AUBURN
UNIVERSITY
College of Sciences and Mathematics

Summer Science Institute

Frequently Asked Questions (FAQ)

1. What is AU Summer Science Institute?

Summer Science Institute at Auburn University is a summer science program for rising 11th – 12th grade students with high aptitude and interest in the fields of **science and mathematics**. The program, supported by the College of Sciences and Mathematics (COSAM) at Auburn University, partners students with experienced AU Science and Math research faculty to explore topics more advanced than what is typically taught in a public or private high school environment. In 2023, the program will occur **June 4-10**.

**Students who are particularly interested in engineering should consider applying to the Auburn University Senior Tigers Engineering Camp for rising 11th and 12th graders instead of the Summer Science Institute.*

2. What is the cost?

Cost: FREE TO YOU! There is a $2500 registration fee per student for program administration. However, the Summer Science Institute is offered at **NO COST** to participants due to financing of registration fees through grants and sponsoring organizations at Auburn University. **All educational and recreational programming, meals, and lodging are provided free of charge to the chosen participants.** **Students may wish to bring some 'pocket money' for items such as souvenirs and extra snacks, but you do NOT need to submit any fees with registration.*

3. What is the application process?

A limited number of students will be chosen each year on an academically competitive basis. Applications are available online (www.aub.ie/outreachssi) each Fall and are due by January 31. Applicants will be notified on or before March 27 of acceptance into the program.

4. When is AU Summer Science Institute?

The program occurs for 6 consecutive days (Sunday through Saturday) during the month of June.

5. What is the daily schedule for Summer Science Institute?

Accepted participants receive week-long college experience and reside in a residential hall on the Auburn University campus while following this general schedule:

Daily Schedule	
7:30 a.m. – 8:15 a.m.	Breakfast
8:30 a.m. – 11:30 a.m.	Morning Instructional Period
11:45 a.m. – 12:45 p.m.	Lunch
1:00 p.m. – 4:00 p.m.	Afternoon Instructional Period
4:15 p.m. – 5:15 p.m.	Campus Tour/Speaker
5:30 p.m. – 6:15 p.m.	Dinner
6:30 p.m. – 9:30 p.m.	Fun Nighttime Activity
9:45 p.m. – 10:45 p.m.	Downtime at the dorm
11:00 p.m.	Lights Out

6. Who is designing and facilitating this program?

Dr. Allen Landers (Professor and Chair, Department of Physics) and Mary Lou Ewald (Director, COSAM STEM Outreach Center) work with faculty representatives from each of the five departments that comprise the College of Sciences and Mathematics at Auburn University (Biological Sciences, Chemistry and Biochemistry, Geosciences, Mathematics and Statistics and Physics) to design a truly unique and advanced experience for SSI participants. Dr. Landers' research and outreach expertise in combination with the extensive program development experience of our STEM Outreach educators result in a program that is like no other in the Southeast.

7. Who will be supervising the students?

During the day, students will be supervised by faculty members and graduate students in the college. During the evening, students will be supervised by counselors who are undergraduate and graduate students in the sciences and mathematics.

All Summer Science Institute instructions, counselors and staff undergo a rigorous application and screen process following Auburn University camp personnel policies. All personnel have extensive experience working with K-12 students and undergo Federal background checks. Students will be supervised 24-hours/day.

8. What types of activities will students engage in during instructional sessions?

The follow is a list of instructional modules that previous Summer Science Institute participants engaged with:

Biomimicry (Biological Sciences): The students were tasked to create an efficient building or city in a hot desert, using adaptations animals and plants use to conserve water, enhance structural strength, and avoid/generate heat.

Materials Physics (Physics): As part of the materials physics module, students learned the importance of understanding and controlling the properties of materials. This knowledge allows us to not only better learn about matter interactions at the atomistic scale but also development of new and more efficient technologies that positively impact our wellbeing.

Biophysics - Assembling Lipids (Chemistry/Biochemistry): As nature's material choice for cell packaging and compartmentalization, lipids are fascinating to study and their assemblies elegant to behold. Consisting mainly of three straightforward hands-on experiments, this module presented the key concepts in lipid assembly chemistry to SSI students. Lipid phase separation, an important area of current membrane biophysics research, was also covered.

Solar Cells - Energy Conversion and Storage (Physics & Chemistry/Biochemistry): Students learned about solar energy conversion and battery storage. Instructors emphasized the need for both technologies to mitigate climate change and satisfy the energy demands of the world. Students measured the efficiency of solar cells and constructed their own batteries using copper and zinc.

Changing color with electricity (Chemistry and Biochemistry): Conducting polymers are being developed for electronic applications ranging from bioelectronics to electrochromic (color-changing) displays. Instructors conceptually introduced polymers and discussed how their chemical structure can be designed to create new materials properties, including charge conduction. Inspired by the discovery of conducting polymers that lead to the 2000 Nobel Prize in Chemistry, students synthesized a conducting polymer film electrochemically using a D battery to create an electrochromic display. After this, students built a simple 2-battery circuit to apply different electrical potentials to the polymer film, causing redox chemistry reactions that led to a few different colors of the display (colorless, green, and blue). The optical origin of color and how light absorption is sensitive to differences in the chemical structure of the polymer was discussed. We ended the module with a demo of an absorbance spectroscopy experiment, in which we watched the polymer absorbance spectrum evolve in real time as the color of the film changed upon applying different electrical potentials.

Plant Genomics (Biological Sciences): Students isolated DNA from corn plants as well as different types of corn chips, such as Doritos, Cheetos, and "GMO-free" Simply Tostitos. While it was fun to check who got the most DNA out of each of these, it also allowed us to check which of these are transgenic or genetically modified, with the examination for presence of foreign DNA by PCR, followed by the running out of any PCR amplified products by gene electrophoresis. Discussion of transgenic plants was done along with findings that most corn snack chips are genetically modified since they are made from GMO corn.

Genetics and Behavior (Biological Sciences): We all know what makes us grumpy, but do other animals experience similar responses to, for example, lack of food or sleep? Can we use the humble fruit fly, that is obviously very different from a human, as a model organism to better understand how these kinds of environmental effects impact aggression and eventually identify genes involved? This activity showed students how model organisms are used in fundamental research, guiding them through the steps of observation, hypothesis development, data collection, and analysis with an experiment examining aggressive behavior in fruit flies. Students looked at aggressive behaviors in flies that were starved and in those exposed to an aggression inducing pheromone, as well as controls. They looked at whether these treatments impacted aggression and whether males were different from females.

Computational Chemistry in the Web Browser (Chemistry and Biochemistry): Students used laptops to draw molecules and submit calculations. One of the big AU computers did the number crunching and sent the results back to us. Then the students could look at structures and spectra to visualize the molecular vibrations and bond orbitals. Split into groups of 2 or 3, the participants designed and performed calculations to answer important chemical questions:

- how is it possible for some noble gas atoms to form chemical bonds?
- how does a cluster of water molecules stay together with hydrogen bonds?
- why is triallene C_4H_4 planar, but diallene C_3H_4 is not?
- why is carbon dioxide a greenhouse gas?
- what do most chemistry textbooks get wrong about the structure of phosphoric acid?
- what are the most and least strained hydrocarbon rings?

Diving Deep into Development and Diversification (Biological Sciences): Students learned about the diversity of invertebrate organisms that live in the oceans. Students studied animals from different phyla, including sponges, corals, bivalves, snails, bristle worms, crabs, brittle stars and sea urchins. Using similarities among the organisms, they constructed a phylogenetic tree to learn the evolutionary relationships among these animals. Students also fertilized sea urchin eggs and tracked their development under different temperature conditions. Finally, students visualized different stages of sea urchin embryogenesis using microscopy and learned about animal development.

A Hands-On Introduction to Applied and Computational Mathematics (Mathematics and Statistics): How can mathematical models and numerical methods be used to solve real-world problems arising in various areas such as engineering, physical and biological sciences, computer science, and social sciences? This module helped to answer that question via intuitive explanation and simple examples such as the population growth model and heat transfer in one and two dimensions. Students also learned to perform numerical simulations with MATLAB - a high-level programming language for numerical computation, visualization and programming.

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