MIT Industrial Liaison Program

MIT Industry Brief

MIT and Life Sciences & Health Care Industries

MIT's Industrial Liaison Program (ILP) can bring the intellectual power of MIT to your organization by providing a direct connection to the knowledge, experience and resources at MIT in these areas – giving you the ideas to stay ahead. For more information about how the ILP can put the resources of MIT to work for you, call us at 1-617-253-2691, e-mail us at liaison@ilp.mit.edu, or visit http://ilp.mit.edu.

MIT and Life Sciences & Health Care Industries

The Massachusetts Institute of Technology (MIT) is a leading center of research and education on topics important to the life sciences and health care industries such as:

- Bioinformatics, Computation, Data
- Biomaterials, Biosensors
- Bio Micro- and Nano-technologies
- Brain & Neuroscience
- Drug and Medical Device Development
- Genomics, Microbiome
- Imaging, Lasers, Spectroscopy
- Medical Diagnosis and Therapeutic Intervention
- Medicine, Engineering, and Science
- Pathology: Cancer, HIV, Other
- Sensory Research: Retinal Implants, Speech/Hearing Science
- Synthetic Biology / Systems Biology
- Wellness / Lifestyle Issues

Below are brief descriptions of a selection of MIT centers, departments, groups, and labs conducting research and education in these areas. Please note that this is not a comprehensive summary of research being conducted at MIT in the topic areas listed above and the center or lab, etc., may fall into more than one category.

BIOINFORMATICS, COMPUTATION, DATA

The ***Clinical Decision Making Group*** is dedicated to exploring and furthering the application of technology and artificial intelligence to clinical situations. Projects include: capturing patient-provider encounters through text speech and dialog processing; integrating data, models, and reasoning in critical care; informatics for integrating biology and the bedside; and secondary use of clinical data.

The ***Computational Biophysics Group*** is focused on understanding conformational changes in biomolecules that play an important role in common human diseases. The group combines computational modeling with biochemical experiments to make connections between conformational changes in macromolecules and disease progression. By employing two types of modeling, molecular dynamics and probabilistic modeling, hypotheses can be developed and then tested experimentally.

The ***Computational Cognitive Science Group*** studies the computational basis of human learning and inference. Through a combination of mathematical modeling, computer simulation, and behavioral experiments, the group works to uncover the logic behind everyday inductive leaps: constructing perceptual representations, separating "style" and "content" in perception, learning concepts and words, judging similarity or representativeness, inferring causal connections, noticing coincidences, predicting the future.

The ***Integrative Neuromonitoring and Critical Care Informatics Group*** leverages critical care data and mathematical models derived from physiology, along with signal processing and estimation methods, to extract relevant information from clinical data. Research efforts are aligned along main projects such as Noninvasive Continuous Estimation of Intracranial Pressure, and Brain Injury in the Preterm Neonate.

The ***Laboratory for Computational Immunology*** is focused on understanding how the adaptive immune system is regulated and on harnessing this understanding to design vaccines against scourges such as HIV. The group brings together theoretical and computational studies, rooted in statistical mechanics, and a diversity of biological experiments and clinical data to do this. A major emphasis is to make mechanistic predictions and design therapies that can be directly tested, and the metric of success is uncovering basic principles and impact on experimental and clinical immunology.

The ***Laboratory for Computational Biology & Biophysics (LCBB)*** develops experimentally-integrated computational modeling frameworks to enable the molecular-level engineering of biological systems. The LCBB focuses on high-resolution fluorescence and electron microscopy datasets to infer and program higher-order nucleic acid and protein structure and function. Major applications of the work include engineering 3D DNA assemblies to control multi-chromophore, -protein, and -lipid organizations for nanoscale energy transport, cellular delivery, and nanoscale imaging of membrane processes including neuronal synapses, bacterial cell wall synthesis machinery, and signaling complexes that govern cell migration. Computational analyses of imaging datasets drive the generation and systematic evaluation of quantitative biological models.

BIOMATERIALS, BIOSENSORS

The ***Laboratory for Atomistic and Molecular Mechanics*** focuses on understanding the mechanics of deformation and failure of biological materials. By utilizing a computational materials science approach, the group's goal is to understand the mechanics of deformation and failure of biology's construction materials at a fundamental level.

The ***Bioinspired and Biofunctional Polymers Group*** research in polymer science attempts to understand the statistical mechanics, thermodynamics, and transport properties of these large molecules and to apply this understanding to the intelligent design of biofunctional and bioinspired polymeric materials with new and interesting properties for applications in biotechnology, energy, and sustainability.

The ***Biomolecular Materials Group*** evolves simple organisms using directed evolution to work with the elements in the rest of the periodic table. These hybrid organic-inorganic electronic and magnetic materials have been used in applications as varied as solar cells, batteries, medical diagnostics and basic single molecule interactions related to disease.

The ***Center for Materials Science and Engineering (CMSE)*** fosters research and education in the science and engineering of materials. Example research areas: Harnessing in-fiber fluid instabilities for scalable and universal multidimensional nanosphere design, manufacturing, and applications; simple engineered biological motifs for complex hydrogel function; nanoionics at the interface: charge, phonon, and spin transport.

The ***Institute for Soldier Nanotechnologies (ISN)*** team of MIT, Army, and industry partners collaborate to create new materials, devices, processes, and systems, and on applied research to transition promising results toward practical products useful to the soldier. ISN research is organized into five strategic areas: Lightweight, multifunctional nanostructured materials; soldier medicine; blast and ballistic threats—materials damage, injury mechanisms, and lightweight protection; hazardous substances sensing; and nanosystems integration.

The ***Laboratory for Bio-Inspired Interfaces (LBI)*** studies bio-inspired materials with the goal of employing design principles extracted from nature in the development of novel synthetic materials that help overcome global challenges in energy, the environment and health.

The ***Soft Active Materials Laboratory*** seeks to design soft materials with unprecedented properties (i.e., extremely tough and strong, ultrasensitive to stimuli, mutable, biocompatible, etc.) and to explore their extraordinary functions in technologies such as wearable and biointegrated electronics, drug delivery and tissue engineering, antifouling, energy harvesting and storage, water treatment.

The ***Department of Chemistry*** is focused on discovering new chemical synthesis, catalysis, creating sustainable energy, theoretical and experimental understanding of chemistry, improving the environment, detecting and curing disease, developing materials new properties, and nanoscience. Teaching and research programs span the breadth of chemistry, including biological chemistry, environmental chemistry, inorganic chemistry, materials chemistry and nanoscience, organic chemistry, physical chemistry.

BIO MICRO- AND NANO-TECHNOLOGIES

The ***Biological Microtechnology and BioMEMS Group*** performs research on microfluidics applied to cell biology, neuroscience, and medicine. The group takes a quantitative approach to technology design, and takes projects all the way from engineering design to fabrication to biological and clinical validation.

The ***Laboratory for Multiscale Regenerative Technologies (LMRT)*** leverages micro- and nanotechnologies to interface living and synthetic systems toward improving tissue regeneration, disease modeling, medical diagnostics and drug delivery. The lab's long-term goals are to improve cellular therapies for liver disease and develop nanotechnology for the diagnosis and treatment of cancer.

The ***Micro/Nanofluidic BioMEMS Group*** is applying micro-/nano-fabrication methods with a focus on micro-/nano-fluidics, biomolecule and cell separation and detection, and nanostructure-biomolecule interactions. The group works on developing tools for detecting, identifying, quantifying, and sorting biomolecules.

BRAIN, NEUROSCIENCE

The ***Bioelectronics Group*** is working at the interface of materials science, electronics and neurobiology with the goal of advancing understanding and treatment of disorders of the nervous system. The group designs, synthesizes and fabricates optoelectronic and magnetic devices that manipulate and record neuronal activity and development.

The ***Center for Brains, Minds & Machines (CBMM)*** is a multi-institutional NSF Science and Technology Center dedicated to the study of intelligence. The aim is to create a new field (Science and Engineering of Intelligence) by bringing together computer scientists, cognitive scientists, and neuroscientists to work in close collaboration in the areas of: Development of intelligence, circuits for intelligence, visual intelligence, social intelligence and theories for intelligence.

The ***Center of Neurobiological Engineering (CNBE)*** brings together MIT's transdisciplinary set of engineers and scientists to tackle the challenges of understanding the body's complex nervous system. To that end, CNBE works to create next-generation tools for experimental investigation of the nervous system and to engineer neurons, neural tissue, and their interactions with cells, devices, and prosthetics. The goal of this endeavor is to help the neuroscience community at MIT and beyond to discover fundamental principles of brain operation, as well as new approaches to the treatment and diagnosis of disease.

The ***High-Throughput Neurotechnology Group*** develops advanced high-throughput technologies for engineering the complex function, reprogramming, and regeneration of the nervous system. With collaborators, the group works on various neurological disorders and diseases including autism spectrum disorder (ASD) and epilepsy for gene and drug screening. The group employs various methodologies including microfluidics, microrobotics, ultrafast optics/microscopy, tissue engineering/printing, drug delivery, neuronal stem cell reprogramming, genetics, RNA/polymer biochemistry, and even quantum physics.

The ***McGovern Institute for Brain Research at MIT*** is a neuroscience research institute committed to understanding the brain in health and disease. Led by a team of world-renowned, multi-disciplinary neuroscientists, the institute conducts research in three broad themes – perception, cognition, and action – using systems and computational neuroscience, brain imaging and cognitive neuroscience, and molecular biology and genetics.

The ***Picower Institute for Learning and Memory*** is an independent research entity within MIT's School of Science, with a mission to unravel the mechanisms that drive the quintessentially human capacity to remember and to learn, as well as related functions like perception, attention and consciousness. With backgrounds from molecular biology and genetics to physiology and systems biology, Picower Institute researchers study the brain from the level of molecules, genes and cells to systems biology and the cognitive system as a whole.

The ***Synthetic Neurobiology Group*** develops tools that enable the mapping of the molecules and wiring of the brain, the recording and control of its neural dynamics, and the repair of its dysfunction. The group distributes its tools as freely as possible to the scientific community, and also applies them to the systematic analysis of brain computations, aiming to reveal the fundamental mechanisms of brain function, and yielding new, therapeutic strategies for neurological and psychiatric disorders.

The ***Department of Brain and Cognitive Sciences (BCS)*** stands at the nexus of neuroscience, biology, and psychology. BCS combines these disciplines to study specific aspects of the brain and mind including: vision, movement systems, learning and memory, neural and cognitive development, language and reasoning.

DRUG AND MEDICAL DEVICE DEVELOPMENT

The ***Analog Circuits and Biological Systems Group*** performs wet molecular biology experiments in living cells and dry experiments with analog nanoelectronic chips. The group creates: novel analog synthetic biology circuits; biological and bio-inspired supercomputers based on analog computation in cells; ultra-energy-efficient and energy-harvesting systems like glucose-powered neural prosthetics; and, ultra-low-power implantable medical devices such as cochlear implants or diagnostic devices. The group's work has wide applications in medicine, biotechnology, biofuels, ultra-low-power, analog, and bio-inspired systems.

The mission of the ***Center for Biomedical Innovation (CBI)*** is to improve global health by overcoming obstacles to the development and implementation of biomedical innovation. CBI is addressing profound challenges in the global biomedical industry by developing, testing, and disseminating new knowledge and tools designed for real world application through the following programs: the Biomanufacturing Research Program, the Consortium on Adventitious Agents in Biomanufacturing, and New Drug Development Paradigms.

The mission of the ***Emergent Behaviors of Integrated Cellular Systems (EBICS)*** is to create a new scientific discipline for building living, multi-cellular machines that solve real world problems in health, security, and the environment. EBICS is focused on building two biological machines: BetaCell Factory, an implantable cellular machine for glucose sensing and insulin release for the treatment of diabetes; and BioBot, an autonomous cellular machine for detecting and neutralizing toxins in the environment. MIT is the lead institution.

The ***Harvard-MIT Biomedical Engineering Center*** uses elements of continuum mechanics, digital signal processing, molecular biology and polymeric controlled release technology to examine the cellular and molecular mechanisms that transform stable coronary-artery disease to unstable coronary syndromes. The laboratory holds patents for drug-delivery devices, tissue-engineered implants, and new drug formulations.

The ***Medical Electronic Device Realization Center (MEDRC)*** is a partnership between the microelectronics industry, the medical devices industry, medical professionals, and MIT to collaboratively achieve improvements in the cost and performance of medical electronic devices. MEDRC aims to transform the medical electronic device industries: to revolutionize medical diagnostics and treatments, bringing health care directly to the individual; and to create enabling technology for the future information-driven healthcare system.

The ***Molecular Engineering Laboratory at MIT*** develops and applies sophisticated computational, theoretical, and experimental methods to probe complex chemical systems on the molecular level and engineer them for high value chemical applications with maximum specificity. Applications are in the fields of continuous pharmaceutical manufacturing, stabilization and formulation of biopharmaceuticals, and nucleation and crystallization. In parallel, the group develops new computational methods that are generally applicable for the engineering of complex chemical systems.

The ***Novartis-MIT Center for Continuous Manufacturing*** is a research collaboration combining the industrial expertise of Novartis with MIT's scientific and technological leadership toward developing new technologies to replace the pharmaceutical industry's conventional batch-based system with a continuous manufacturing process. Continuous manufacturing benefits include: Accelerating the introduction of new drugs through efficient production processes; requiring the use of smaller production facilities; minimizing waste, energy consumption, and raw material use; monitoring drug quality on a continuous basis; and enhancing process reliability and flexibility to respond to market needs.

The mission of the ***Ragon Institute of MGH, MIT and Harvard*** is to contribute to the accelerated discovery of an HIV/AIDS vaccine and to establish itself as a world leader in the collaborative study of immunology. The scientific leadership comprises a diverse group of world class immunologists, geneticists, infectious disease specialists, and computational and systems biologists from the Massachusetts General Hospital (MGH), MIT, Harvard, the Broad Institute, Harvard-affiliated hospitals in Boston and from other leading institutions.

GENOMICS, MICROBIOME

The ***BioMicro Center*** is an integrated genomics facility that provides both expertise and equipment for systems biology. The core has significant resources in microarrays, next-generation sequencing and in high-throughput screening as well as bioinformatics and BioIT. The Center is a joint endeavor between the Departments of Biology and Biological Engineering, the Koch Institute for Integrative Cancer Research (Genomics Core and Bioinformatics and Computing Core), and the MIT Center for Environmental Health Sciences (Genomics and Imaging Facilities Core).

The ***Center for Environmental Health Sciences (CEHS)*** studies the biological effect of environmental agents, individually and in combination, with specific emphasis on how such exposures affect human health and the health of our ecosystem. CEHS research can be sorted into five research themes: DNA damage, DNA repair and genomic stability; inflammation chemistry and biology; microbiomes and environmentally induced diseases susceptibility; bioengineering for environmental health; and chemistry and transport of pollutants in the atmosphere, water, and soil.

The ***Center for Microbiome Informatics and Therapeutics (CMIT)*** is a New England regional center to advance the science of the human microbiome and the treatment of conditions and diseases associated with an altered microbiome. The center's focus is on supporting the intersection of research, clinical practice, computational biology, and engineering. Located at MIT, with co-directors from MIT and Massachusetts General Hospital (MGH), the center is dedicated to fostering and supporting a research ecosystem involving the participation of hospitals, other universities, and research institutes in the region.

The ***Computation & Biology Group*** comprises members from the Department of Mathematics and the Theory of Computation group at the MIT's Computer Science and Artificial

Intelligence Laboratory. The group focuses on designing algorithms to gain biological insights from advances in automated data collection and the subsequent large data sets drawn from them, as well as software for compressive genomics, systems biology, genomics, structural bioinformatics, and population genetics.

The ***Computational Biology Group***'s research is focused on the computational foundations of genomics, developing algorithmic, statistical, and machine learning methods to interpret the functional elements encoded in the human genome, reconstruct the regulatory circuits they define, and understand their evolutionary mechanisms. Research addresses genome interpretation, gene regulation, epigenomics, and genome evolution.

The ***Computational Genomics Group*** studies stem cell based developmental biology with original computational methods that build predictive models from high-throughput experiments. The group designs these experiments with its collaborators in other laboratories to reveal key events during development, including dysfunctions that can lead to human disease. In addition, the group is interested in the genetic foundations of human disease, and studies the broad question of how an individual's genotype influences their phenotype.

IMAGING, LASERS, SPECTROSCOPY

The ***MGH / HST Athinoula A. Martinos Center for Biomedical Imaging*** is one of the world's premier research centers devoted to development and application of advanced biomedical imaging technologies. The center's mission is to advance imaging in healthcare through technology development, translational research and education. Located on the MGH Research Campus (Charlestown, MA), the center is home to roughly 100 faculty researchers and more than 200 affiliated and visiting faculty, postdoctoral research fellows and graduate students, who work toward the development and continued improvement of new hardware and software and procedures for data acquisition, visualization and statistical analysis, as well as creative application of these advances to biologically and medically relevant investigation.

The ***Martinos Imaging Center at the McGovern Institute at MIT*** provides access to state-of-the-art brain imaging technologies for MIT researchers and their collaborators throughout the Boston area. The center offers a variety of imaging technologies, including human magnetic resonance imaging (MRI), small-animal MRI, electroencephalography (EEG) and magnetoencephalography (MEG). Major research themes at the center include: brain mechanisms of perception, memory, emotion, executive function and social cognition; developmental studies of children, including developmental disorders such as autism and dyslexia; and translational studies on the neural basis of many different psychiatric and neurological disorders.

The ***MIT-Harvard Center for Magnetic Resonance (CMR)*** focus combines expertise and instrumentation in solution-state Nuclear Magnetic Resonance (NMR), solid-state NMR, Electron Paramagnetic Resonance (EPR), Dynamic Nuclear Polarization (DNP), microwave technology, magnet design, probe and console design, synthesis of polarizing agents for DNP, and the development of biochemical labeling strategies. In essence the center's combined core and collaborative research effort covers essentially all aspects of magnetic resonance that are important for structural biology and many areas of magnetic resonance imaging.

The ***Laser Biomedical Research Center (LBRC)*** provides integrative photonic solutions to complex problems in biological research, pharmaceutical development, and medical diagnosis. Equally important, the center maintains a diverse array of collaborative and service research projects covering many biomedical areas that includes neuronal connectomics, liver fibrosis diagnosis, nerve regeneration imaging, improving selectivity of photodynamic therapy, sickle cell biomechanics, identifying mesenchymal stem cell, novel imaging with carbon nanotube, and developing chemometric algorithms for cancer biopsy specimens.

The ***Magnetic Resonance Imaging Group*** conducts investigations in medical imaging with MRI technology, focusing on optimal methods for acquisition, reconstruction and processing of in vivo imaging data. The group's interests include techniques for efficient sampling and spatial encoding of spectroscopic magnetic resonance data, whereby small signals, originating, for example, specifically from neurons in the brain, yield information not observed with conventional structural imaging. Applications of these and related methods include a study of the progression of Alzheimer's disease and characterization of multiple sclerosis.

The ***George R. Harrison Spectroscopy Laboratory*** is engaged in research in the field of optics and spectroscopy for the purpose of furthering fundamental knowledge of atoms and molecules and pursuing advanced engineering biomedical applications. Research activities can be grouped in two major categories: research in physical science, which includes atomic physics/quantum optics and chemical/molecular spectroscopy, and in biomedical physics and engineering.

MEDICAL DIAGNOSIS & THERAPEUTIC INTERVENTION

The ***Center for Integration of Medicine and Innovative Technology (CIMIT)*** is a non-profit consortium of Boston teaching hospitals and engineering schools (MIT was a founding member of CIMIT), which fosters interdisciplinary collaboration among experts in translational research, medicine, science and engineering, in concert with industry, foundations and government, to rapidly improve patient care. CIMIT's mission is to improve patient care by facilitating collaboration among scientists, engineers and clinicians to catalyze the discovery, development and implementation of innovative technologies, emphasizing minimally invasive approaches.

The ***Computational Physiology and Clinical Inference Group (CPCI)*** develops and applies computational models of human physiology for clinical monitoring and inference. The group's research focuses on cardiovascular, cerebrovascular, respiratory and neurological applications. The overarching objectives of the research in the CPCI Group are to enhance patient monitoring, improve clinical decision-making, and better understand physiological and pathophysiological processes.

A novel partnership between ***MIT and Massachusetts General Hospital (MGH)*** is addressing three major challenges in clinical medicine: improving the diagnosis of disease; developing new approaches to prevent and treat infectious and autoimmune diseases; and developing more accurate methods of diagnosing and treating major neurodegenerative and psychiatric diseases.

MEDICINE, ENGINEERING, AND SCIENCE

The ***Harvard-MIT Division of Health Sciences and Technology (HST)*** brings together MIT, Harvard Medical School (HMS), Harvard University, Boston area teaching hospitals in a unique collaboration that integrates science, medicine, and engineering to solve problems in human health. HST's interdisciplinary approach to biomedicine leads to stunning innovations, such as the drug regimen that transformed HIV/AIDS into a treatable disease and the only noninvasive technology for observing the brain in action.

The ***Institute for Medical Engineering and Science (IMES)*** aims to accelerate innovation across a spectrum of activities that span discovery, design, and delivery of new medical devices and products. IMES is focused on the following challenges: To make diagnosis cost-effective and accurate, and guide individual clinical decisions based on real-time monitoring and massive patient data sets; enable systematic design of vaccines and therapies for existing and emerging infectious diseases; enhance human cognitive function by developing accurate diagnostic and therapeutic approaches for neurodegenerative and neuropsychiatric disorders; enable remote monitoring of chronic and post-acute-care patients with mobile and/or at-home devices that can communicate with caregivers; and develop accurate diagnostic and therapeutic approaches for cardiovascular diseases.

The ***Madrid-MIT M+Visión Consortium*** is a partnership of leaders in science, medicine, engineering, business, and the public sector dedicated to catalyzing change in Madrid's healthcare innovation ecosystem by accelerating translational research and encouraging entrepreneurship.

The ***Whitehead Institute for Biomedical Research*** is a leading, nonprofit research and educational institution dedicated to improving human health through basic biomedical research. All Whitehead faculty are also professors at MIT. Whitehead scientists run pioneering programs in cancer research, immunology, developmental biology, stem cell research, regenerative medicine, genetics, and genomics.

The ***Department of Biology***'s areas of research include: cellular, developmental and molecular biology, biochemistry and structural biology, classical and molecular genetics, plant molecular biology, immunology, microbiology, neurobiology, and computational and systems biology.
Training and research in the department range from general biology to more specialized fields of study and investigation. Quantitative aspects of biology are emphasized and molecular biology, biochemistry, genetics, and cell biology are an essential part of the academic program. MIT biologists are deeply engaged in both fundamental research and its applications.

The goal of the ***Department of Biological Engineering (BE)*** is to develop effective biology-based technologies for application across a broad spectrum. Research areas include: Biomaterials; biophysics; cell & tissue engineering; energy; environment; microbes; microdevices; molecular therapeutics; nanotechnology; pharmacology; synthetic biology; systems biology; and toxicology.

MIT's ***Chemical Engineering Department's (ChemE)*** explores the terrain of chemistry, biology, and physics through groundbreaking investigation into areas such as nanotechnology, biomedical processes, molecular computation, and catalysis. Research projects fall into at least one of nine broad areas: Thermodynamics and molecular computations; catalysis and reaction engineering; systems design and engineering; transport processes; biological engineering; materials; polymers; surfaces and structures; and energy and environmental engineering.

The ***Biomechatronics Group*** seeks to advance technologies that promise to accelerate the merging of body and machine, including device architectures that resemble the body's own musculoskeletal design, actuator technologies that behave like muscle, and control methodologies that exploit principles of biological movement. The group combines the scientific discipline of organismal and cellular neuromechanics with the technological discipline of bionic device design.

PATHOLOGY: CANCER, HIV, OTHER

The ***David H. Koch Institute for Integrative Cancer Research at MIT*** brings together biologists and chemists along with biological, chemical, mechanical, and materials science engineers, computer scientists, clinicians and others, to bring fresh perspectives and an interdisciplinary approach to advancing the fight against cancer. Koch Institute research is strategically focused on five target areas: Developing nanotechnology-based cancer therapeutics; creating novel devices for cancer detection and monitoring; exploring the molecular and cellular basis of metastasis; advancing personalized medicine through analysis of cancer pathways and drug resistance; and engineering the immune system to fight cancer.

The ***MIT-Harvard Center for Cancer Nanotechnology Excellence*** is a collaborative effort among MIT, Harvard University, Harvard Medical School, Massachusetts General Hospital, and Brigham and Women's Hospital. It is one of eight Centers of Cancer Nanotechnology Excellence awarded by The National Cancer Institute (NCI), part of the National Institutes of Health (NIH). It focuses on developing a diversified portfolio of nanoscale devices for targeted delivery of cancer therapies, diagnostics, non-invasive imaging, and molecular sensing. In addition to general oncology applications, the Consortium focuses on prostate, brain, lung, ovarian, and colon cancer.

The ***Center for Gynepathology Research***, co-directed by an MIT engineer and a Harvard Medical School clinician, the Center for Gynepathology Research brings together over 15 laboratories and clinical practices in the Boston area and around the world to foster both basic and clinical research in endometriosis, infertility, pre-term birth, sexually-transmitted disease, and other pathologies of the female reproductive tract.

The ***Ludwig Center for Molecular Oncology*** unites members of the Koch Institute and MIT's extended cancer research community in a mission to unravel the mysteries of metastasis. As part of its focus on tumor invasion and dissemination, the Center is developing new approaches in molecular imaging and cellular detection to identify sites of metastasis early in the disease course and to follow the navigation of metastatic cells throughout the body.

SENSORY RESEARCH: RETINAL IMPLANTS, SPEECH & HEARING SCIENCE

The ***Auditory Physics Group*** at the Eaton-Peabody Laboratory of Auditory Physiology (EPL) works to solve fundamental problems in the mechanics and physiology of the auditory system. Research interests of the group include cochlear nonlinearity and amplification, middle-ear mechanics, and otoacoustic emissions.

The ***Auditory Physiology Group*** conducts research on the mechanics of the auditory system, including the external, middle, and inner ear, and neural processing mechanisms. Other interests include cochlear implants as auditory prostheses and cochlear micromechanics. Much of the work of the group is conducted in the Eaton-Peabody Laboratory, a joint MIT-Massachusetts Eye and Ear Infirmary facility.

The ***Harvard-MIT Program in Speech and Hearing Bioscience and Technology (SHBT)*** is the only one of its kind in the country – a tight-knit research community dedicated to multidisciplinary training in basic, clinical and applied approaches to the study of all aspects of human communication and the treatment of its disorders. The faculty's diverse research interests range across speech, hearing, voice, language and balance.

The major thrust of the ***Retinal Implant Research Group*** is to develop a microelectronic retinal implant to restore vision to patients with age-related macular degeneration and retinitis pigmentosa. The group's implant design has unique features that improve its safety, function, and performance. Efforts are currently underway to test the implant design. The group works closely with colleagues in Boston area hospitals.

The ***Sensory Communication Group*** conducts research on hearing aids, the tactile communication of speech, and auditory perception and cognition. The goal of the hearing aid research is to develop improved hearing aids for people suffering from sensorineural hearing impairments and cochlear implants for the deaf. The goal of the tactile communication research conducted by the group is to develop tactual aids for persons who are profoundly deaf or deaf-blind to serve as a substitute for hearing in the reception of speech and environmental sounds.

SYNTHETIC BIOLOGY / SYSTEMS BIOLOGY

The ***MIT Computational and Systems Biology Initiative (CSBi)*** is a campus-wide education and research program that links biologists, computer scientists, and engineers in a multi-disciplinary approach to the systematic analysis of complex biological phenomena. CSBi places equal emphasis on computational and experimental methods and on molecular and systems views of biological function.

The ***Molecular Machines Grou***p is focused on pioneering the field of Avogadro scale engineering, which seeks to understand

and approach the fundamental limit of engineered complexity deliverable per unit cost. The group has a particular focus on applications within synthetic biology, novel computing machines, and nanostructured devices for energy production. Research example areas include context-aware biology and GPCR activation prediction with sequence conservation analysis.

The ***Synthetic Biology Center (SBC @ MIT)*** is focused creating an infrastructure of synthetic biology tools, engineering sophisticated biological systems efficiently, and applying synthetic biology for grand challenges in the world. The group conducts research on genetic programming, DNA synthesis and assembly, genome design, simplifying genetics, genetic circuits, and more.

The ***Synthetic Biology Group*** is focused on advancing fundamental designs and applications for synthetic biology. Using principles inspired by electrical engineering and computer science, the group is developing new techniques for constructing, probing, modulating, and modeling engineered biological circuits. Application areas include infectious diseases, amyloid-associated conditions, and nanotechnology.

WELLNESS / LIFESTYLE ISSUES

The Media Lab's ***Advancing Wellbeing*** initiative addresses the role of technology in shaping our health, and explores new approaches and solutions to wellbeing. The program is built around education and student mentoring; prototyping tools and technologies that support physical, mental, social, and emotional wellbeing; and community initiatives.

The ***MIT Age Lab*** is a multidisciplinary research program that works with business, government, and NGOs to improve the quality of life of older people and those who care for them. The AgeLab applies consumer-centered systems thinking to understand the challenges and opportunities of longevity and emerging generational lifestyles to catalyze innovation across business markets. Work at the AgeLab sits at the intersection of infrastructure, information, and institutions and explores ideas in information-seeking, the power of place and 'things' in the environment, as well as business strategies and government policies to develop solutions for aging successfully.

MIT Connection Science, with its novel "Living Labs" paradigm for research in the field, brings together interdisciplinary experts to develop, deploy, and test new technologies and strategies for design in actual living environments. In collaboration with Harvard Medical School and Massachusetts General Hospital, MIT is conducting a comprehensive analysis of health and behavior by linking behavioral data with personal health records to understand and identify opportunities to improve population health & well being.

The ***Little Devices Group*** at MIT develops empowerment technologies for health, believing that innovation and design happens at the frontline of healthcare where providers and patients can invent everyday technologies to improve outcomes. The group's work is interdisciplinary and combines mechanical engineering, electrical engineering, biology, clinical medicine and global health. The group's portfolio maps onto 4 global disease burden domains using a growing toolkit of technologies and approaches: diagnostics; therapeutics; vaccines; and behavioral.

The mission of the Massachusetts Institute of Technology is to advance knowledge and educate students and others in science, technology, and additional areas of scholarship. MIT is committed to generating, disseminating and preserving knowledge and to working to bring this knowledge to bear on the world's great challenges. As part of its mission, MIT maintains relationships with industrial organizations that enable the exchange of ideas in the context of real-world problems and demonstrate how principles studied at MIT are applied to generate practical benefits for industry and society. MIT's Industrial Liaison Program helps develop these relationships by facilitating industry's access to MIT and its vast resources.