Bioengineering and Environmental Systems Division

The Bioengineering and Environmental Systems (BES) Division supports research that:

a) expands the knowledge base of bioengineering at scales ranging from proteins and cells to organ systems, including mathematical models, devices and instrumentation systems. Current interest areas include tissue engineering and the development of biological substitutes; biosensors, i.e., devices that use a biological component; food processing, especially with respect to food safety; and metabolic engineering, including the application of systems analysis tools to understand metabolic transport.

b) applies engineering principles to the understanding of living systems, development of new and improved devices, and products for human health care. Emphasis is placed on engineering research that contributes to better and more efficient health care delivery and aid to people with disabilities.

c) improves our ability to apply engineering principles to avoid and/or correct problems that impair the usefulness of land, air and water. Current interest areas include environmental remediation, especially with respect to understanding the fate and transport of surface and groundwater pollutants; novel processes for waste treatment; industrial ecology; technologies for the avoidance of pollution; technology to limit fouling of the ocean.

d) advances fundamental engineering knowledge of the ocean environment and develops technological innovation related to conservation, development, and use of the oceans and their resources.

Three program areas comprise the BES Division:

- Biomedical Engineering/Research to Aid Persons with Disabilities
- Biotechnology/Biochemical Engineering
- Environmental/Ocean Systems

Biomedical Engineering/Research to Aid Persons with Disabilities

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Information on application procedures may be found in the NSF Grant Proposal Guide (NSF 99-2) and on the NSF Home Page (http://www.nsf.gov).

NSF 99-19 (Replaces NSF 97-113)

Biomedical Engineering/ Research to Aid Persons with Disabilities

Bioengineering and Environmental Systems Division

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National Science Foundation

Biomedical Engineering/Research to Aid Persons with Disabilities Programs

The Biomedical Engineering and the Research to Aid Persons with Disabilities (BME/RAPD) Programs support investigations which apply engineering methods and fundamental scientific principles to address problems at the interface of engineering and modern biology/clinical medicine. These Programs emphasize investigations which seek to generate fundamental knowledge. The engineering/science fields represented in the Biomedical Engineering Program are motivated by potential application to important health problems. The investigations usually have ultimate diagnostic or treatment related goals. Engineering and technology developments which permit the exploration of new interfaces are of particular interest. The Research to Aid Persons with Disabilities Program supports research for the characterization, restoration, or substitution of normal function in humans. Research supported by either Program should lead to the development of new technologies or to novel applications of existing technology.

The program supports research from all areas of biomedical engineering and research to aid persons with disabilities. The field is characterized by its strong cross disciplinary nature and priority is given to projects that are dependent on basic knowledge of both engineering and the life sciences. An appropriate balance between theory and experiments is encouraged.

Areas of Research

- Research directed toward better understanding of the design, fabrication, and use of biomaterials (synthetic materials) to replace part of a living system or to function in intimate contact with living tissue such as artificial skin and total joint replacements, soft tissue replacements, cardiac pacemakers, stents, and other implant materials.

- Research aimed at basic understanding of the design, fabrication, packaging and application (including implantation) of biomedical sensors (electrodes, optical, chemical, mechanical and bioanalytic) for quantifying physiological signals and monitoring phenomena characteristic of living tissue.

- Technology to aid the sensory impaired and methods for measuring improved performance. New approaches to aids for the persons with disabilities including prosthesis design.

- Research related to the analysis and control of biological systems.

- The technology and application of biomechanics including kinematics design and analysis.

- Medical application of robotics and intelligent machines for assisting in complex procedures.

- Computer assisted medical interventions including surgery or orthopedic application.

- Advanced imaging techniques involving conventional or non-conventional modalities or virtual and augmented reality.

- Advanced single and multimodality imaging techniques for display of anatomic detail and physiologic function.

- Technology for non-invasive diagnostics.

- Research to expand understanding of the function of living systems from the molecular to the physiological level, including the constitutive database, necessary to implement integrative models of these systems.

- Integrative mathematical models for biological complexity from the gene to the organ and beyond as a theoretical framework for biological design.

- The use of hybrid technologies as functional interfaces between tissues and artificial systems.

- Devices and technology that impact on health care delivery systems including intelligent and highly miniaturized approaches.

- New technology or methods for reducing health care costs and methods for assessing the impact of the technology.

- Biomedical signal processing, analysis and networked communications of information in health care delivery systems.

- Undergraduate and graduate engineering design projects which provide prototype “custom designed” devices that will directly aid a specific disabled person while providing a meaningful design experience for the student are welcome. This "real world" experience is designed to give students a sense of purpose and pride, help engineering schools serve the community, attract new students into engineering, and raise student interest in graduate education.

- Exploratory investigations of nanoscale and microscale biological, chemical and physical phenomena for the development of new health care technologies for minimally invasive applications in medical diagnosis and therapy.