metagenomics, and people with the expertise to help evaluate them. Our goal is to decide this spring on a specific topic—where to take the sample, how to analyze it—followed by testing at the lab bench in 2019, a small pilot program in 2020, and deployment in 2021. Email me: <u>amy@ssp.org</u>.

Gone are the days of glass plates, darkroom mishaps, measuring engines, and mechanical calculators, but I can assure you that the heart of SSP remains unchanged. Listening to participants and faculty, reading the campus blogs, one still feels the "creative stress" and community warmth unique to SSP. Our faculty work tirelessly every summer to maintain the quality and spirit of SSP as we continue to grow.

### SSP in Astrophysics at New Mexico Institute of Technology



by Dr. Adam Rengstorf, Academic Director



In my 7th consecutive SSP summer, it was my honor to work again with Associate AD Bill Andersen (in his 11th summer), and Site Director Barb Martinez (in her 9th). We knew what to expect! Teaching Assistant and Residential Mentors Katie Dunn '13, Claudia Yun, Devin Whitten,



2018 NMT T-Shirt Design

and Lawson Kosulic were indispensable too of course. Together the seven of us led 36 participants through the successful completion of the Near-Earth Asteroid Orbit Determination research project at New Mexico Tech.

Preparation and motivation of the participants were excellent overall. The few without both physics and calculus worked hard and kept up with the rest of the group. Those most prepared academically continually attempted the more challenging, extra work we offered them.

Teams went up the hill to Etscorn Observatory 87 times over 30 evenings. We lost only 37 shifts to clouds (and 1 to high winds). Many of the participants saw the Milky Way for the first time in their lives in the dark skies above Socorro. Throughout the summer, we were all treated to a great twilight view of Mercury setting behind "M Mountain".

Bill and I each taught 33, 3-hr classroom blocks, while others added 14 more: Programming Instructor Aaron Bauer '06, Technical Writing Prof. Gillian Andersen, our friends Drs. Michele Kirchoff and Rogerio Deienno from Southwest Research Institute, and of course the TAs.

Shorter, more frequent problem sets facilitated a smooth, reasonable workflow. We assigned 8 psets in astronomy, 8 in math/physics, and 3 in Python. Each participant wrote code for the least squares plate reduction, aperture photometry, ephemeris generation, and finally the orbit determination itself. As usual, observing notebooks were due before each observing session, plus weekly team progress reports. Something was due at midnight every day except Sundays, field trip days, and Open House Day.

By the end of the program, all 12 teams had obtained reasonable orbits using the method of Gauss with a differential correction for orbit improvement. New this year, we also required a "Monte Carlo" run, which gave participants a very clear picture of the uncertainties in their orbital elements, a concept important to any experimental data analysis, but not often taught in high schools. Teams submitted their data to the Minor Planet Center, which was promptly accepted and published by the MPC.

Summer Science Program became a turning point of my life. The opportunity to conduct research is fascinating in itself, but the chance to work as a team with the most talented peers and faculty is absolutely exceptional.

#### - Tonia Zakorchemna '18

After 16 summers, we are very comfortable at New Mexico Tech. SSP again had exclusive use of their C-14 telescope and SBIG camera at Etscorn. This equipment worked flawlessly and, on the rare occasion that we needed Dan Klinglesmith's help, he was there in short order. However, the tower PCs in the computer lab are definitely dated; we never had 36 working at once. Hopefully they will get replaced one of these years.

For the third summer, the policy of "downtime" did tremendous good. Participants must be in their rooms for at least 4½ hours per night. No, that isn't enough sleep, but it sets a minimum expectation. Any work is handed in by midnight; at 1:15 am a TA clears the computer lab and sends participants to the dorm.

I very much enjoyed working with Barb again this summer. She has to take care of everything non-academic: participant health and well-being, field-trip logistics, campus administration, and even a sick AD! And Leslie Clark continues to define the new role of Campus Manager. She simply knows what has to be done and how / when to help. Our whole team made 2018 Summer Science Program in Astrophysics at New Mexico Tech an unqualified success!

### SSP in Astrophysics at the University of Colorado

by Dr. Agnès Kim, Academic Director





This was my first return to SSP since 2008 and my first in Boulder. Just as I remembered, the 36 participants were not shy about asking questions ... of me, Associate AD Dr. Michael Dubson, our TAs, and the guest speakers.



We split the Gaussian OD method into 4 parts, each packaged as a

2018 CU Boulder T-Shirt Design

self-contained piece of Python code that participants wrote then debugged using assigned test data. By week 5, as they assembled the parts and plugged in their own observations, each part already worked, so the final push was less hectic than we had feared. By the end, all teams successfully obtained orbital elements for their asteroids and submitted their observations to the Minor Planet Center, guided by Dr. Dubson. Thanks to our great TAs, they also wrote high quality OD reports using LaTeX maybe for the first time at SSP?

Our participation in the inter-campus parallax experiment came to naught because our group forgot to set the epoch correctly, thereby mispointing the telescope. But it was a positive interaction via video with the other two groups.

The facilities here are perfect for SSP. The observatory also houses our classroom, computer lab, and TA office. The twin 20" telescopes point precisely (if one remembers to set the epoch).

Observatory Manager Fabio Mezzalira was phenomenal in helping out with technical difficulties, even when our server was

They weren't kidding when they called it the experience of a lifetime. It's the best way I could have spent the first time away from my family. Now I'm excited to be a part of the alumni community.

- Smruthi Balasubramaniam '18

attacked by hackers and quarantined by the university firewall. The nearby dining hall can be busy, but the variety there is amazing, and most nights we maintained the SSP tradition of assigned tables.

Dr. Dubson combined wisdom from previous SSP summers, valuable local knowledge and contacts, and his award-winning expertise as an educator. I tried not to rely on him too much! His dedication to SSP is outstanding and it was just a pleasure to work with him. Site Director Seth Price was personable and beloved; the participants called him "Dad". The best prank of the summer was when they covered his storm chaser Crown Vic with Post-it notes. New to both SSP and Boulder, he climbed a steep learning curve to handle logistics plus health, safety, and behavior issues, including hospital trips (fortunately nothing too serious).

Four outstanding TAs formed a synergistic team of good role models, motivating, comforting, tutoring, and enforcing, taking good mental and physical care of our participants. Bradley challenged them with QOD's and programming tasks. Dahlia was a caring and firm big sister to the participants and always got the grading done on time. Isaac handled the blog, plus first aid for aches and small injuries. Maria wrote procedures for the telescopes and Python libraries, also organizing water balloon fights and origami sessions. As a group, we found our groove!

Promptness was a chronic challenge despite "down time" set at 1:30 am, when participants were expected to be in their rooms unless still observing. We still never succeeded in getting everyone in the classroom and seated by the time the hour hand moved into place. I compared the participants to electrons in the degenerate interiors of white dwarfs, antsy and in constant motion (as a group, they had already decided that electrons had feelings).

On the last night we suspended down time, and everyone (especially the TAs) discovered how little sleep they would get without it!

### SSP in Biochemistry at Purdue University

by Dr. Mark Hall, Academic Director





Our second program, now with the full complement of 36 participants, went very smoothly. Each team of three was assigned a novel fungal pathogen and taught to isolate, then model in software, its critical Cdc14 enzyme. Finally, we challenged them to hypothesize a small molecule that would bind to an active site on the enzyme, inhibit its activity, and thereby form the basis of a safe fungicide to protect crops.



Our Associate Academic Director, Prof. Martha Oakley from Indiana University, was all-around fantastic. Much more knowledgeable in chemistry than I, she has a very fun and engaging teaching style. In daily lectures, everyone asked extensive questions ... both Martha and I often had to stop taking questions to get through the material! I also thoroughly enjoyed working with Site Director Laura Corley. She handled our field trips, guest speakers, and other special events perfectly, along with participant health and safety.



Four terrific TAs gave us peace of mind as supervisors, tutors, and mentors, in and out of the wet labs. John Whitney's unflagging energy amazed us for the second summer. His fellow Purdue Biochem major Emily Overway had worked in these labs, so she knew her way around, and she "got" SSP culture very quickly. Hannah Nikole Almonte '14 arrived with the least lab experience, but exerted extra effort to learn, and pulled double duty on the residential side of things. Devin Srivastava '15, a veteran of our 2016 pilot, was highly effective in multiple ways, including taking many photos and organizing the tri-campus video call. Lab Assistant Jacob Crosser was also a huge help.

The challenge of this project - the need to teach a month's worth of lab skills each week - contributed to faculty workdays of 12-15 hours, including Saturdays. Next summer we must add either a 5th TA or a 2nd Lab Assistant.

We also have an equipment wish list in case anyone reading this report can help: analytical and media balances; portable burners for sterile culture work; multi-channel pipettors (P-20 and P-200); a micro-sonicator for processing of cell extract samples; SDS-PAGE plates; casting stands and clamp assemblies; pipet tip boxes, especially yellow tips. Last but not least: a plate reader (or two). It's our primary analytical instrument, heavily used for all the enzyme assays and protein concentration measurements. This is not typical equipment for a teaching lab, and we only have one. Acquiring another is absolutely essential.

SSP is a bunch of people that are similar enough to click in an instant, but different enough to learn from each other. - Zachary Kellner '18

The guest speaker series, and the field trips to Argonne National Lab, DowDuPont, and Lilly, were truly memorable. Drs. Susan Jerian and David Essayan returned to enthusiastically present about clinical drug trials and the FDA drug approval process, through a series of lectures and group activities over two days. Last but not least, we carved out a little time to relax outdoors, visiting Turkey Run to hike, the beach at Indiana Dunes, and the Indy zoo.

Post-departure, I used in-house 3-D printers to create a physical model of each enzyme, and mailed it to each participant. Unfortunately, our department's 3-D printers are slow and unreliable. I am hoping we can find someone to do that for us elsewhere next summer.

The hugs and tears on Departure Day told us that our program had its desired impact: to provide a truly transformative experience for budding young scientists.

# **60th Celebration!**

In July, SSPers and their families from 1959 through 2018 gathered in Boulder for a full weekend of reminiscing and networking. On Sunday morning, the Annual Membership Meeting was held in-person for the first time, and streamed live on Facebook. Videos of that meeting and every presentation are on the SSP alumni group Facebook page, <u>facebook.com/</u> <u>groups/sspalbum</u>



Dr. Scott Pace '75 gives the history of U.S. space policy



Audience participation during Dr. Mike Dubson '73's "Boom" presentation



Dr. Bonnie Valant-Spaight '89 and family review the timeline.



SSPers pose by the astrograph used at Thacher in the '60s and '70s

# 60th Survey: Are you there?



These survey results are incomplete... unless all alumni are included! If you haven't done so yet this year, take 10 minutes now to complete the survey.

#### ssp.org/60thsurvey

#### **Undergraduate Majors**



# **College Destinations of '17ers**

Amherst	Lawrence Phillips
Boston University	Molly Szpakowski
Brown University	Dominick Joo, Edgar Villegas
Caltech	Alya Al-Kibbi, Madeline Gardner, Hagan Hensley, Adrian Lopez, Alexander Pan, Carola Zanoletti
Univ. of Cambridge	Arpit Kalla, Collin Montag
Carnegie-Mellon Univ.	Neel Gandhi
Columbia University	Myria Chen, Jang Hun Choi, Ketan Jog, Emily Wang, Elaine Zhu
CU Boulder	Zhiyu Yao, Gina Staimer
Duke University	Caroline Katz, Michael Tian
Georgia Tech	Alexander Yu
Hamline University	Jonathan Thio
Harvard University	Alberto Mosconi '16, Denisse Cordova Carrizales, Jessica Dong, Carolyn Ge, Xinyi Zhang
Harvey Mudd College	Sabra Dunakey, Maxwell Holloway, Benjamin Khoury
Imperial College	Tudor-Octavian Sirbu
Johns Hopkins Univ.	Yuseong Oh
MIT	Joyce An, Juliana Chew, Charles Coffey, Vittorio Colicci, Leyna Duong, Laney Flanagan, Tyler Higgs, Ally Hong, May Huang, Lenna Kanehara, Isaac Lau, Jessica Lee, Erin Leydon, Steph- anie Li, Alex Liu, Yunfei Ma, Kelsey Merrill, Ethan Nevidomsky, Elena Romashkova, Kathryn Tso, Madeline Wang, Nicholas West, Katherine Xiong, Carine You, Stephanie Zhang
Olin College of Engin.	Hyunkyung Rho
Oxford University	Ipsita Singh
Univ. of Pennsylvania	Anusha Sriram, Sunny Zhang
Princeton University	Chandrika Chandrashekar, William Cowen-Breen, Kimberly Hou, Doris Li
Stanford University	Felipe Calero Forero, Odelia Lorch, Eli Navarro, Ayush Pandit, Jared Smith, Alexander Sun
UC Berkeley	Do Hyun Cheon, Pranav Nagarajan, Austin Sun, Jeffrey Tao
UC Santa Barbara	Ruining Zhang
UCLA	Emma Esquivel
UNC Chapel Hill	Kean Leung
Univ. of Chicago	Glenda Meyer
Univ. of Edinburgh	Paula Espinosa Alonso
Univ. of Michigan	Jesse Pattison
Univ. of Minnesota	Tyler Douglas
Univ. of Maine	Margaret Turcotte Seavey
USC	Helen Burch
Washington University	Jordan Stone
Williams College	Lauren Fossel

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#### **Letter from the Chair** by Dr. Michael Weiss '74, Board Chair

Five years after the Moore Foundation grant launched us on a growth trajectory, we on your Board of Trustees are very enthusiastic about implementing the strategic planning now in place.



The SSP experience was transformative for my daughter Leah—as it was for me in 1974 and has been for so many young people, especially young women. Leah's middle

school had not encouraged girls to pursue math or science. She was apprehensive about attending SSP due to a lack of coding experience. Despite these initial trepidations, Leah thrived at SSP and even blossomed as the go-to person for her team in Python coding. To make a long story short, Leah went from SSP to study physics at Harvard College, then at Cambridge, England, and two months ago received her PhD in semiconductor physics.

My wife Carol and I attribute Leah's trajectory to SSP: it was the turning point in her passion for science. Seeing that firsthand convinced us to make SSP our major pro bono volunteer and philanthropic cause. Expanding SSP—and ensuring its future viability via an endowment—will make a huge positive impact on our society (and the world) by creating transformative experiences for many more adolescents at a critical juncture in their lives.

We recently moved to Indianapolis, where I am chairing Biochemistry & Molecular Biology at the Indiana University School of Medicine. Fortuitously, this positions me well to interact with the committed faculty members at Purdue who designed our biochemistry curriculum, Drs. Mark Hall and Joe Ogas. Remarkably, student reviews from Biochemistry have been just as enthusiastic as those from the astrophysics programs. Applications are soaring.

SSP's future is bright. Thank you for being a part of it.