

2016 High School Science Summer Schools and Apprenticeships at HWI

Dates for the two summer programs for 2016 are July 5-22 and Aug 1-19 (9:00 AM to 3:00PM daily). Students who can commit to one or the other of these sessions full time will receive priority. Applications for admittance are available from this website.

Early applications are recommended since attendance may be limited. There is an attendance fee of \$150.00 to cover materials and incidental expenses. The fee may be waived in cases of need.

This year we will offer more intensive training in computer programming to interested students.

Program Outline.

There are three levels of student participation in the HWI apprenticeship programs (a) all day Friday for qualifying students in City Honors School in Buffalo, (b) on Thursday and/or Friday after school for students in any Buffalo-area school throughout the school year, and (c) summer internships of 5 days a week for 3 weeks. Students should have completed seventh grade.

Training is computer intensive. The students learn to use state-of-the-art computer programs for amino and nucleic acid sequence analysis of the genomes of all bacteria and eukaryotes. The training includes the use of the most heavily used programs for biological analysis on the World Wide Web and a suite of unique programs developed in our laboratory for proteomic and genomic analysis. The students mine the data in the gene and protein banks of the world.

The four major goals of the research are to determine (1) the order of evolution of all living species, (2) the nature of evolution of the sequence and function of families of proteins present in all species, (3) the origin and evolution of the genetic code, and (4) the identity of the last universal common ancestor of all species.

The students are **not** replicating previous experiments for which the results are already known. They are conducting experiments that have never been done before and that challenge basic tenets of structural biology. In this way, students learn that genuine research demands flexibility, adaptability, creativity and patience.

The students are given opportunities to present their research goals and results and their interpretation of their data to coworkers, classmates, laymen, and scientists. They learn to organize and focus their presentations at an appropriate level for each of these audiences. The students are offered the opportunity to be fully qualified coauthors of abstracts published in the proceedings of national and international scientific meetings and manuscripts submitted to leading scientific journals. Qualified authorship requires that the student make significant contributions to the gathering and analysis of data critical to the publication and that the student has a full grasp of all details and aspects of the work and the manuscript.

The summer program will run five days a week for three weeks with one hour a day of formal lectures. Two hours of student presentations are scheduled for every Friday.

The 2014 summer program was held for 7 hours a day. Some college students participated in the program as assistant mentors and some high school teachers and graduate students were included to enrich the program. Nine teams of 2 or 3 students, each led by a veteran of the summer program, were assigned individual projects (analysis of one of the 50 proteins present in the ribosome) and began PowerPoint presentations by the third day. All members of the team participated in the 1-hour presentations. At the end of the school, all parents were invited to a luncheon and overall summary presentation. A dozen students have continued independent supervised study involving preparation of manuscripts for publication concerning the ribosomal protein they analyzed.

Returnees and students who can attend all three weeks of the program will be given priority. Prospective students will be notified regarding their status after their completed application is received and reviewed.

A. Application

Students complete a detailed application that evaluates their interest level, evidence of suitability for a career in research, and potential for successful completion of the program.

Students can be interviewed (often in the company of a parent) and given a tour of HWI research facilities, an overview of the goals of the research project, the potential role they will play in the project and what will be expected of them

B. Procedures

On the first day students who are accepted into the program are given details concerning the immediate data collection goals; and methods are described and students begin to gather data with minimal explanation of the relationship between the data and their ultimate goal. They are thrown into the deep end of the pool, but this has proven effective. By the end of the first week the students prepare one or more power point slides summarizing and organizing the data they have collected, identifying patterns and suggesting possible relationships to the goals of the project as they understand them. The student presentations are given at the Friday lunch “show and tell”. Each student is given individual responsibilities to become the student expert in the use of a specific computer program for data gathering, illustration and analysis and are responsible to instruct others on the use of that program. Students are assigned a subset of the data to be gathered about which they are to become the expert. They prepare a detailed analysis and report. When students have sufficient data and a reasonable grasp of the potential significance of their work they are encouraged to draft a manuscript suitable for submission to a scientific journal. They are given model papers from suitable science journals to choose among.

C. Presentations

Students are encouraged to present their work to: (a) fellow students in appropriate classes at their high school, (b) local, regional and state-wide science fairs and scientific symposia (e.g. UB’s Gifted Math & Science Program), (c) regional college undergraduate math and science

symposia, (d) meetings of the scientific staff of the HWI, and (e) National meetings of the American Crystallographic Association and other appropriate scientific societies (Molecular Evolution, Biochemistry, Biophysics). The Board of Directors of the HWI, parents and laymen are invited to attend the Friday lunches and tour the Institute.

D. Evaluation

Each student is evaluated in terms of initiative, commitment, interpersonal skills, work ethic and dependability. Students submit detailed evaluations of the strengths, weaknesses, highlights of the program, what they have gained from the experience, and where they see need for specific improvement in the program. All evaluations are taken into consideration in modifying the program to increase its effectiveness.

Other valuable experiences provided by the program include media interviews (newspaper, television), opportunities for independent and cooperative investigations, synergy of bringing the student together with their true intellectual peer group irrespective of gender, ethnicity and economic status and picnics with parents, splat ball outings, lunches at ACA (with parents).

Most of the students have many other interests including music, literature, sports, art, business entrepreneurship, computer games and challenging puzzles.