

Title: Promoting In-Depth Human Health Exploration through Guided Individual Projects Utilizing Genomic Sequencing Technologies.

**Attachment 3B
Research Subaward
Agreement**

Subaward Number:

Subrecipient Contacts

Institution/Organization ("Subrecipient")

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City: La Jolla State: CA Zip Code: 92093-0934

EIN No.: 95-6006-144 Reg. in CCR? Yes No

DUNS No: 80-435-5790 Congressional District: CA-053

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Total funds requested: \$2000

Title: Promoting In-Depth Science Exploration Through Guided Individual Projects Utilizing Genomic Sequencing Technologies.

Project Description

The Project

We propose a disease awareness and prevention project that will impact both participating high school students and surrounding communities through hands-on engagement in a health driven inquiry-based curriculum.

Our society is currently faced with a plethora of diseases that have contributions from heritable genetic factors, but are believed to be preventable with the help of a healthy lifestyle and awareness. Understanding the underlying causes of diseases which propagate a majority of deaths in the United States including cancer, diabetes, stroke, and heart disease is integral to developing lifelong prevention practices on the population scale; especially in light of obesity being at an all time high and steadily increasing. In exploring the topic of health outcomes the opportunity to simultaneously genomics is readily available because of the overlap with personalized medicine, and the development of 21st century molecular diagnostic tools. The project we propose will engage high school juniors in examining the genomic elements of aforementioned diseases through inquiry-based lessons provided by the guidance of an “expert” genomics graduate level researcher from UC San Diego’s Biomedical Sciences Division. Students will participate in activities such as computer-based genomic analyses of actual disease DNA sequences, basic computer programming in a linux environment, in addition to experiencing wet-lab concepts such as DNA extraction, polymerase chain reactions (PCR), gel electrophoresis, and next-generation sequencing. These experimental experiences would eventually develop into a higher-level project resulting in a variety of student created items including sharable electronic media, fitness plans based on individual profiles in response to state fitness testing standards, and awareness of preventing disease. Curriculum developed in the classroom as a primary run will be extended to additional schools and the surrounding community members through student exhibitions in public science programs and online archives located on the High Tech High school website.

Our strategy aims to emphasize genomic sequencing technologies and computer science as a platform to educate students on disease physiology during weekly meetings over the course of the 2013-2014 school year. Modules will include lessons on current-generation sequencing technologies and their applications to disease, methods to characterize disease using the human genome i.e. molecular characterization of cancer cells, the implications of ‘personalized’ or precision medicine, and an overview of the current American health care system. A critical component of our strategy as educators would be to make these lessons as hands-on as possible to maximally increase student learning and retention.

An example module would be to first educate students on a particular complex disease with a high probability of affecting them in their lifetime, i.e. cancer or Alzheimer’s disease, through probing questions including: *What are the known causes of this disease? How does the disease progress in an typical patient?* And, How have my parents genetically contributed to my chance of developing the disease. Once a basic understanding has been established we can then explore how genomic technologies such as whole genome sequencing are utilized to treat an individual and guide therapeutic interventions. Methods will be designed to help students explore parameters of a healthy lifestyle and methods to maintain health. Lesson plans designed in this manner will easily be extended to other schools and the surrounding classrooms in conjunction with participation from the Socrates Program Fellows.

The project will culminate in an exhibition for the North County San Diego community in March of 2014 in which the students will articulate findings in genomics, display their personal health monitoring metrics, and present disease prevention strategies as a means to educate the community. Additionally, projects will be submitted to the Greater San Diego Science and Engineering Fair (GSDSEF) in March of 2014, a prestigious, competitive science fair which every year screens about 12,000 submissions. The Disease Awareness and Prevention project will continue on to serve as the basis of the health care curriculum at High Tech High North County. The project exhibition will also serve as a forum for the “Young Leaders in Health Care” club to share their work each year.

The Students and Site

We will work with approximately 70 students from High Tech High, where Mr. Leader has been a science teacher for 9 years, thus he has built a high level of understanding for the current educational needs required in that environment. High Tech High is project-based school that serves a broad spectrum of students in an inclusive and untracked setting in North County San Diego.

The Members

Dr. Schork, Mr. Quarless, and Mr. Leader came together during the 2013 as members of the UC San Diego Socrates Fellowship. This is a National Science Foundation-funded GK-12 fellowship designed to improve connections between research scientists and K-12 teachers. Dr. Chrispeels was—and is—the faculty member in charge of the Socrates program, Mr. Quarless participated as a Socrates Fellow and Mr. Leader participated as a Socrates Teacher Partner. We are enthusiastic about the possibility of extending our partnership through the HOPES grant.

Dr. Schork brings many years of experience communicating cutting-edge science to the public. He also has an extensive network of contacts in a variety of scientific fields which he can draw upon to provide advice and access to resources for our students.

As a professional educator, Mr. Leader is the one best suited to helping the students identify their interests, choose an appropriate project, and understand the scientific concepts that provide the foundation for their project. She will be the on-the-ground contact for students who need advice and help between the weekly meetings.

As the one with the most day-to-day experience designing, performing, and trouble-shooting experiments, Mr. Quarless will facilitate the designing and implementing of the genomics curriculum. Mr. Quarless has participated in a variety of research projects as a member of the Biomedical Sciences Research Division that pertain to genomics and its applications to disease and is a great addition to the group.

Assessing Effectiveness

Since this is a year long, comprehensive project, effectiveness will be assessed with summative assessments of content in terms as set by current state-based standards. This will be based on both a comparison with the previous year’s CST scores with formative assessments directly related to the content delivered. “Presentations of Learning” and the culminating exhibition of work to the community will serve as an informal assessment of understanding, comprehension and relevance.

To assess the effectiveness of our teaching strategies we have devised an assessment that will ask students to journal their experiences and keep track of lessons in an individual notebook. Many topics, especially ones concerning genomic sequencing, will require a high-level of conceptuality. Thus students being able to draw out their thoughts will be a prime metric for learning assessment. Student journals will be reviewed by Mr. Leader and Mr. Quarless during weekly meeting with students.

Biosketches

Member Biosketch: Nicholas Schork

Dr. Schork is Director of Bioinformatics and Biostatistics at the Scripps Translational Science Institute; Director of Research, Scripps Genomic Medicine; and Professor, Department of Molecular and Experimental Medicine at The Scripps Research Institute. Dr. Schork's interest and expertise is in the areas of quantitative human genetics and genomics, especially the design and implementation of methodologies used to dissect the genetic basis of complex traits and diseases. Prior to his appointments at Scripps, Dr. Schork was a Professor of Biostatistics and Psychiatry, and Co-Director of the Center for Human Genetics and Genomics at the University of California, San Diego from 2000-2007. From 1994-2000 Dr. Schork was an Associate Professor of Epidemiology and Biostatistics at Case Western Reserve University in Cleveland, Ohio and an Associate Professor of Biostatistics at Harvard University. Between 1999 and 2000 Dr. Schork took a leave of absence to conduct research as the Vice President of Statistical Genomics at the French Biotechnology company, Genset, where he helped guide efforts to construct the first high-density map of the human genome. Dr. Schork has been selected as a member of a number of scientific journal editorial boards, is a frequent participant in U.S. National Institutes of Health-related steering committees and review boards, and has also been on the advisory board of five companies. He is currently Director of the Bioinformatics and Biostatistics Core of the NIA-sponsored Longevity Consortium and a member of the NHGRI's Genetic Association Information Network (GAIN) data analysis committee. Dr. Schork has published over 230 scientific articles and book chapters on the analysis of complex, multifactorial traits and diseases. Dr. Schork earned a B.A. in Philosophy, an M.A. in Philosophy, an M.A. in Statistics, and a Ph.D. in Epidemiology all from the University of Michigan in Ann Arbor, Michigan.

Member Biosketch: Matthew Leader

Matthew Leader is an 11th grade biology teacher at a project based charter school, High Tech High North County. Before teaching biology, he traveled and volunteered in community development projects in Central and South America and worked in physical sciences and microbiology labs at the Scripps Institution of Oceanography. Matthew started teaching middle school math and science and has been teaching biology at High Tech High for the past six years. He received a Bachelor of Science at the University of California at San Diego in General Biology and Teaching Credentials at San Diego State University. Matthew is an AmeriCorps alumnus and has recently completed a Masters in Education in Teacher Leadership at the HTH Graduate School of Education and participated in internships with NASA and the J. Craig Venter Institute. He has also enjoyed his time participating as a Socrates Teacher Fellow the past 2 years and has successful collaborative efforts and findings in periodicals in the United States and abroad.

Member Biosketches: Danjuma X. Quarless

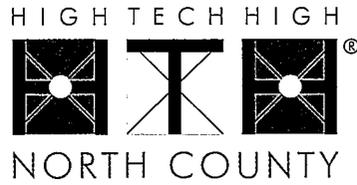
Danjuma Quarless is a third year Ph.D student at the University of California, San Diego in the Biomedical Sciences Division of the School of Medicine. Currently, Danjuma is advised by the widely recognized biostatistician, Dr. Nicholas Schork, and conducts research at the Scripps Translational Science Institute, which is a subdivision of the Scripps Research Institute. Danjuma's research leverages computational genomics, biostatistics, and primary applications of whole genome sequencing to molecularly characterize patients with cancer in addition to and severe mental conditions such as bipolar disorder. Before matriculating to UCSD Danjuma attended Whitworth University in Spokane, Washington where he received Bachelor of Arts degrees in Mathematics and Computational Biology. While at Whitworth Danjuma was a member of the fully funded undergraduate scholarship program Act Six, which provided structured course, work on various multi-racial topics including racial awareness, cultural sensitivity, and community inclusion.

Mr. Quarless was connected with Mr. Leader when he accepted a position in the 2013-2014 Socrates k-12 education graduate student cohort. Mr. Leader and Mr. Quarless have established a working

collaboration for the 2013-2014 school year where High Tech High North County will be the primary appointment of Mr. Quarless.

Dissemination of Funds

Classroom material (\$10 * per student)	\$700
Experiment Materials (\$10 * per student)	\$500
Educational video and images	\$100
DNA Extraction Reagents	\$150
Computer Hardware	\$150
Field Trip Transportation	\$300
TOTAL	\$2000



July 21, 2013

To Whom It May Concern:

I am writing this letter in support of an application for the American Society for Biochemistry and Molecular Biology HOPES seed grant as a joint venture between UCSD and High Tech High North County with the SBC High Tech High District.

This project will enable students to create meaningful work and media that will make a difference both for our student body but also for the community as a whole.

If the grant is awarded, High Tech High will provide structure to support the success of the project and the development of future programs that assist with student health and a genetics curriculum.

Isaac Jones

Principal, High Tech High North County

Dear HOPES grant evaluators:

I offer my full support to Danjuma Quarless concerning his HOPES grant application. Danjuma is a current member of my research group and has recently been accepted as a member in the Socrates Fellowship for the 2013-2014 cohort. The program was started at the University of California, San Diego with a National Science Foundation GK12 grant. The purpose of the program is to facilitate a structured and rigorous learning environment for students who wish to develop skills in science communication and teaching. Danjuma will be working with a single high-school biology teacher throughout the duration of the 2013-2014 school year. During this time he will be expected to develop and implement a project with specified endpoints based on the specific area of his thesis research that engages students at the high-school level in hands-on experiential learning. The members of the ScienceBridge staff will support Danjuma's training throughout the course of his program tenure of through constrictive feedback and critiques, multiple group meetings, and lesson on teaching strategy. The primary objective of the Socrates program is to improve Danjuma's verbal, written, and conceptual communication ability so that he may be a more effective in conveying science to all audiences.

Danjuma has been a great contribution to my research program for the past two years and I believe that he has great potential as an educator. Danjuma has excellent presence as a speaker, is a clear thinker, and instructor in addition to being a sound scientific researcher, which are important skills to have in the classroom. I have no reservations that he will do an outstanding job in presenting advance science curriculum in a manner that is palatable to students of all education levels, while greatly improving his communication ability. Furthermore, as an African American he will be a superb role model for the students in high-needs schools in which ScienceBridge works, including schools in the High Tech High network.

Sincerely,

Nicholas J. Schork, Ph.D.
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