Biomedical Engineering Graduate Program in METU / ANKARA

Faculty of Engineering
- Electrical and Electronics and Engineering
- Mechanical Engineering
- Engineering Sciences
- Metallurgical and Materials Engineering

Informatics Institute

Faculty of Arts and Sciences
- Biological Sciences
- Chemistry
- Statistics
- Physical Education and Sports

Institute of Applied Mathematics

by S. Kocabıyık
The program aims to provide an understanding of the problems in biological sciences and in medicine, and a foundation for solving these problems by applying methods and concepts from engineering, physics, chemistry and biology.
MAJOR RESEARCH FIELDS

Production of bioactive molecules and recombinant therapeutic proteins

Understanding molecular mechanisms of diseases and new diagnostic markers

Medical Imaging and Image Processing

Mathematical modelling, Computational Biomechanics

Tissue implants, engineering and regenerative controlled release systems, immobilizations for biosensors and bioreactors.
**Research Teams: Biomolecular Engineering Team Research**

- **Recombinant therapeutic proteins**
  - Molecular machines: proteasomes and molecular chaperonines
  - Structure/activity/stability analyses of antibiotic resistance genes
  - Improving stability and activity of enzymes through rational design and using a small HSPs

- **Purification and formulation of naturally occurring antifungal proteins**
  - Toward mammalian cells for treatment of human superficial infections of skin and mucosal membranes

- **Diseases mechanisms & new diagnostic markers**
  - Novel oncogene and tumor suppressor candidates
  - Inflammatory pathways leading to the development of colorectal cancer
  - Neuro/peptide hormones which are related to obesity and neurodegeneration
  - Detection of abnormally elevated or decreased expression levels of proteasome
Research Teams: Biomolecular Engineering Team Labs

Protein Structure and Function
- Modernly equipped with state-of-art research equipments laboratory for molecular biology and recombinant DNA research, protein expression/purification/functional and structural characterization/ (UV/Visible and fluorescent spectroscopy, electrophoresis systems, image analyzers, qPCR Light Cycler, highspeed centrifuges etc)

Pharmaceutical Biotechnology
- Well equipped for up- and downstream processes, facilities for protein synthesis, purification, and yeast genetics studies

Cancer Research
- Department of Biological Sciences’s Core facilities:(limited) lab. animal facilities, cell culture facilities, microscopy, spectorscopy, ultracentrifuge etc,
- Research laboratories well-equipped for cancer biology studies
Research Teams: Bioelectrical Engineering Team Labs

**Medical Instrumentation**
- e.g., EEG, ECG, EMG, phonocardiogram, rheograph, recorders
- Image acquisition and output devices particularly for realtime subtraction imaging techniques
- Up-to-date, fast computers, parallel processing cluster for Brain Research

**Magnetic Resonance Imaging**
- 0.15 Tesla Oxford body magnet,
- Spectrometer electronics,
- PC based front-end,
- Computing and simulation facility,
- RF coil design

**Microelectronics MEMS and Optoelectronics BioMEMS Research Group**
- A microelectronics fabrication facility for 4", 6" and partially 8" wafer processing with a 1000 sq. meters of class 100 and class 1000 clean room area for fabrication and 300 sq. meters of class 10000 clean room area for electrical testing of IC's and active discrete components
- Equipment include a stepper with a 0.35µm resolution, automatic photo resist coaters, DRIE, RIE, ICP RIE, PECVD, LPCVD, a contact aligner with wafer bonders, oxidation and diffusion furnaces, a vacuum probe station for wafer level probe testing, and a number of metrology equipment
<table>
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<tr>
<th>Gait and Motion Analysis System</th>
<th>Kinematic Support System</th>
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| Soft Tissue Testing & Modeling | • In vivo soft tissue testing with indenter  
|                                | • Mathematical modeling of experimentally observed soft tissue mechanical behavior |
| Bone Remodeling                | • Design and production of Dental Implants  
|                                | • Passive human wrist joint modeling for simulation of mechanics of surgery |
## Research Teams: Biomaterials Team Research

### Biomaterials and Tissue Engineering Center of Excellence
www.biomaten.metu.edu.tr

### Bone Tissue Engineering (TE)
cartilage TE, wound dressings, controlled drug delivery systems

### Materials for hard tissue replacement, synthesis and processing
Bioceramics: Glasses and Gels for Biotechnology
Hybrid Sol/Gels for Immobilization of DNA, Encapsulation of Biomolecules in Solids, Antibacterial Coatings and Materials
*Functional, structural and regulatory analyses of molecular machines

*Purification and formulation of the naturally occurring antifungal proteins

*Structure/activity/stability analyses of antibiotic resistance proteins for new drug design

*Improving stability and activity of enzymes with potential medical uses

*Novel oncogene and tumor suppressor candidates located genomic instability regions

*Inflammatory pathways leading to development of colorectal cancer

*Processing, intracellular trafficking, and secretion of neuro/peptide hormones

*Detection of abnormally elevated or decreased expression levels of proteasomes by RAMAN spectroscopy

*Electro-magnetic source imaging of the human brain

*Developing new ways of imaging

*Developing signal processing algorithms and applying them on biological signals

On-going project subjects

Bioactive molecules

Mathematical Modelling

New disease markers

Imaging & analysis

by S. Kocabıyık
International and national research programs managed (last 5 years) by the BIOMED teams

- Total 135 / by 18 faculties

- National and International Projects

- Sponsors
  - The Scientific and Technological Research Council of Turkey (TÜBİTAK), Turkish Academy of Sciences (TÜBA), Scientific Research Council of Middle East Technical University, T.R. Prime Ministry Satete Planning Organization (DPT)
  - EU -FP6/FP7, -STREP, -Marie Curie , COST, British Council
  - Industry

- Publications in SCI Journals

- Total 150 / by 18 faculties
Partnership with large facilities, university hospital and industries Partnership

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<th>University Hospitals</th>
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<tr>
<td>• Hacettepe University Faculty of Medicine, Ankara University Faculty of Medicine and Teaching Hospital, Ankara University Faculty of Veterinary Medicine, Hacettepe University Faculty of Medicine, Gulhane Military Medical Academy /Faculty of Medicine</td>
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<td>• Hacettepe University Stem Cell Research and Application Center (PEDISTEM)</td>
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<th>METU CENTRAL LABORATORY</th>
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<td>• 2 R&amp;D Centers</td>
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Core facilities of METU:
Central Laboratory-I
- Advanced Material Characterization R&D
  electrical/optical and magnetic measurements, elemental analysis

Core facilities of METU:
Central Laboratory-II
- Molecular Biology and Biotechnology R&D
  services in protein purification (HPLC, FPLC), DNA and protein sequencing, DNA synthesis, mass spectroscopy, FTIR, ESR, confocal laser scanning microscopy and image processing

Departmental Facilities:

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