K-12 and Higher Education: Why Collaboration is Vital

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The education mission of the ERC Program is to:

- Impact and augment engineering curricula at all levels, from precollege to life-long learning, with educational materials derived from ERC research.
- Produce graduates who will be adaptive, creative innovators in a globally connected, innovation-driven world.
- Increase the diversity of the STEM workforce by including all members of society, regardless of race, ethnicity, or gender, in all aspects of the centers' activities.
- Integrate research, education, diversity, outreach, and industrial collaboration.
- View ERC as change agents for academic engineering programs and the engineering community at large.
NSF’s FY 2013 Engineering Research Centers (Lead institutions)

Note: All centers are multi-university partnerships; university shown is lead institution.
NSF’s FY 2013 Engineering Research Centers
(Lead institutions and core partners)

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BMES ERC Strategic Plan

PROFOUND UNTREATABLE DISEASES
- Blindness
- Dementia

TESTBEDS
- RETINA
- CELLULAR
- CORTICAL

ENABLING TECHNOLOGIES
- SYSTEMS ON A CHIP
- POWER & DATA MNGT.
- INTERFACE TECHNOLOGY

FUNDAMENTAL RESEARCH
- Neuroscience
- Non-linear modeling
- Neural networking modeling
- Biologic Si architecture
- Image enhancement
- Low power
- Biophysics
- Alternative power
- Data compression
- Efficiency
- Bioheat
- Interface science
- Neural integration
- Inflammation
- Cell proliferation
- Directed growth
- Impedance of polymer
- Electrochemistry

• Commercial Neural Prosthetic Systems
• Other Implantable Actuators and Sensors (Drug Delivery)
Hallmarks of a Partnership

Key Components of a Successful Partnership

• Mutually beneficial
• Built on strengths and resources of partners
• Target specific populations and associated needs (needs assessment)
• Realistic and clearly identifiable goals and timelines
• Measurements of progress and success
• Cognizance of institutional cultures
• Dedicated key personnel
• Identified roles and expectations of personnel (job descriptions)
• On-going evaluation and assessment
• Continuous communication
• Long-term
In recognition of the importance of early education intervention, the BMES has leveraged its considerable resources and talents to establish a robust K-16 STEM pipeline.

BMES ERC STEM Pipeline:

- **Elementary School**
  - Students and Teachers
- **Middle School Program**
  - Students
- **High School**
  - Students, Teachers and Counselors
- **Informal Educational Experiences**
  - Students, Extended Families and Educators
- **Summer Research Programs**
  - High School Students and High School and Community College Teachers
Elementary School Outreach

Science for Life (SFL)

- Modular science and engineering curricula
- Focused on BMES ERC research
- In-the-classroom instruction
- Mentors/role models (1 USC : 1 HS : ~10 MS students)
- Formative and Summative Assessments
High School Outreach

Engineering for Health Academy (EHA)

- Small Learning Community with a focus on Biomedical Engineering
- Multi-year course of study (3 years, 4 core courses, Capstone Class)
- Science Fair projects each year
- Mentoring component (USC BME undergraduate and graduate students)
- College admissions preparation
- Longitudinal study of students
Informal Educational Experiences

• **Science and Engineering Fairs**
  – Students defend projects to university/industry judges

• **Discovery Science Family Day**
  – Teaching parents about the science and engineering curriculum their children are learning through hands-on activities

• **Middle School Events**
  – Shadow EHA scholars, Q&A panels with USC/HS researchers and students and ERC Lab Tours

• **University Field Trips**
  – Includes admission presentations and engineering department information sessions, tour of ERC labs

• **Science Parent Workshops**
  – Elementary school parents are exposed to STEM through “workshops of interest”
Summer Research Programs

Summer High School Advanced Research Program (SHSARP)
Participants are:
• rising 11th graders from throughout greater LA region
• integrated into on-going research projects at USC
• immersed into research culture
• mentored by USC students and postdocs
• develop and practice soft skills
• expected to present a seminar and write a paper
• paid a stipend

Research Experience for Teachers (RET)
Teachers:
• are high school and community college teachers
• learn about cutting edge research
• receive curriculum development in translating lab experiences into classroom activities that address NGSS and SLO and have authentic assessment components
• participate in academic year follow-up activities
• are encouraged to form long-term partnerships between partnering institutions
• create final presentation, paper and dissemination plan
For more Information, please visit:

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http://bmes-erc.usc.edu
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