Department of Bio and Brain Engineering	Academic Department Website: https://bioeng.kaist.ac.kr/
	Academic Department Office: 042)350-4302~4

◼ **Overview**

Mission

The mission of the department is to foster human resources that will create new knowledge and technology in the fields of Bioengineering and Brain Engineering. Through this ambitious endeavor, we seek to develop technology that will raise quality of life and open a new future for the people of Korea and the world.

Strategy

We seek to make technical innovations in bioengineering and brain engineering, especially by utilizing the strengths of Korean electronics and information technology. We aim to make valuable contributions to Korea's industrial development, and to promote technological progress throughout the world.

Background

The department was established in 2001 as the Department of Biosystems funded by a 30 billion won donated by Mr. Moon Soul Chung, the chairman of a company called Mirae Corporation, at a time when the concept of bio fusion technology was being recognized. Starting with five faculty members in 2002, the number has steadily increased to 24 in 2017. As of 2017, 319 undergraduates and graduate students are studying in the department.

 Driven by the spirit of challenge and creativity that led KAIST, the department offers research and educational programs for the development of innovative technology in Bioinformatics and System Biology, Bioimaging, BioNano and Brain Engineering. Translational research and practice strategies have been established in the focus area in biomedical engineering. The department serves as a focal point for bio fusion research at KAIST with the goal of joining the list of the world's top 10 biomedical engineering departments within 10 years.

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The department's educational philosophy focuses on discovering talent and providing in-depth specialized training in a broad spectrum of disciplines as it evolves and grows. Students are required to take compulsory bioengineering courses that are designed to evenly cover the entire field so that students can develop an attitude of integrated thinking and cooperation. Each graduate student of the new Program of Brain and Cognitive Engineering is trained to take a leadership role in nurturing the next generation of leaders in this emerging field both within academia and industry. Students are also encouraged to participate in a variety of extracurricular activities to fully enjoy their campus life.

Approximately half of the students who receive a bachelor's degree go on to graduate school. Students receiving higher degrees go on to careers in academia, industry and government where they discover and develop the technology of tomorrow and train the next generation of scientists and engineers.

◼ **Academic and Research Activities**

Bioinformatics/ Systems Biology

Bioinformatics initially investigates the methods concerned with analyzing DNA/RNA sequences and gene combination by utilizing contemporary computer technology and consequently focuses on developing data structure and software algorithms which enable efficient analysis by computer. From these developments, predictions of the manifestation of specific functions can be made and this presents candidates for medicinal substances: its efficacy is predicted. Bioinformatics also conducts research regarding the technique to predict patterns of genetic sequences that express certain functions. Genetic information that leads from DNA to RNA, proteins, and finally life-supporting functions, requires massive amounts of data processing and research is now being conducted regarding methods of large-scale data storage and extraction. Systems biology refers to the quantitative analysis of the dynamic interactions among multiple components of a biological system and aims to understand the behavior of the system as a whole. Systems biology involves the development and application of system-theoretic concepts for the study of complex biological systems through iteration over mathematical modeling, computational simulation and biological experimentation.

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Bioelectronics

As bioelectronics is the fusion of the life science and electronics, we study ways to measure and analyze neural signals accurately, and we conduct research regarding the signal processing mechanisms of the brain and neural system. We train our researchers to develop artificial intelligence systems and new medical treatments based on our research. Our main research fields are as follows:

- Measurement, manifestation, and analysis of medical signals and images including EEG, fMRI, NIRS and radiological medical imaging
- Understanding the neural information process mechanism and developing algorithms on visual, auditory, and cognitive functions of living organisms
- Microelectronics devices and human functional systems that imitate neural information processes.

BioNano/MEMS

The BioNano/MEMS field studies the characterization of biomaterials and structures and quantitatively analyzes biological functions and underlying principles; we develop microelectromechanical tools and methods for the extraction, control and manipulation of bioinformation. Based on the engineering modeling of biological phenomena and the application of bio-function analogy, we look at ways to develop bio-inspired materials, functional devices, and systems. Related research areas include design and analysis; the materials and fabrication process; testing and measurement; and the integration and application technologies for biosensors, actuators, nanobio devices and nano- or micro-electromechanical systems (NEMS or MEMS).

Neural Engineering

Neural engineering studies engineering techniques that seek to understand and regulate functions and behavior of the nervous system including the brain. It is an emerging interdisciplinary field of research that offers methodology that will allow for more effective and precise analysis of the nervous system. Neural engineering conducts research in a wide variety of subjects that fuse together neuroscience and bioengineering including neural interfaces, artificial neural chips, neuroinformatics and computer modeling, neural information processing, neural tissue engineering, cognitive engineering, and biorobotics. Cutting-edge proving the quality of life; and entertainment.

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Biomedical Imaging

Modern biological and medical discoveries are heavily dependent on imaging. Hence, biomedical imaging researchers are focused on developing novel imaging techniques as well as overcoming the performance limit of the traditional imaging systems. In our department, biomedical imaging groups have focused on magnetic resonance imaging, x-ray computed tomography, positron emission tomography, near-infrared spectroscopy as well as various types of modern optical imaging systems.