Open Call for Research Project Proposals

The Summer Science Program (SSP) is one of the longest-running research-based enrichment programs for highly gifted high school participants from around the U.S. and the world. Enrollment at each campus is limited to 36, mostly rising high school seniors. See summerscience.org.

SSP seeks proposals for new research projects in the areas of genomics/bioinformatics, broadly defined, to challenge high-achieving teenagers. Appropriate projects will meet certain criteria, described below.

Author(s) of the winning curriculum will receive the $2,500 Curriculum Prize, and can propose for funds to support all costs related to curriculum development and testing, including summer salaries, equipment, and consumables.

Program Design and Goals

The Program’s goal is to accelerate the development and raise the aspirations of its participants. Applicants are evaluated through a holistic process very similar to that of highly selective colleges. We admit roughly 10% of applicants, those excelling in the most challenging math & science courses available to them, and showing evidence of maturity and motivation, especially in the face of obstacles. These young people arrive with great potential; SSP inspires them to “realize” that potential in both senses of the word.

Participants do authentic, hands-on research from start to finish, working in teams of three. Since 1959, participants have researched asteroid orbit determination. In 2017 we added a second project, in Biochemistry: enzyme modeling and inhibitor design.

Participants find collaborative research to be a refreshing and motivating contrast to the competitive, individualized coursework of high school. Many are surprised to discover that being surrounded by equally bright and interesting peers is as rewarding socially as it is intellectually. Indeed, cultivating a supportive community of scholars is another primary goal of SSP. The spirit of cooperation and collaboration is reinforced by an Honor Code and an absence of exams, grades, or formal credit; the experience itself is the reward.

Inspired by this intense, 39-day immersion in a scientific community, most SSP alumni choose STEM majors at leading colleges and universities. Many have gone on to become leaders in their chosen professions, and cite the Program as “the educational experience of a lifetime.”

Faculty

The senior faculty on each campus includes two PhD-level scientist / educators and a Site Director. Four Teaching Assistants and Residential Mentors, as the title implies, integrate academic and residential/social roles. Graduate or upper-class college participants majoring in a related field, many are alumni returning to SSP. This integration allows mentoring and collaboration to continue during all waking hours.
Submission
Submit questions and proposals by email with your CV to Dr. Amy Barr Mlinar, Chief Academic Officer, cao@ssp.org.

Required Criteria for New Projects

1. **Common research.** Each team of 3 or 4 participants will conduct the same or very similar research, but will generate their own data. Depending on the nature of the project, this might be research on a specific target, or creation of a new entity or some other unique data set and outcome. It may require collaboration not only within teams but also across teams. Each team could be responsible for generating one aspect of a larger project, such that data from all teams are needed for the final analysis. There are many possible scenarios. The key is that all teams employ the same research techniques and tools.

2. **Scientifically relevant.** The common project should not be a mere lab experiment, for which the “correct results” are known in advance and would not advance science in any way. It should be reasonable to expect its relevance to be maintained for at least five years, preferably longer.

3. **Duration.** The experiment or measurements and analyses can be reliably started and completed in about 35 calendar days by each team of 3. Successful completion need not be guaranteed, but should be a reasonable expectation if prescribed procedures and techniques are followed.

4. **Novel material.** Most of the available ~120 hours of classroom time are needed to teach concepts not normally taught in AP-level high school science courses, so that few, if any, participants arrive already knowing the specific academic material and experimental techniques that will be required.

5. **Challenging.** The difficulty of the project and related academic material is at an undergraduate college level. Highly gifted rising high school seniors will be challenged to digest the material at the rapid pace it will be presented. As with most research, no one can do it alone.

6. **Experimental concepts.** The project involves exposure to many key concepts of experimental science, such as experiment design, controls, data reduction, error analysis, calibration, signal-to-noise ratio, statistical analysis, etc. as applicable. Participants are forced to face experimental realities such as negative, ambiguous, poor quality, or unexpected data and/or results.

7. **Accessible, transferable techniques and equipment.** Required equipment is available at multiple college campuses. A project requiring custom, leading-edge, unproven, or particularly hazardous techniques or equipment would make it difficult to find faculty to teach the program and a campus to host it.

Recommended Criteria

8. **Minimize “black boxes”.** The project is taught from first principles, avoiding the use of techniques or equipment that would allow participants to do the project without meaningful understanding of the underlying science.

9. **Interest level.** The project involves an area of science that has above-average appeal to participants, because it is perceived to be particularly exciting and relevant.

10. **Interdisciplinary.** The project draws from more than one field of science, and possibly non-STEM disciplines such as socioeconomics.

11. **Computer Science.** Computer programming techniques and skills are needed for data reduction and/or analysis.
12. **Accountability.** Each participant or team “owns” a specific target, measurement, or outcome.

13. **Reasonable costs.** The cost per participant for consumables and access to equipment is no more than a few hundred dollars.

### Additional Information and Context

#### Background on SSP’s Design

SSP participants, rising high school seniors from around the U.S. and the world, are among the most promising of their cohort in terms of potential for future contributions to STEM or other professions. They are carefully selected for motivation, talent, and maturity; in 2018, 1142 applied for only 108 spaces. They arrive with the best preparation that could be expected of any high school participant anywhere. Our goal is to challenge them up to and beyond their considerable abilities.

Enrollment at each campus is a diverse population of 36 participants (with female/male parity in recent years). Resident faculty include an Academic Director (AD), Associate Academic Director (AAD), four Teaching Fellows, and a Site Director. The AD and AAD – typically doctorates with university teaching experience – divide the classroom time, assign homework, and oversee the progress of participants through a project/experiment that is undertaken over the duration of the program. The Teaching Fellows – upperclass undergrads or graduate participants in their first or second year – provide guidance to the participants in completing their experiment, conduct tutorials, and act as residential advisors in the dorm. The Site Director is responsible for residential, health, and administrative matters.

Several crucial aspects of SSP’s overall design should be continued in any new program. There is tight integration between the core project/experiment and the rest of the program. Participants work in teams of 3 (or possibly 4). Each team conducts the entire hands-on project from start to finish: collect data, perform quality control, reduce the data, analyze it, and write a final report.

Classroom time must be carefully planned to enable participants to master the first principles underlying the experiment. In other words, lectures support the project explicitly, with little time for other material. The level of presentation is similar to a typical course for college sophomores or juniors, but the pace is even faster. There are no tests or grades. Participants are expected to work collaboratively within the bounds of an Honor Code.

The schedule features:

- 39 days and 38 nights in continuous residence for participants, and about a week longer for faculty
- Classroom time: up to eight, 3-hour blocks per week, totaling ~120 hours over the entire 39 days.
- Laboratory / Research Time: Time dedicated to the experiment and analysis; keeping the participants challenged and working hard is essential, including most evenings.
- Homework: designed to supplement learning, to be very challenging and to encourage participant collaborations. Homework is checked but not graded. There are no tests.
- Field trips to scientific, cultural, and recreational destinations in the area
- A guest lecture and reception about once a week, offering participants direct encounters with notable scientists and other professionals

Participants complete SSP with enhanced aspirations for college and career, many self-identifying as scientists for the first time. Most subsequently enroll at MIT, Caltech, Stanford, the Ivies, and other selective institutions. The Summer Science Program has changed the lives of over 2,200
young people, launching most into fruitful careers in STEM research or applications, and motivating them to “give back” to the Program, even decades later. Since 2000, SSP has been the only summer enrichment program operated and largely funded by its own alumni.

For more information visit [www.summerscience.org](http://www.summerscience.org).
Frequently Asked Questions

Q) Is funding offered by SSP for new project development?
A) SSP has received a private donation to support the development and testing of a new project. The top-ranking project will receive a $2500 prize and the opportunity to propose for funds to support all costs related to curriculum development and testing, including salaries, equipment, and consumables.

Q) What is a typical time frame from project proposal to deployment?
A) During our last curriculum expansion, the project was developed during the summer of Year 1, tested with ~a dozen select students during the summer of Year 2, followed by the deployment of a new program (24 students, two faculty, four TAs, and a Site Director) in the third year.

Q) Is it assumed that the author(s) of a project proposal would also be available to teach it if deployed by SSP?
A) Ideally, the author will be willing to lead its development and testing, and teach it if deployed. If that is impractical, we will work with the author to find alternatives.

Q) It is absolutely necessary for participants to collect their own data? Much research today is done on high-quality data that is either publicly available or generated on request elsewhere, such as an offsite lab or remote sensor.
A) Yes. At least some participant-acquired data must be used in the project, and more is better. Participants should experience the messiness of hands-on experimentation, so their own data should be a necessary part of the project. Data acquired elsewhere by others and simply provided or downloaded, does not meet this requirement. Participants must use equipment besides a computer.

Q) Must the experiment / project be completed by the end of the program, or may participants continue working on it afterward?
A) Participants need to feel a sense of closure and completion before they return home. Ideally though, they would have the option to pursue a follow-up or extension of the project from home.

Q) SSP’s design includes up to ~120 hours of “classroom time”. Should that be traditional lecturing, or could it be lab time, small working groups, or a “flipped classroom”?
A) Any productive use of the time is fine.