



2017 Annual Report / Vol. 59 **Celebrating the Past, Looking to the Future**

INSIDE

60th Anniversary Member Survey Interim Results..2,3

Academic Directors' Reports4-6
Chief Academic Officer's Report10
SSP & Harvey Mudd10
College Destinations
Lotter from the Chair 12

LINKS

- Take the member survey: ssp.org/60thsurvey
- Save the date: 60th Anniversary celebration, July 14, 2018, Boulder, CO: ssp.org/dinner
- Donate securely to the 2018 Annual Fund: ssp.org/support
- Join the Facebook group facebook.com/ groups/sspalum

Sixty summers ago next year, the Summer Science Program began as a radical educational experiment. Two dozen boys, working in teams of three, would use a borrowed telescope to take photographic plates of main-belt asteroids then calculate their orbits.Would it work? How would the experience affect them, academically and socially?

Next June, for the sixtieth consecutive summer, teenagers will leave home for SSP.Three campuses will welcome 108 talented and diverse teens from around the world; half will be young women. At the University of Colorado Boulder and New Mexico Tech, they will take digital images of near-earth asteroids, then write software to calculate and even animate their orbits. Those at Purdue will design inhibitors to fungal crop pathogens. On each campus, the integrated, intense challenge of doing hands-on research in a collaborative community will transform them profoundly, just as it has for the more than 2,500 alumni who came before them.

We know this because of the miraculous rescue of the program from extinction in 1999, the impressive continuing support by alumni even decades after they participated as teens, and the extraordinary staying

power of SSP's design (aka "secret sauce"). That continuity now extends to participants doing Biochemistry as well as Astronomy; though the project is different, everything else about the experience, from three-person teams to the guest lecture series to the talent show, is retained. Science is integrated into Life, something that these teenagers have never experienced before SSP.

Your Board of Trustees has decided not to stop there. Plans are in the works to add more campuses gradually, and more opportunities for engagement and networking by alumni, former faculty, parents, and other friends. All of us are interesting people doing interesting things, in and out of science.

SSP's 60th Anniversary year, which started Oct. Ist, is a time to reflect on our good fortune in being associated with this small but excellent nonprofit. Like the brilliant participants it attracts, SSP itself has great potential to impact the world for the better.

On July 14th in Boulder we will celebrate with one another and 36 of the 2018 participants. Please plan to attend! Visit ssp.org for information.



Across three campuses and two fields of science, SSP has the same profound impact on gifted teens.

MEMBER SURVEY RESULTS

Preliminary results of the 60th Anniversary Survey, by year of SSP participation



Undergraduate Majors



Terminal Degrees (PhD, MD, JD) Astronomy Physics Geology / Earth Science Chemistry / Biochemistry Computer Science Mathematics Engineering Biology / Life Sciences Medical Doctor Law Arts / Humanities Social Science 1959-69 1970-79 1980-89 1959-69 19¹⁰⁻¹⁹ 19⁹⁰⁻⁹⁹ Other 2000-09

Alumni Careers





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 at ssp. org/60thsurvey. SSP is unique among summer programs, because its mission includes offering **continuing value** to its alumni, faculty, and friends. The online database allows members to find one another for networking, professional, and social opportunities. We also use it to demonstrate impact to potential sponsors, and to plan events such as the **60th Anniversary Celebration** on July 14th in Boulder.

ssp.org/60thsurvey



Report from New Mexico Institute of Technology

The Astronomer's Blessing: "Clear Skies" BY DR.ADAM RENGSTORE ACADEMIC DIRECTOR



SP participants work very hard. In our 15th summer at New Mexico Tech, something was due at midnight every

day between the 3rd day and the 36th, except Sundays and field trips.Associate Academic Director Dr. Bill Andersen,



Campus T-shirt design

Adjunct Programming Faculty Aaron Bauer, and I worked to keep the workflow steady and challenging but doable, by assigning shorter, more frequent problem sets, plus observing notebooks and research team weekly summaries.

"Monsoon season" was mild: clear in June, with enough breaks in the clouds in July that all 12 teams were able to obtain their data locally – in 87 observing shifts over 30 nights. No recourse to remote observing was needed! Each team submitted its data to the Minor Planet Center to help other scientists predict the asteroid's future path, published in the July 23 and July 30 issues of the Minor Planet Supplement. Each participant also wrote Gaussian orbit determination code in Python. With a prudent selection of six near-Earth asteroids, all converged to reasonable orbital elements. I encouraged those who finished early to compare the Method of Laplace, and to create an animation of their asteroid's orbit.

The campus observatory worked well, so we rarely tested the personal motto of Dr. Dan "I make dome calls" Klinglesmith. Dan again gave us exclusive use of a dome and C-14 telescope, SBIG camera, and the control room. He is a treasure. For the first time at Tech, we used a computer lab in Speare Hall, large enough to hold all 36 participants. I'm fortunate to have been able to work with Bill Andersen four years in a row. We complement one another, swapping lecture times and adding material as needs arise. Dr. Andersen lectured on math, physics, and orbital mechanics, then concluding with a series on relativity and quantum mechanics, always of interest to these bright and curious teenagers. I was very happy with our wonderful TAs. They played to each others' strengths and filled in gaps as needed. They each told me privately of their fear of not working hard enough! Katie Dunn was a powerhouse and took on the extra responsibility of scheduling all the observations. Rasmi Elasmar modeled best practices and behaviors, both academically and socially. As a returning TA, Rebecca Sellers was even better this year than last (which is saying a lot). Jeff Wheeler presented a very relaxed, positive work ethic and another good role model.

This was only my second summer working with Site Director Barb Martinez. I've learned to back away from non-academic matters, deferring to Barb, which is the right thing for any AD to do! She agrees that the 2-6 A.M."down time" policy has had a large positive impact on the program. While four hours is not enough sleep, it sets a bare minimum and a general expectation.

Field trips included the regulars: Magdalena Ridge Observatory, White Sands National Monument, a hiking trip (this year to Tent Rocks National Monument), Santa Fe, and of course the Very Large Array. Before Old Timers' Day in Magdalena, we toured John Briggs's Astronomical Lyceum. Six guest speakers came to call, including Mad Scientist Dr. Larry Sverdrup, and Dr. Nina Lanza in her third appearance on Open House Day. John Briggs '76 gave appropriate Closing Remarks on the last evening as a very successful program concluded!

It's rare to come across an atmosphere as closely knit as that of SSP. My interactions with this amazing group have reinforced just how powerful collaboration is in every sense, and I'll treasure the close relationships I've forged here for the remainder of my life. - Eric He '17

Report from University of Colorado

Being Boulder

BY DR. TRACY FURUTANI, ACADEMIC DIRECTOR



B y the end of SSP 2017 at CU Boulder, all 12 teams had received confirmation from the Minor Planet Center that their near-Earth asteroid positions and magnitudes would be published in the Minor Planet Circular! The operative phrase was "tired but happy."



Each team imaged their asteroids from brandnew twin 20-inch Plane Wave telescopes on the campus observatory deck.After lectures

and homeworks on calculus, physics, astronomy, and Python programming, and developing a least squares plate reduction routine, each participant wrote a Gaussian orbital determination program. I know what you're wondering, and yes, they included a light travel-time correction. They also coded an ephemeris generator, and used it to check the accuracy of that orbit. Some coded differential correction for better orbital elements, or compared the alternate LaPlacian method, or wrote an animation of their asteroid amongst the planets.

Associate Academic Director Michael Dubson '73 devised a cool new "side project": teams took images of the Gallilean moons of Jupiter, then used an app he wrote to fit orbits to those observations. A team helped with data reduction and testing. Separately, in conjunction with the New Mexico Tech campus (AD Adam Rengstorf) and the Yale Summer Program in Astrophysics (AD Michael Faison), two teams and their remote colleagues took simultaneous observations of an NEA, then calculated its distance from Earth using parallax.

Most of these teens were away from home for the first time, learning how to do laundry and budget dwindling cash-on-hand for the last two weeks. Their collective mom, Site Director Laura Corley, arranged visits to the orthodontist, breakfasts on Sundays, and took calls from worried parents at all hours. Helping participants in and out of the observatory was the first-ever TA corps who were alumni of the same SSP campus (2012 at Westmont College): Jonathan Joo, Tanay Bhandakar, Cyndia Cao and Lindsey Whitesides. They all did a terrific job.

SSP is by far the most authentic environment I have worked in. Here I am easily uplifted and motivated by peers, TAs, professors, and the ideas we share and contribute. - Odelia Lorch '17

In the last days, Drs. Michelle Kirchoff and Kevin Walsh from Southwest Research Institute in Boulder helped teams to extrapolate the fate of their asteroids over the next ~50 million years. Rest assured, none of these asteroids will be colliding with the Earth during that time.

To mention just three other guests: Dr. Larry Sverdrup now holds the SSP record for most appearances. He did his famous series of "Mad? Science!" demos. Physics Nobel Laureate (one of four at CU) Eric Cornell explained precise measurements of the electron dipole moment. Planetary Scientist and Trustee Dr. Janice Bishop '81 gave the Closing Address.

Field trips included the VR lab and Juno probe Mission Control at Lockheed-Martin Space Systems, and a geology hike led by Rockware founder Jim Reed. It was good to see the Milky Way inside Fiske Planetarium, since our trip to a "dark sky site" was clouded out.

We so appreciate the "local group" of SSPers: Doug Duncan '68 (TA '74-'76), Adam Thodey '91, Mathis Habich (TA '15-'16), and Becky Rapf '06 (TA '11-'12). And finally, heartfelt thanks to Seth Hornstein and Fabio Mezzalira at the observatory, Francisco Salas and Nick Conant at Fiske Planetarium, Nicole Simmons in the Physics Department, and Kristine Grosland in Conference Services.

Report from Purdue University

First Time is the Charm

BY DR. MARK HALL, ACADEMIC DIRECTOR



he first SSP in Biochemistry was a huge success. The admissions process attracted and enrolled 24 amazing young people who were prepared, eager to learn, friendly, and hard working. They



quickly formed a supportive community, led Campus T-shirt design by an amazing faculty team. I fear the bar has been set very high for future summers!

The Biochemistry Department at Purdue served as a welcoming host of our classroom, TA office, work areas, and of course the wet labs. Although we had enough space and equipment this year, expanding to full enrollment of 36 next summer will require more electrophoresis equipment, plate readers, incubators, pipettor sets, and especially, more Microsoft Surface tablets. Each participant needs access to a tablet in the lab – particularly for molecular modeling, but also for literature searches, working on reports during the workshops, and other activities that involve data processing and analysis.

I assigned each of eight teams a crop pathogen enzyme that had never before been studied. All teams successfully completed the experimental objectives: purify their enzyme, model its 3D structure; design small molecules to inhibit its activity; model the inhibitors in the active site of their structural models; and write a report of their findings for publication in a public database.

My expectations were unrealistic in some ways, given the time constraints. Fitting everything into 40 days was hard! Teams finished their inhibitor designs too quickly to take full advantage of the structural and biochemical information they had generated. Asking each team to create a complete manuscript ready for publication was naïve. We held three writing workshops ... not enough. Next summer, I will make adjustments in these areas. For example, I'll provide a template for a shorter final report, freeing up more time for inhibitor optimization.

We were blessed with terrific guests, too many to list here. Notably, Drs. Susan Jerian '79 and David Essayan ran a 1½ day workshop on drug

development: everything from pre-clinical studies through Phase III clinical trials and FDA approval. Dr. Matt Geller '64 led another, on making the leap from science to getting a new drug to market. Fellow Purdue Biochemist Joe Ogas '81 – who first encouraged me to develop this project for SSP – was not exactly a guest, but gave a guest lecture and helped in many other ways. We took wonderful field trips, both recreational (canoeing, hiking) and scientific (Dow Agrosciences, Eli Lilly, Argonne National Lab).

Associate Academic Director Dr. Stefan Paula's expertise on molecular modeling was essential, and he spent many extra hours in the labs. Gary Einhorn was very effective as Site Director, proactive in dealing with any problem, while showing in many ways his concern for participants' wellbeing and success.

The TAs complemented one another in skills and personalities. GiHun Choi was especially qualified as a mentor in the lab, with a great personality that participants loved. He cared about them and went way beyond the call of duty. I knew John Whitney from my courses and he did not disappoint: an absolute workhorse, and a real asset on the non-academic side with his campus knowledge. Ioana Plesca's two summers of SSP TA experience was a huge asset. Participants both liked and respected her. She clearly loves SSP and really puts her heart and soul into being a TA. Rochelle Camden put a lot of time and effort into making SSP fun for the participants, while being very serious about taking good care of them.

I felt so free at SSP - free to work hard, play hard, and live as myself. Through all our struggles and successes, I have not only created incredible memories, but also learned invaluable lessons. - Emily Wang '17

CHIEF ACADEMIC OFFICER'S REPORT

by Dr. Amy Barr Mlinar '94

This year marks a turning point for SSP. For the first time, we have run a summer program focused on biochemistry. Having spent time on each of the SSP campuses this summer, I am very pleased to say that the biochemistry program retains the rigor, supportive culture, and playful character one expects at SSP, while exploring a new and exciting area of science. All of us are thrilled to have provided this experience to an additional 24 students, and to a group of students who might not have applied to a purely astronomy-based program.



As we enter a new era, SSP faces new challenges. I have been charged to kick off new initiatives behind the scenes to ensure our continued success: a quantitative assessment of how SSP changes students' attitudes toward science and research; streamlining our admissions practices; recruiting new faculty; providing more training and constructive feedback for faculty; and planning for expansion of SSP into new campuses and new curricula.

To continue expanding SSP while maintaining its quality, we need additional hands and fresh eyes, drawing from the expertise in our alumni base, and from non-alums who appreciate our educational mission. As always, I welcome members of the community to contact me with input at any time: cao@ssp.org.

Thank you for your continued support of SSP. I will report my progress in subsequent editions of the UT.

Dr. Amy Barr Mlinar is SSP's first Chief Academic Officer. She is class of '94, former TA, longtime Trustee, and a working research astronomer.



The Boulder campus featured our first-ever all-alumni teaching faculty (L to R) Michael Dubson '73, Lindsey Whitesides '12, Tracy Furutani '79, Jonathan Joo '12, Tanay Bhandarkar '12, Cyndia Cao '12 on the observing deck of the campus observatory, just across the street from our dorm.

SSP AND HARVEY MUDD, TOGETHER AGAIN



Our ties with Harvey Mudd College in Claremont, California go back to the 1960s, when HMC helped operate SSP in an informal consortium with Caltech, Pomona College, and Thacher School (the original host campus). Over the decades, 63 SSP alumni have enrolled there, including 8 current undergrads.

Recently SSP signed an agreement with Dean of Faculty Lisa Sullivan, to establish Harvey Mudd as an "academic partner" of the Summer Science Program. The agreement outlines several areas of possible cooperation, ranging from recruiting Mudders to teach at SSP, to potentially moving SSP's administrative headquarters to their campus.

COLLEGE DESTINATIONS OF 'I6ERS

Amherst	Maria Eduarda Belota Moreno, Yuanyi Yin
Caltech	Olivia Durrett, Rosita Fu, Jae Yoon Kim, Kenyon Prater, Yuchen Tang
Cambridge	Valentinian Mihai Lungu, Aida Sánchez Ricol
Columbia	Stanley Yu
Cornell	Arpit Kalla, Collin Montag
Duke	Anna Kasradze, Rahul Ramesh
Georgia Tech	Sara Branham
Harvard	Gayatri Balasubramanian, Zachary Gelles, Arian Mansur, Victor Qin, Devin Srivastava, Elisa Zhao Hang
Harvey Mudd	Kathryn Chan, Nathaniel Sunbury, Daniel Torres
МІТ	Kevin Chen, Brin Harper, Ivy Huang, Eun Young Jung, Anna Khoroshilov, Gabriel Mintzer, Giramnah Pena-Alcantara, Luke Qi, Michal Reda, Nolan Reilly, Sonia Reilly, Nestor Santia- go-Perez, Abigail Stein, Michelle Tang, Afura Taylor, Annie Yun, Emily Zhang
Nat. Univ. of Sin- gapore	Faiqa Dawood
Pennsylvania	Haroni Amare
Princeton	Neha Anil Kumar, Douglas Chin, Jason Kim, Hernan Valles, Yan Zhang
Sabancı University	Pranav Kalra
Stanford	Nicholas Becker, Annie Chen, Francesco Insulla, Kalyani Ramadurgam, Malick Sere, Chris Wang, Amber Yang, Lucy Zhu
Tufts University	Lilianna Houston
UC Berkeley	Manan Khattar, Bryan Portillo, Alice Zhao
UC Santa Barbara	Yiluo Li
UNC Chapel Hill	Sarah Lipstone
Univ. of Chicago	Jessica Metzger, Molly Sokota
Univ. of Michigan	Alexander Davenport, Rashika Rao, Julian Tarazi
Yale	Andong Cao, Abigail Mintz, Anna Rose Polish, Keshav Raghavan, George Sabatakakis, Zhengdong Wang

We were extremely impressed with our son's participation at SSP 2017. Nick truly had an awesome experience and came back with the biggest smile on his face, and with 35 new friends. He was challenged academically beyond what he could have received in his school. Through many failures and long hours, he felt honored to be part of a group who collaborated and persevered together to achieve success.

- Clint and Kristin West, parents of Nick West '17





Business Office: 108 Whiteberry Dr Cary, NC 27519 Address Service Requested



by Dr. Michael Weiss '74, Board Chair

By now you've heard: following four years of development and testing, as funded by the Gordon and Betty Moore Foundation, the classic asteroid project has been joined by one in protein biochemistry, created by Mark Hall at Purdue at the



urging of his colleague Joe Ogas '81. Its enormous success this summer proves that SSP's unique design isn't limited to one field of science.

This August saw the largest-ever cohort of new alumni: 96. They shared the exhilaration—and sheer exhaustion—of tackling a challenging scientific problem together. Thanks are due to the volunteers on our admissions committee for the daunting task of selecting participants from an outstanding and growing pool of applicants. The applicant pool is remarkably diverse in many dimensions, including geography, ethnicity, and gender. But an admission rate under 10% means we must turn away hundreds of well-qualified applicants who would benefit greatly from the "secret sauce" of SSP.

Should we expand SSP further? Your Board is exploring the timing of a second Biochemistry campus. We also retain as a strategic asset a Metagenomics project that was developed in parallel. I welcome your thoughts; write to me at chair@ssp.org.

SSP is a jewel of an institution, well worthy of our support. We'll mark its 60th Anniversary with a Celebration on July 14th in Boulder. I hope to see you there!

12