THE RACHEL AND SELIM
BENIN SCHOOL OF
COMPUTER SCIENCE
AND ENGINEERING

Bioengineering

Hebrew University

HU

Research Topics

Solutions For a New Economy

Israel is a significant player in the life sciences industry as a result of its interdisciplinary capabilities, which bring together cutting -edge medical institutes, an excellent research base, software expertise, and top engineers.

BLOOMING INDUSTRY

Of the existing 800 life sciences companies, most were founded during the last decade. In fact, more than half of the industry was established in the last five years. Remarkably, close to 30% of these new companies are already revenue-generating entities.

The industry is heavily biased toward toward the medical device sector, with 54% of the companies, biotech is the second largest with 19%, and the pharmaceutical sector is third with 10% of local life sciences companies.

Bioengineering at the Hebrew University

Bioengineering is a multidisciplinary field that weaves together biology, physics, chemistry, computer science and medicine aiming to advance knowledge and create tangible applications in biology and medicine. This rapidly growing field provides a new level of understanding of biological systems, ranging from the molecular scale to entire organisms, by applying engineering-based analytical and experimental approaches.

The Hebrew University of Jerusalem, Israel's first university, is a multidisciplinary research institute, where intellectual pioneering, cutting-edge scientific discovery and a passion for learning flourish. Founded in 1918 by Albert Einstein and Sigmund Freud, the university spans seven faculties, sixteen schools and over 100 interdisciplinary research centers. Counting seven Nobel laureates among its faculty and alumni, the university is justly proud of its position at the cutting edge of world science. The Hebrew University has recently been ranked by *The Scientist* as the 2nd best place to work outside the United States.

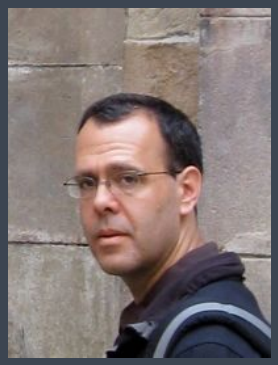
The Hebrew University of Jerusalem established the Center for Bioengineering in 2005 from a position of strength and a long history of medical innovation. Members of the center include Prof. Aaron Lewis, the father of Near Field Optics and the director of Hadassah Laser Center; Prof. Nissim Benvenisty, director of the Stem Cell Unit and the first lab to differentiate and genetically manipulate human embryonic stem cells; and Prof. Shimon Benita, head of the Institute of Drug Development and a world leader in nano-medicine.

The Center for Bioengineering has a diverse and multidisciplinary faculty spanning 18 members specializing in medicine, life sciences, engineering, chemistry and computer science. It offers a five-year direct PhD program in bioengineering to top Israeli and international students, and an advanced course in Biodesign Innovation in partnership with the Faculty of Medicine, School of Business Administration and Stanford University.

Bioengineering
Hebrew University

Systems Biology at Hebrew University

Computational techniques and high throughput screening platforms have become a basic research tool in modern biology. Micro devices, robotic platforms and gene arrays provide data which enables a deeper understanding of complex biological responses to injury or disease. Computational tools enable us, for the first time, to analyze biological information on this scale.



Innovation in this field is driven by interdisciplinary understanding of scientists such as Prof. Nir Friedman, winner of the Juludan Prize for Advancing Technology in Medicine, and a prestigious European Research Council (ERC) advanced grant.

Prof. Friedman is a computer scientist driven deeply into biology and is currently setting up a state-of-the-art robotic facility for the study of transcriptional regulatory networks in yeast.

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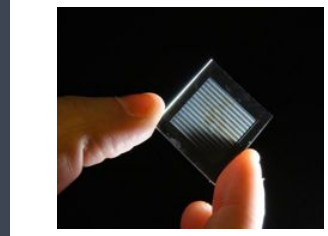
Microdevices in Biology and Medicine

BioMEMs, nanoscience and optoelectronics at The Hebrew University of Jerusalem

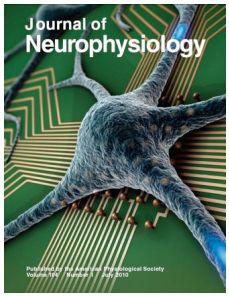
Microfabrication technology has already changed the world around us. Hiding under the shiny coat of our cars, iPods, cellphones, laptops, and TVs, the integrated circuit and silicon microchip changed the way we live. Micro-scale features enable an unparalleled control over electrical signals resulting in nearly magical computational, communication and memory powers. At the dawn of the 21st century, a similar revolution is changing the study of biology and the practice of medicine.

Microscale patterns, three-dimensional features, and the physics of small places radically change our ability to screen thousands of conditions, control the cellular microenvironment, and provide innovative tools for diagnosis and treatment of disease.

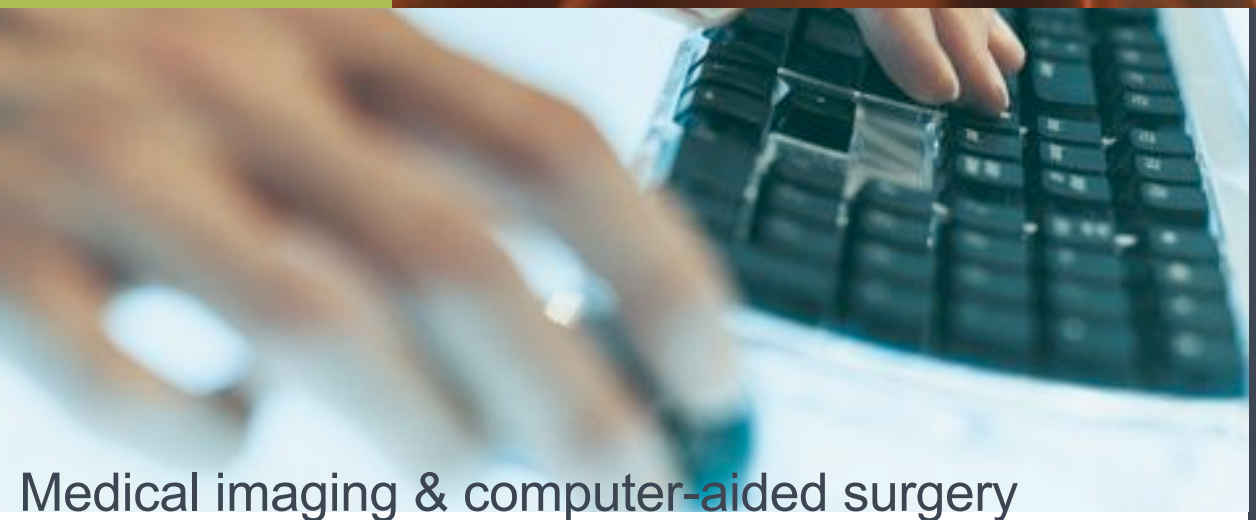
Dr. Yaakov Nahmias, director of the Center for Bioengineering and the recipient of an NIH career award for young scientists, is an emerging leader in this field. His microLiver Technologies (μLT) lab is focused on the development of high-throughput microfabricated platforms for the study of liver development, drug toxicity, and metabolic disease. Funded by a prestigious ERC starting grant, his microdevices gain insight into the intricate transcriptional-metabolic program which regulates HCV infection. One of his compounds, a novel triple nuclear receptor ligand, is currently in clinical trials at Massachusetts General Hospital. A second project, funded by an FP7 consortium, aims to develop a liver-simulating device for the cosmetic industries. Such devices would fundamentaly reduce the use of animals in research and are developed in the context of a much larger effort to simulate human-on-a-chip.



Prof. Aaron Agranat, director of the Brojde Center for Innovative Engineering, and the winner of the Discovery Innovation Award is a world leader in optoelectronics. His revolutionary KLTN crystal enables communication routing speeds 10,000 times faster than normal. Together with Prof. Shimshon Belkin he developed innovative biosensors integrating fluorescent bacteria with optoelectronic microchips for rapid sensing of water quality. Another project, led by Prof. Yuri Feldman, modeled human sweat ducts as an array of microscale helical antenas, demonstrating a response in the sub-Terahertz region to human stress with clear clinical and security applications.



Finally, Prof. Micha Spira and Prof. Joseph Shappier developed a novel neuroelectronic microchip consisting of an array of noninvasive gold-mushroom-shaped micro electrodes (gMmEs). The array offers unparalleled recording of neuronal activity as well as neuronal stimulation without breaking the cellular membrane. It offers a new approach to high fidelity neural prosthetics and brain-machine systems.



Medical imaging & computer-aided surgery

The medical image processing group at the School of Computer Science and Engineering is working closely with physicians to develop the next generation of image algorithms and robotic systems to improve the planning, execution and evaluation of surgical procedures.

Scientists such as Prof. Leo Joskowicz, winner of the 2007 Kaye Innovation Award are developing novel, image-guided microsurgical tools for the precise, automatic targeting of structures inside the brain, while others like Dr. Raanan Fattal and Prof. Dani Lischinski are developing new algorithms for high resolution imaging of complex 3D ultrasound sheets

Living, playing and learning in Jerusalem

Jerusalem Metropolitan Area

Many are familiar with the beauty and uniqueness of the old city of Jerusalem, its ancient walls, magnificent history and importance to Judaism, Christianity and Islam. And yet over the last 60 years the city has bloomed into a modern metropolis of close to a million residents. The city is home to the Israel Museum, site of the Dead Sea scrolls, the Museum of Islamic Arts, and Yad Vashem. It is home of the world renowned Israeli Philharmonic Orchestra, the site of Israel's International Film Festival and the International Jazz Festival. Jerusalem offers travelers world-class cuisine and an active nightlife in the many dance clubs, bars, and live music venues that line the streets of downtown.

The Center for Nanoscience and Nanotechnology

The Harvey M. Krueger Family Center for Nanoscience and Nanotechnology was established in 2001 by the Hebrew University. The center supports a state-of-the-art clean room with advanced photolithography, metal deposition, and E-beam facilities. The center also includes advanced characterization facilities including AFM, electron microscopy,and X-ray tools.

http://nanoscience.huji.ac.il/

The Center for Genomic Technologies

The Center for Genomic Technologies at The Hebrew University serves as a National Research and Service Lab dedicated to providing genomic services to the academic, medical and industrial sectors in Israel.

The center provides DNA Sequencing, Deep Sequencing, Genotyping (Microsatellite analyses, SNP determination, whole genome scan - linkage associated studies), DNA Microarray, Bioanalyzer, and RT-PCR technologies.

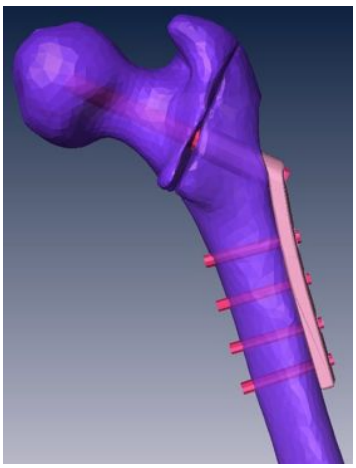
http://www.bio.huji.ac.il/eng/services.asp

Professional Development

The School of Engineering at the Hebrew University of Jerusalem is recruiting faculty for tenure-track positions in systems biology & bioengineering. Contact us for details.

Biodesign Innovation @ HUJI

The Biodesign Innovation Program is a multi-disciplinary, trans-faculty academic course of The Hebrew University of Jerusalem, in collaboration with the extremely successful Biodesign Program of Stanford University. The course is taught over two semesters of one academic year and instructs in the design of a medical devices, from needs analysis and inception through design, testing, patenting and funding.



Biodesign Innovation is designed for teams of three: a PhD student in engineering, an MD in training, and an MBA student. Teams take on medical challenges and devise a solution to take through prototype, testing, patent application and the development of a coherent business plan. Many such projects are expected to advance to market.

Biodesign Innovation combines the resources of the Faculty of Medicine and its allied Hadassah Medical Center, The School of Computer Science and Engineering, The Faculty of Law and The School of Business Administration. A strong relationship with the Biodesign Program of Stanford University ensures the success of this program.

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