Optimizing NIH Efforts to Engage Pre-college Students in Biomedical Science

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SMRB
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The NIH Mission

“NIH’s mission is to seek fundamental knowledge about the nature and behavior of living systems and the application of that knowledge to enhance health, lengthen life, and reduce illness and disability.”

- to develop, maintain, and renew scientific human and physical resources that will ensure the Nation's capability to prevent disease

- In STEM education NIH is primarily focused on workforce development
Leveraging the NIH investment in people and infrastructure for STEM education

• NIH supports more than 300,000 research personnel at over 2,500 universities and research institutions in every state, Puerto Rico and DC

• In addition, about 6,000 scientists work in NIH’s own Intramural Research laboratories (six campuses in MD, NC, AZ, MT)

• No other agency has these unique resources to leverage for STEM

• How do we use them?
### R25 Education Projects

#### 8 - 15 weeks
- S/F up to $5,000 per high school student, up to $6,000 per college student, and up to $21,000 per teacher
- $1000 training expenses
- 8 Institutes
- 38 active awards in FY14
- 25 states
- Total cost $7,882,804
Discovery to Cure Internship Program

The Discovery to Cure Internship Program was established in 2003 by Dr. Gil Mor, Professor of Obstetrics, Gynecology & Reproductive Sciences, with the goal of exposing students from local schools to Yale’s biomedical laboratories to open their minds to pursue career opportunities in science and medicine. The initial program enrolled four students from two local high schools with the participation of two laboratories at the Department of Obstetrics Gynecology and Reproductive Sciences. Since then, the program has grown to include over 35 schools from throughout the country as well as internationally. The program now includes undergraduates and teachers. The program is highly competitive (less than 12% acceptance) and since its inception a total of over 260 high school students, undergraduates and high school teachers have successfully completed the Program. Several interns have presented their research work at science fairs, including the Connecticut Junior Science and Humanities Symposium at UCONN, the National JSHS, Pfizer Life Science Award, Connecticut State Science Fair, International Science and Engineering Fair and the Siemens Westinghouse Science and Technology Competition, achieving semifinalist, finalist and first place status. Approximately 20% of the students have published their findings in peer-reviewed scientific journals.

The Discovery to Cure Internship Program is now a NIH supported program (NOH 1R25HD072591-01)

For more information please click on the link below.

DTC High School Internship Program

DTC Undergraduate Internship Program

DTC High School Teacher Internship Program

R25HD072591 HICHD
- 260 HS students, HS teachers, undergrads over 9 years
- 25 slots/year, 12% acceptance rate
- 20% have published in peer-reviewed journals
R25 DA032520 NIDA
160 undergraduate since 1994 outcomes
• 8 in Ph.D. programs
• 5 in M.D. programs
• 2 received MS
• 1 MPH
Administrative Supplements for individuals to research awards

- summer research experiences for high school students, college undergraduates, and science teachers
- R01, R15, R37, or P01 awards
Research Supplements to Promote Diversity in Health-Related Research for High School Students

This supplement enables principal investigators to provide research opportunities to high school students in their projects. Priority shall be given to students from socioeconomically disadvantaged backgrounds, racial and ethnic groups, individuals from underrepresented groups in biomedical sciences, e.g., African Americans, American Indians/Alaska Natives, Hispanics, and Native Hawaiians and other Pacific Islanders.

The research activity proposed by the high school student should be encouraged to address various aspects of health-related research, e.g., basic, clinical, and social sciences. Support should be provided during the period of support to enable the student to have full-time research effort each year during the school year. Principal Investigators may propose a program (i.e., equivalent to two or more independent supplement applications) with a total of up to $50,000 in direct costs and no more than 12 months of support.

More than one high school resident (P01) or contract.

**PA-12-149**
Research Supplements to Promote Diversity in Health-Related Research (Admin Supp)

- 26 ICs and Offices
- Very flexible
  - 42 mechanisms
  - HS student, undergrads, grad, post docs, teachers

Research Supplements to Promote Diversity Web links:
Program Announcement (PA-12-149) for Research Supplements to Promote Diversity in Health-Related Research (Admin Supp)
Leveraging Research Centers and Resources
ION@Yerkes Accepting Applications; Summer 2014 Program Open to High School Students and Middle and High School Teachers

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The Yerkes National Primate Research Center is pleased to announce the ION@Yerkes, a partnership between the Center for Behavioral Neuroscience (ION)@Yerkes, and Emory University. The program is now accepting applications from highly motivated high school students and teachers.

The program, which will begin June 2014, will provide an immersive summer experience for participants. The program consists of two distinct parts:

Week one – Scholars will participate in hands-on research activities, including brain imaging, cognitive neuroscience, and primate behavior research. Scholars will also engage in scientific communication and ethics training.

Week two – Scholars will work in teams to conduct research projects and present their findings at a research symposium. Scholars will also have the opportunity to visit other research institutions in the area.

The program is open to high school students and teachers from institutions located within a 250-mile radius of Atlanta, GA.

Participants will be selected based on their academic achievements, extracurricular activities, and alignment with the program’s goals. The application process is now open, and applications will be accepted until March 1, 2014.

For more information, please visit the program’s website at www.emory.edu/yerkes or contact Lisa Newbern at lisa.newbern@emory.edu.
• Self-contained biology teaching modules for use in high school and middle school
• Modules utilize live cultures of *Tetrahymena thermophila*, a safe, easy to grow protozoan
• Hands-on, inquiry-based approach designed to address core biological concepts
• Multi-tiered for use in middle or high school classes
• Summer teacher workshop
Yesterday we did our first Tetrahymena experiment by feeding them India Ink particles to observe food vacuole formation over a period of time. Today we analyzed the data and brainstormed other ways to test food vacuole formation.

**Groton NY Science Fair 2011**
Three students from Mr. DeVoe's 7th Grade Life Sciences class designed an experiment utilizing Tetrahymena thermophila to studied the effects of temperature on the feeding behavior of tetrahymena
The University has had an active venom research program for almost 40 years, and on March 24, 2000, the Texas A&M University Board of Regents established the National Toxins Research Center.

Mission
The National Natural Toxins Research Center focuses on the discovery of medically important toxins found in snake venoms.

P40 Viper Resource Center - The National Natural Toxins Research Center
- ORIP/DPCPSI
- Texas A&M University-Kingsville
- 2014 - Nine High School students
- DoEd Upward Bound Math & Science
Student Training

- Purification and characterization of venoms:
  - High Performance Liquid Chromatography (HPLC)
  - SDS Electrophoresis
  - Electrophoretic Titration
- Various activity assays:
  - Hemorrhagic
  - Proteolytic
  - Coagulation
  - Fibrinolytic
  - Aggregation
- Cloning from cDNA libraries for disintegrin molecules
- Tissue culture assays
  - Cell binding
  - Cell migration
- Creation of Research

Viper Resource Center - The National Natural Toxins Research Center

Student comments from the 2009 Summer Research Program at NNTRC

Jennifer Allan:
"Working at the NNTRC has allowed me the opportunity to learn lab techniques alongside several accomplished researchers and professors. Prior to joining the NNTRC, I did not have any research experience. I am now aware of how venom proteins may be able to cure or prevent illnesses."

Tracey Alvarado:
"I was able to learn about the different instruments used and how to apply these techniques to important biochemical research. This opportunity has opened my eyes to the career of doing biomedical research."

Cody Bigelow:
"I'm a sophomore in high school. Before attending this research program, I had no background in a research lab. Thanks to this program, I have learned about the different types of instruments that are used in the lab and how to use and apply them in different assays."

Kesi Guillec:
"I have learned many concepts in the field of Molecular Biology that correlates with medical research. After being so directly involved in medical research, I have now gained a new respect for people who work so diligently to develop a new drug."

[Images of students and laboratory equipment]
NIH Intramural Summer Internship Program

- Eight+ week research experience at all levels
  - High School
  - College
  - Medical/Dental
  - Graduate (MS, PhD, PharmD, PsyD, etc)
- Many workshops and other educational opportunities
- Access to pre-graduate advising
- End-of-summer poster session

- ~1200 students each summer (25% HS students)
- ~1250 intramural labs with ~7,500 investigators and trainees

http://www.training.nih.gov/student/sip/
Observations

• Leveraging the investment in people and research infrastructure is the unique contribution NIH can make in STEM

• There are many approaches
  • Group training programs
  • Individual supplements to existing research awards
  • Appropriate use of NIH-supported resources with co-funding

• It is widely done (but challenging to quantify)