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Twenty Years of an Independent SSP

by Richard Bowdon '74, Executive Director

Summer 1999 was the last SSP at Thacher School. We alumni knew it to be a uniquely valuable educational experience, worth saving. So we decided to try to continue it elsewhere. That meant incorporating as independent nonprofit. Twenty years ago this fall, five of us filed the paperwork and got to work. We didn't know how to run a summer program ... we didn't even know exactly what about SSP made it so transformative (what we called the "secret sauce"). So we changed as little as possible.



Fast forward to 2019. By now we've fully deconstructed the recipe. We know what can be altered: the location, the field of science ... and what can't: the collaboration, the values and traditions, the honor code, the integrated academic and residential faculty roles. These are essential ingredients in SSP's design that create its life-changing impact on young people.

Pros and Cons of Independence

Most academic summer programs are operated by the host campus, and taught by its faculty. Only a handful of independent programs exist. The Summer Science Program is not only independent, it's ultimately controlled by its "members": alumni, former faculty, and other supporters.

We are masters of our own fate. We need no one's permission to maintain SSP's values and unique traditions. We can make admissions decisions with absolute integrity, with no preference for children of donors, Trustees, or other insiders.

By now SSP has existed on seven campuses and in two fields of science: 82 programs over 61 years. In every one, dedicated faculty have done their best to ensure that all 2,761 participants receive every benefit of the authentic SSP experience.

Continued from pg. 1

We, the above-mentioned initial directors of this corporation, hereby declare that we are the persons who executed the foregoing Articles of Incorporation, which execution is our act and deed.



Our independence has made, and still makes, that possible. But independence has its challenges. Here are three:

- We operate without a financial safety net. SSP survived after Thacher only because individual alumni, parents, and other friends came to its rescue. That support still keeps us going. If it ever ended, so would SSP.
- Most colleges run their "conference services" as a commercial, for-profit sideline, charging outsiders what the market will bear.
- We have to find faculty willing to leave their homes, families, and routines for six weeks.

"In-house" programs don't face those challenges.

Maybe you can help. Are you, or someone you know, potentially willing and able to teach at SSP in a future summer, whether in astrophysics, biochemistry, or some field new to us? Can you suggest a potential future experiment or host campus partner? Email me at execdir@ssp.org. And of course, we always welcome your financial support, and your time volunteering for a committee or special project. Thank you!

New Community Members Named

SSP's members are alumni, former faculty, and others recognized by the Board of Trustees as having contributed to the program's success over multiple summers. At its Planning Meeting on Oct. 6, the Board welcomed these individuals to our extended family:

Gillian Andersen	The spouse of longtime faculty member Bill Andersen, Gillian leads a workshop on technical writing for SSPers at New Mexico Tech each summer.
David Essayan	David helps us evaluate new project proposals, and since the Biochemistry pro- gram opened, co-leads a workshop on drug clinical trials with his spouse Susan Jerian '79.
Woody Halsey	As the son of SSP's first Director, the late MacDonald Halsey, Woody literally grew up with SSP as part of his life and has stayed in touch as an adult.
Tyrone Hayes	A longtime and popular guest speaker, Tyrone gives an unforgettable talk on the environmental effects of the herbicide atrazine.
Michelle Kirchoff	A Research Scientist at Southwest Research Institute, Michelle organizes and leads a workshop on nonlinear orbit dynamics, a natural extension of analytical orbit determination.
Nina Lanza	Nina is a Los Alamos National Lab scientist, and longtime and popular guest speaker.
Jon Swift	The resident astronomer at Thacher School, Jon spearheaded the renovation of its venerable observatory. In August he led a tour of the observatory for an SSP '84 reunion.
Lea Ybarra	Lea is former CEO of the Center for Talented Youth at Johns Hopkins. She serves on the Nominating Committee and as an advisor for strategic planning.

2019 By the Numbers

How do teens first hear about SSP?

Some find us online, others are told by a parent, teacher or peer, or by one of our academic partners. A multi-channel recruiting effort keeps the applicant pool diverse.

How many apply each year?

Applications hit another record of 1,321, for an overall admission rate of about 11%. That puts a strain on the Admissions Committee but allows maximum flexibility.



Is there any difference between the applicant pools for Astro and Bio?

Each had almost exactly the same number of applicants: just over 650 for 72 spots. Interestingly, more females applied to Bio (55/45), and more males to Astro (64/36). By design we maintained 50/50 gender balance at every program.



How much does SSP cost?

SSP is relatively long, therefore relatively expensive: \$7,150 this year. Like colleges, we determine financial need from parents' tax returns. Unlike colleges, we guarantee to meet all demonstrated need with grants. Total aid has grown with SSP's expansion, exceeding \$400,000 this year.

Where do the students come from?

School Location

Short answer: everywhere. We continue to enroll over a quarter from California, and half a dozen at each program from outside the U.S., always including China and India.





Indiana Illinois

FALL 2019

SSP in Astrophysics at New Mexico Institute of Technology

by Dr. Adam Rengstorf, Academic Director



After 18 problem sets, 85 observing shifts, 3 dozen Method of Gauss Python programs with convergent solutions, and a dozen team submissions to the Minor Planet Center and Orbit Determination final reports, we have 36 wonderful new alumni.



Each summer, participants quickly make the program their own, setting the tone and creating the community. This summer in particular, I noticed how compassionate these teens were, working to build each other up and help each other. They instantly embodied the spirit of SSP, both academically and personally, and made the summer smooth and fun.

This was my 6th summer as NMT Academic Director, working with Assistant AD William Andersen, and my 4th with SD Barb Martinez. An all-alumni TA corps of Cyndia Cao '12, Anthony Flores '14, Descartes Holland '12, and Emma Louden '15 rounded out the team. Among us, we had the combined experience of 40 SSPs!

Dr. Andersen taught all the calculus, physics, and orbital

The intensity of every aspect of SSP is different from anything else I have ever experienced. Every part of SSP has felt like a heightened sense of reality. I have never worked so hard in my life and yet feel so refreshed.

- Jonah Henry '19

dynamics. I taught astronomy, observational technique, data reduction, astrometry, photometry, and the Method of Gauss. Ms. Martinez took care of everything outside of the classroom with her usual expertise and kindness. Returning "visiting faculty members" Aaron Bauer '06 and Gillian Andersen taught Python and led a workshop on scientific writing.

We kept the participants busy with 18 problem sets, observing notebooks, weekly team research reports, QoDs, and evening tutorials as needed. A problem set or code was due every night at midnight, except Sundays, field trips, and other special events.

Suitable near-Earth asteroids were scarce this summer – I had to fill in with a couple of Mars-crossers – but we did have two "potentially hazardous" asteroids. All the teams did very well, especially considering how difficult some of the asteroids were to image, and more clouds than last summer. The telescopes at Etscorn Observatory were in prime condition thanks to its late Director Dan Klinglesmith, who died of cancer soon after SSP ended. "Dr. Dan the Astroman," who helped with all 17 SSPs at NM Tech, will be sorely missed.

Field trips included White Sands National Monument, the Very Large Array, Magdalena Ridge Observatory, and the very cool Astronomical Lyceum run by John Briggs '76. We also visited EMRTC and Santa Fe and did some local hiking.

Another successful SSP program at New Mexico Tech is in the books!

SSP in Astrophysics at the University of Colorado at Boulder

by Dr. Agnès Kim, Academic Director





On July 31st, I reluctantly returned 36 changed teenagers to their families and "normal life." Through rain or shine (metaphorically and literally), they had just worked their way through six weeks of relentlessly collecting and reducing data, to determine the orbit of their asteroid and submit their observations to the Minor Planet Center.



This was my second year serving as AD at Boulder, reuniting with Mike Dubson '73. We also welcomed back TA Bradley Emi '13. Three new TAs, Helen Cai '15, Julia Wei '14, and Jerry Xuan '14, hit the ground running. Our TAs

bonded with each other and with the participants, each bringing their personalities into the relationships. They challenged participants to work up to potential and offered loads of advice on life in college and beyond. It was an honor to work with them.

We welcomed a new Site Director, Richard Witt, an aerospace engineer now teaching physics at Ladue Horton Watkins High School in Missouri. Rich could do anything from optimizing roommate assignments to navigating the Byzantine CU parking bureaucracy. He brought a fresh perspective, using his experience as a teacher to anticipate participants' needs.

We got off campus sometimes, to hike the beautiful foothills nearby, and to visit the pedestrian mall in downtown Boulder for shopping and swing dancing. On the way back from Lockheed Martin Space Systems, headquarters of the Juno mission to Jupiter, the bus overheated, continuing the SSP tradition of being temporarily stranded.

Our terrific guest speakers included two alumni/Trustees, Mike Teorodescu '06 and Doug Duncan '68. Eric Cornell spoke for the fourth time, giving an accessible, riveting lecture on ultracold atoms. Not many high school students get the chance to chat with a Nobel Laureate!

This summer we asked the Southwest Research Institute scientists to lead their workshop on nonlinear orbital dynamics a few days earlier, so participants could include the results in their final reports. We required Monte Carlo simulations from every team. Participants again used Overleaf (LaTeX) to format their reports.

Teaching at SSP is thrilling. We get to create an environment where everyone can fit in, do real science, make lifelong friends, and go home with new confidence. While their academic preparation varied widely, in the end, all completed the program successfully. The talent show on the last night climaxed with a TA-led sing-along and an emotional group hug.

What was initially a daunting experience has now become perhaps the most defining 6 weeks of my life. In SSP I experienced my first taste of being an independent researcher, made friends, and learnt more about science and myself than I would have thought possible.

- Avantika Garg '19

SSP in Biochemistry at Purdue University

by Dr. Mark Hall, Academic Director



In 2019 I was happy to welcome back Associate AD Stefan Paula and his computational modeling expertise. New Site Director Debra Arvin did a wonderful job organizing guest speakers and field trips, and ensuring participants' safety, health, and happiness. She drew from her years



of experience as a high school teacher and basketball coach, including the "break on 3!" routine to end dinners.

A wonderful TA team held everything together, providing constant guidance, mentoring, and support. John Whitney anchored the team, in his third summer, training the other TAs in the fine art of protein biochemistry and everything else. Kelsey Bullens, a recent graduate from Purdue's biochemistry program, knew the campus inside (the lab) and out. Julianne Yang fit in right from day 1, putting her biochemistry undergraduate degree from "the fine institution" of U Illinois to good use. She ran the daily QOD contests, the program blog site and Instagram account, and took most of the photos. Bernardo da Silva '12, a Princeton molecular biology major, brought his understanding of SSP culture and traditions. A huge addition this year was Lab Assistant Gabrielle Buck, another Pur-

SSP is a journey of discovery, exploration, collaboration, and reflection. SSP has shaped my perspective, my goals, my aspirations, and my very self.

- Alex Dong '19

due biochem major. Gabby unfailingly set up the labs every day, preparing reagents, testing equipment and procedures, and helping participants.

We welcomed guest speakers Warren Rogers '76, Minosca Alcantara, and three Purdue professors: Christina Li '03, Pete Pazcuzzi, and Phillip Low. For the third year, Susan Jerian '79 and David Essayan put on a two-day workshop on clinical trials in drug development. Field trips to Argonne National Lab, Eli Lilly, Corteva Agriscience, Indiana Dunes, Turkey Run State Park, and Tropicanoe Cove Water Park rounded out the program.

The expression "work hard, play hard" fits every SSP. The project isn't easy. This summer mistakes were made: assays had to be repeated; enzymes became inactive;

mystifying kinetic curves were occasionally produced. However, by departure day, all twelve teams had identified at least one rational design for potential fungicidal compounds to protect crops from devastating pathogens.



As I have come to realize, the SSP experience is much more than the experimental project. The overall design, the close community of bright young minds figuring out science together, makes for a truly unique and memorable summer, emphasized by the abundance of tears shed as we all said goodbye.

06

SSP in Biochemistry at UC San Diego

by Dr. Betsy Komives and Dr. Martha Oakley, Academic Directors







Together, we did it! Cloning Mark Hall's research project in enzyme modeling and inhibition wasn't easy, even with his lab protocols, lecture slides, and even three veterans of SSP '18 at Purdue. We shared the Academic Director duties, assisted in the teaching by



Barry Grant, an expert in bioinformatics and molecular modeling. Everyone benefitted from the resourcefulness of Site Director Laura Corley, who, in spite of the challenges of a new campus, handled the logistics of field trips, guest speakers, and all the participants' nonacademic needs.

Four recent college graduates served as our outstanding TAs: Emily Overway, Joe Forzano, Tyler Natof, and Rachel Blake. They worked tirelessly as lab instructors, tutors, and mentors. We never could have gotten through the project without Emily, who took a leadership role for both the academic and residential aspects. Joe's unflagging energy and ability to catch on quickly amazed us. Tyler's interactions with participants showed quiet perception and maturity. Rachel navigated the local landscape and made everything more fun. 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 weekends.

Twelve teams of three participants purified a novel fungal pathogenic enzyme, assayed its activity towards 24 substrates and 11 inhibitors, and then predicted its structure and compound binding in silico. Several teams were able to identify an irreversible inhibitor binding site, using proteomics mass spectrometry. Following the Purdue tradition, after departure we printed a 3-D model of each participant's enzyme and mailed it to them.

Field trips to Eli Lilly and Vertex opened participants' eyes to the newest technologies in drug discovery. Drs. Susan Jerian '79 and David Essayan presented the gripping story of how a drug makes it to market. UCSD Executive Vice Chancellor Elizabeth Simmons '80 and her spouse, physicist R. Sekhar Chivukula '78, joined us for dinner one evening. We resumed the old tradition of Wednesday afternoon beach trips. Our last trip was to the famed San Diego Zoo.

The hugs and tears on Departure Day, and the follow-up thank-you notes and emails, told us that despite some bumps in the road, we managed to give the authentic SSP experience to these 36 budding young scientists.

I come from a low-income family in an area with few opportunities. This program has reinvigorated my interest in a biochemical career and has allowed me to make friendships that I will never break. In essence, SSP truly is the educational experience of a lifetime.

-Harry Heiberger '19



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Letter from the Chair

by Dr. Michael Weiss '74, Board Chair

What a year in astrophysics! The 50th anniversary of Apollo 11, the Nobel Prize in Physics for the discovery of exoplanets, and an image of a black hole attest to the continuing vibrancy of the first science.

This year's SSP participants shared in this excitement—honoring a legacy begun in 1959. The Biochemistry project launched at Purdue three summers ago, and "cloned" at UC San Diego this past summer, showed that our "special sauce" isn't limited to astrophysics.

What's next? Chief Academic Officer Dr. Amy Barr Mlinar '94 is now evaluating project proposals in the emerging field of metagenomics. Exploiting the genomics revolution and big data, metagenomics promises to be as foundational to 21st-century biology as Newton's laws are to physics.

In the lifetimes of SSP '19 alumni, I predict evidence will be found for extraterrestrial life. Elements of each of these fields – Astronomy, Biochemistry, Genomics – will be central to this profound milestone in humankind's relationship to the universe!

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