

# THE WALTER REED ARMY INSTITUTE OF RESEARCH

## Science Education Outreach

### *Continuity in Science Education from Middle School through College*

The Walter Reed Army Institute of Research (WRAIR) continues to be at the forefront of developing and implementing a **continuum of STEM education opportunities** essential to developing the potential in our youth for rigorous STEM careers. The U.S. technological advantage may soon be lost due to the “flat” world- weak science, technology, engineering and mathematics (STEM) education and poor problem solving and preparedness seen by weak scoring internationally of American students. Our current national competitiveness in STEM education is poor. The federal workforce is aging and our graduate schools are filled with foreign nationals. Paradigm shifts on the battlefield of the future require our vigilance in preparing the next generation of STEM professionals. The DoD and the U.S. economy must have the driving force of science and technology advanced by U.S. citizens. U.S. student populations no longer have the mentors for STEM careers or choose other, more lucrative or less challenging careers because of the lack of enthusiasm in our STEM education pipeline.

Beginning with middle school, our scientists mentor young people through the necessary years of study, preparation and experience to become a scientist. Within these programs, our locally trained college and high school students then mentor even younger students (6<sup>th</sup> -12<sup>th</sup> grade), a concept named **near-peer mentoring** by WRAIR scientists. Recognizing the potential of **all youth**, especially inclusive of untapped student populations, of all backgrounds, ethnicities, geography, economic status and academic access, students experience a sequence of authentic research opportunities with stipends through three programs. Two of the following three programs were developed and evaluated at the WRAIR.

- Gains in Education of Mathematics and Sciences (GEMS) 6th through 12th grade
- Science Engineering Apprentice Program (SEAP) primarily 10th through 12th grade
- College Qualified Leaders (CQL) undergraduate and graduate students



#### Future Direction

Under a 5-year SEPA grant, the near-peer mentoring concept is being tested within formal middle and high school settings in DC and Maryland schools to benefit the STEM classroom and teachers. Collaborations between academia, government and industry will foster more opportunities and the continuity and needed near-peer mentoring to improve U.S. STEM education.

#### Current Resources:

- The U.S. Army Educational Outreach Program (USAEOP) provides funding for administration, near-peer mentors and participants in the summer GEMS program.
- Grant funding from the NIH National Center for Research Resources Science Education Partnership Award (SEPA), Principal Investigators: Yourick and Jett
- \$1.5M from WRAIR research budgets for CQL participant stipends
- Teaching laboratory and office space



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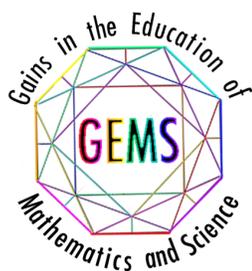
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#### Scope of Problem and STEM Education Positive Outcomes

- While the USAEOP, the NIH National Center for Research Resources and the NIH Office of Science Education (Dr. Barbara Alving/Dr. Tony Beck, Dr. Bruce Fuchs) recognize U.S. needs in STEM education, these endeavors require support and recognition for valuable advances the teaching and learning of science.
- The USAEOP and the US Army Medical Research and Materiel Command have disseminated GEMS to Alabama, Mississippi, New Mexico, Texas and to five other sites in Maryland. Support for expansion and dissemination of GEMS would broaden the STEM pipeline, access a diverse student pool and has been proven to enhance overall performance in school by improving attitudes towards all types of learning.
- WRAIR programs offer continuity from middle to graduate school, provide missing sequential mentoring through experiential levels and capture/recapture of students that may be lost to the STEM fields. Our program evaluations, over 10 years, show that the GEMS outcome is scientifically literate students who now actively consider STEM careers and value lifelong learning.

#### STEM Education Programs



The GEMS program prepares interested and enthusiastic middle/high school students for academically advanced programs and communicates STEM through genuine laboratory experiences. The students are taught by **near-peer mentors** who translate current research and scientific concepts into modules suitable for GEMS students.

*Beginning GEMS* introduces students, 7<sup>th</sup> to 9<sup>th</sup> graders, to basic concepts in physics, chemistry, mathematics, and biology through hands-on, inquiry-based experiments (1 week). *Intermediate GEMS* is designed for returning or older students, 10<sup>th</sup> and 11<sup>th</sup> graders, and can be repeated another year because of continuing development of unique science activities with chemical rockets, neuroscience, chemistry, robots, maglev trains, cell culture experiments, simple machines and more. (1-2 weeks). *Advanced GEMS* students attend for four weeks, allowing them to pursue a more in-depth program. The students research and prepare a presentation on one of the GEMS topics at the end of the four weeks. These students are frequently selected for full internships the following year.

SEAP students are academically advanced high school students, mostly 11<sup>th</sup> to 12<sup>th</sup> graders, selected to participate in an active research laboratory. Students complete a minimum of an 8-week internship, a poster and paper with a literature review. SEAP prepares students for the Intel Science Talent Search (“Junior Nobel Prize”) and the Intel International Science and Engineering Fair (ISEF).



The **CQL** program serves the research and teaching experience needs of college students who may or may not have previously participated as HS students in the SEAP program. Accomplished undergraduate and graduate interns contribute to research and publications.

**Near-peer mentors** are CQLs who spend most of their time in the teaching laboratory. The near-peer mentor is the driver for the success of the GEMS program, responsible for greatly heightening the STEM potential of the sometimes completely inexperienced and unmentored science enthusiast. As role models, near-peer mentors prepare and teach modules and encourage GEMS to take high-level science and math classes in high school, and to enlighten them about college life and pathways to careers.