Courses of Interest:

(http://ocw.mit.edu/OcwWeb/web/courses/courses/index.htm#top)

Biological Engineering

Macroepidemiology

(http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-102Spring-2005/CourseHome/index.htm)

Course Description: This course presents a challenging multi-dimensional perspective on the causes of human disease and mortality. The course focuses on analyses of major causes of mortality in the US since 1900: cancer, cardiovascular and cerebrovascular diseases, diabetes, and infectious diseases.

Chemicals in the Environment: Toxicology and Public Health

(http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-104JSpring-2005/CourseHome/index.htm)

Course Description: This course addresses the challenges of defining a relationship between exposure to environmental chemicals and human disease. Course topics include epidemiological approaches to understanding disease causation; biostatistical methods; evaluation of human exposure to chemicals, and their internal distribution, metabolism, reactions with cellular components, and biological effects; and qualitative and quantitative health risk assessment methods used in the U.S. as bases for regulatory decision-making.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-104JSpring-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introductory Lecture	Watch film A Civil Action	From the Real World to Hollywood and Back Again	Epidemiology: Persons, Places, and Time	Epidemiology: Test Development and Relative Risk	Biostatistics: Concepts in Variance
Biostatistics: Distribution	Confidence Intervals	Biostatistics: Detecting Differences	Biostatistics: Poisson	Environetics: Cause and Effect	Environetics: Study Design -

and the Mean		and Correlations	Analyses and Power		Retrospective versus Prospective
Environetics: Putting it all together - Evaluating Studies	Evaluating Environmental Causes of Mesothelioma	Quantitative Risk Assessment 1a	Quantitative Risk Assessment 2	Toxicology 1	Toxicology 2
Toxicology 3	Toxicology 4	Toxicology 5	Quantitative Risk Assessment 3	Quantitative Risk Assessment 4	

Systems Microbiology

(http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-106JFall-2006/CourseHome/index.htm)

Course Description: This course covers introductory microbiology from a systems perspective, considering microbial diversity, population dynamics, and genomics. Emphasis is placed on the delicate balance between microbes and humans, and the changes that result in the emergence of infectious diseases and antimicrobial resistance. The case study approach covers such topics as vaccines, toxins, biodefense, and infections including Legionnaire's disease, tuberculosis, Helicobacter pylori, and plague.

Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-106JFall-2006/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Early Earth/ Microbial Evolution	Cell Structure/ Function	Biological Energy Conservation	Microbial Growth	Metabolic Regulation	Virology
Information Flow in Biological Systems	Regulation of Cell Activity	Genetic Exchange in Bacteria	Experimental Evolution: Optimization of Metabolic Systems	Genomics I	Genomics II
Metabolic Diversity I	Metabolic Diversity II	Microbial Ecology	Microbial Growth Control	Microbe-host Interactions	Immunology I
Immunology II	Diagnostic Microbiology	Person-to-person Transmission	Epidemiology	Animal- and Arthropod-	Review

transmitted Diseases

Mechanisms of Drug Actions

(http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-201Fall-2005/CourseHome/index.htm)

Course Description: This course covers the chemical and biological analysis of the metabolism and distribution of drugs, toxins and chemicals in animals and humans, and the mechanism by which they cause therapeutic and toxic responses. Metabolism and toxicity as a basis for drug development is also covered.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-201Fall-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction and Principles	Chemistry/ Biochemistry Review	Overview of Drug Development	Uptake/ Transport/ Distribution of Drugs	Drug Transporters	Bioethics Seminar
Drug Transporters (cont.)	Introduction to Drug Metabolism	Liver Lecture	Drug Metabolism 2	Drug Metabolism 3	Drug Metabolism 4
Oxygen Radicals in Drug Toxicity	Drug Toxicities	Drug Toxicities (cont.)	Bioethics Seminar	Pharmacokinetics	Pharmacokinetics (cont.)
Receptors and Case Study - Omeprazole	Case Study - Omeprazole	Case Study - Omeprazole (cont.)	Case Study - Acetaminophen	Case Study - Acetaminophen (cont.)	Case Study - Statins
Case Study - Statins (cont.)	Drug Industry Seminar	Case Study - Statins (cont.)			

Molecular and Cellular Pathophysiology

(http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-450Spring-2005/CourseHome/index.htm)

Course Description: This course focuses on the fundamentals of tissue and organ response to injury from a molecular and cellular

perspective. There is a special emphasis on disease states that bridge infection, inflammation, immunity, and cancer. The systems approach to pathophysiology includes lectures, critical evaluation of recent scientific papers, and student projects and presentations.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-450Spring-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction to 20.450 and HCC	Cellular Pathology	Inflammation	Liver Anatomy and Histology	Immunity	Neoplasia
Neoplasia (cont.)	Infectious Diseases	Liver and Biliary	Hepatocarcinogenesis	Animal Models	Special Topic

Design of Medical Devices and Implants

(http://ocw.mit.edu/OcwWeb/Mechanical-Engineering/2-782JSpring-2006/CourseHome/index.htm)

Course Description: This design course targets the solution of clinical problems by use of implants and other medical devices. Topics include the systematic use of cell-matrix control volumes; the role of stress analysis in the design process; anatomic fit, shape and size of implants; selection of biomaterials; instrumentation for surgical implantation procedures; preclinical testing for safety and efficacy, including risk/benefit ratio assessment evaluation of clinical performance and design of clinical trials.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Mechanical-Engineering/2-782JSpring-2006/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Clinical Problems Requiring Implants for Solution	Principles of Implant Design / Design Parameters: Permanent versus Absorbable Devices	The Missing Organ and its Replacement	Criteria for Materials Selection	Tissue Engineering I: Scaffolds	Tissue Engineering II: Cells and Regulators
Case Study of Organ Regeneration	Design Specifications	Biocompatibility: Local and	Design Specifications: Tissue	Degradation of Devices: Natural and	Biocompatibility: Scar Formation

	Biomaterials Survey	Systemic Effects	Bonding and Modulus Matching	Synthetic Polymers	and Contraction
Degradation of Devices: Corrosion and Wear	Federal Regulation of Devices I	Oral Presentations of Proposals for Design II	Federal Regulation of Devices II	Scaffolds for Cartilage Repair	Implants for Bone
Implants for Plastic Surgery	Cardiovascular Prostheses: Heart Valves and Blood Vessels	Devices for Nerve Regeneration	Musculoskeletal Soft Tissues: Meniscus, Intervertebral Disk	Dental and Otologic Implants	Other Devices: Spinal Cord, Heart Lung
Final Oral Presentation of Designs (Mock FDA Panel)					

Molecular Principles of Biomaterials

(http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-462JSpring-2006/CourseHome/index.htm)

Course Description: This course covers the analysis and design at a molecular scale of materials used in contact with biological systems, including biotechnology and biomedical engineering. Topics include molecular interactions between bio- and synthetic molecules and surfaces; design, synthesis, and processing approaches for materials that control cell functions; and application of state-of-the-art materials science to problems in tissue engineering, drug delivery, vaccines, and cell-guiding surfaces.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biological-Engineering/20-462JSpring-2006/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Biodegradable Polymeric Solids	Biodegradable Polymeric Solids	Controlled Release Devices	Controlled Release Devices (cont.)	Case Studies in Complex Controlled Release	Hydrogels as Biomaterials
Hydrogels as	Hydrogels as	Hydrogels as	Hydrogels as	Engineering Biological	Engineering Biological

Biomaterials (cont.)	Biomaterials (cont.)	Biomaterials (cont.)	Biomaterials (cont.)	Recognition of Biomaterials	Recognition of Biomaterials (cont.)
Engineering Biological Recognition of Biomaterials (cont.)	Bioceramics and Biocomposites	Bioceramics and Biocomposites (cont.)	Bioceramics and Biocomposites (cont.)	Molecular Devices	Nanoparticle and Microparticle Biomolecule Drug Carriers
Nanoparticle and Microparticle Biomolecule Drug Carriers (cont.)	Basic Biology of Vaccination and Viral Infections	Basic Biology of Vaccination and Viral Infections (cont.)	Drug Targeting and Intracellular Drug Delivery for Vaccines	Drug Targeting and Intracellular Drug Delivery for Vaccines (cont.)	DNA Vaccines
DNA Vaccines (cont.)					

Biology

Genetics

(http://ocw.mit.edu/OcwWeb/Biology/7-03Fall-2004/CourseHome/index.htm)

Course Description: This course discusses the principles of genetics with application to the study of biological function at the level of molecules, cells, and multicellular organisms, including humans. The topics include: structure and function of genes, chromosomes and genomes, biological variation resulting from recombination, mutation, and selection, population genetics, use of genetic methods to analyze protein function, gene regulation and inherited disease.

Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biology/7-03Fall-2004/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Physical Structure	The Complementation Test and	Mendelian Genetics	Probability and Pedigrees	Chromosomes and Sex Linkage	Recombination and

of the Gene	Gene Function				Genetic Maps
Three-factor Crosses	Tetrad Analysis	Phage Genetics	Gene Structure and DNA Analysis	Mutations and Suppressors	Bacterial Genetics: Transposition
Bacterial Genetics: Transduction	Complementation in Bacteria: Plasmids	Complementation in Bacteria: Recombinant DNA	Prokaryotic Regulation: Negative Control	Prokaryotic Regulation: Positive Control	Prokaryotic Regulation: Regulatory Circuits
Eukaryotic Genes and Genomes I	Eukaryotic Genes and Genomes II	Eukaryotic Genes and Genomes III	Eukaryotic Genes and Genomes IV	Transgenes and Gene Targeting in Mice I	Transgenes and Gene Targeting in Mice II
Population Genetics: Hardy-Weinberg	Population Genetics: Mutation and Selection	Population Genetics: Inbreeding	Human Polymorphisms	Statistical Evaluation of Linkage I	Statistical Evaluation of Linkage II
Complex Traits	Chromosome Anomalies I	Chromosome Anomalies II	Genetics of Cancer I	Genetics of Cancer II	

Topics in Experimental Biology

(http://ocw.mit.edu/OcwWeb/Biology/7-18Fall-2005/CourseHome/index.htm)

Course Description: This independent experimental study course is designed to allow students with a strong interest in independent research to fulfill the project laboratory requirement for the Biology Department Program in the context of a research laboratory at MIT. The research should be a continuation of a previous project under the direction of a member of the Biology Department faculty.

This course provides instruction and practice in written and oral communication. Journal club discussions are used to help students evaluate and write scientific papers.

Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biology/7-18Fall-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Impromptu Description of Research Project, Logic of a Paragraph	Logic of a Research Paper, Organization of a Research Proposal, How to Present Data in a Lab Talk	Data and Figures, Results and Preliminary Results	Project Outline and Journal Club	Introduction, Background and Significance	Experimental Plan
Discussion of Paragraphs, Ethical Conduct of Science, Citations and Plagiarism	Methods and Materials	Scientific and Non-scientific Abstract	Discussion (cont.) and Polishing your Writing		

Cellular Neurobiology

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-09JSpring-2005/CourseHome/index.htm)

Course Description: This course serves as an introduction to the structure and function of the nervous system. Emphasis is placed on the cellular properties of neurons and other excitable cells. Topics covered include the structure and biophysical properties of excitable cells, synaptic transmission, neurochemistry, neurodevelopment, and the integration of information in simple systems and the visual system.

Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-09JSpring-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction to the Nervous System	Membrane Channels and Signaling	Ionic basis of the Resting Potential	Action Potential I	Action Potential II	Neurons as Conductors: Propagation of the Action Potential

Electrical and Chemical Synaptic Transmission	Mechanisms of Transmitter Release at Synapses	Indirect Mechanisms of Synaptic Transmission	Biochemistry of Synaptic Transmission	Learning and Memory I	Learning and Memory II
From Genes to Structure to Behavior	Nervous System Development I	Nervous System Development II	Axon Guidance I	Synapse Formation	Fine-Tuning Synaptic Connections
Vision I	Vision II	Hearing	Olfaction and Other Sensory Systems	Pain and Thermoreception	Higher Order Cognitive Function

Ubiquitination: The Proteasome and Human Disease

(http://ocw.mit.edu/OcwWeb/Biology/7-340Fall-2004/CourseHome/index.htm)

Course Description: This seminar provides a deeper understanding of the post-translational mechanisms evolved by eukaryotic cells to target proteins for degradation. Students learn how proteins are recognized and degraded by specific machinery (the proteasome) through their previous tagging with another small protein, ubiquitin. Additional topics include principles of ubiquitin-proteasome function, its control of the most important cellular pathways, and the implication of this system in different human diseases. Finally, speculation on the novel techniques that arose from an increased knowledge of the ubiquitin-proteosome system and current applications in the design of new pharmacological agents to battle disease is also covered.

Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biology/7-340Fall-2004/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction	Discovery of the Ubiquitin Conjugation System	Protein Degradation in Trafficking Membranes I: Endoplasmic Reticulum Associated Degradation	Protein Degradation in Trafficking Membranes II: Endocytosis and lysosomal Degradation	Role of Ubiquitination in Transcriptional Regulation	Ubiquitination in Cell Cycle Control and Programmed Cell Death

Ubiquitin-like Proteins	Functions of the Ubiquitin-Proteasome System in the Immune System	(ERAD) Pathway Ubiquitin and Cancer	Ubiquitin and Neurodegenerative Diseases: Alzheimer's and Parkinson's Diseases	More Diseases Involving Ubiquitin: Huntington's and Von Hippel-Lindau Disease	Too Much Degradation Can Be as Bad as Not Enough: Cystic Fibrosis and Liddle's Syndrome
Potential Therapeutic Strategies in Ubiquitin-Related Diseases					

Under the Radar Screen: How Bugs Trick Our Immune Defenses

(http://ocw.mit.edu/OcwWeb/Biology/7-340Spring-2007/CourseHome/index.htm)

Course Description: In this course, we will explore the specific ways by which microbes defeat our immune system and the molecular mechanisms that are under attack (phagocytosis, the ubiquitin/proteasome pathway, MHC I/II antigen presentation). Through our discussion and dissection of the primary research literature, we will explore aspects of host-pathogen interactions. We will particularly emphasize the experimental techniques used in the field and how to read and understand research data. Technological advances in the fight against microbes will also be discussed, with specific examples.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biology/7-340Spring-2007/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Phagocytosis	Toll-like receptors (TLRs)	The proteasome and ubiquitin	Major histocompatibility (MHC) class I antigen presentation	Major histocompatiblity (MHC) class II antigen presentation	Cytokines
Programmed cell death	Molecular mimicry	Antimicrobial peptides: Innate			

immunity
effectors

The Radical Consequences of Respiration: Reactive Oxygen Species in Aging and Disease

(http://ocw.mit.edu/OcwWeb/Biology/7-343Fall-2007/CourseHome/index.htm)

Course Description: This course will start with a survey of basic oxygen radical biochemistry followed by a discussion of the mechanisms of action of cellular as well as dietary antioxidants. After considering the normal physiological roles of oxidants, we will examine the effects of elevated ROS and a failure of cellular redox capacity on the rate of organismal and cellular aging as well as on the onset and progression of several major diseases that are often age-related. Topics will include ROS-induced effects on stem cell regeneration, insulin resistance, heart disease, neurodegenerative disorders, and cancer. The role of antioxidants in potential therapeutic strategies for modulating ROS levels will also be discussed.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biology/7-343Fall-2007/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction and background	The high price of energy: Mitrochondrial production of ROS	Radical messengers: ROS as facilitators of cellular signaling	Hired assassins: ROS in anti-pathogen defense	Antioxidants: fighting the good fight	The free radical theory: ROS and aging
The root of the problem: oxidative damage in stem cell renewal	Balancing act: ROS effects on insulin resistance and diabetes	Breaking hearts: ROS in ischemic reperfusion injury	Brain drain: oxidative stress in neurodegenerative diseases	Foot-soldiers of renegade cells: ROS in cancer and oncogenic transformation	Fighting fire with fire: more ROS or less ROS as therapeutic strategies?

Protein Folding Problem

(http://ocw.mit.edu/OcwWeb/Biology/7-88JFall-2007/CourseHome/index.htm)

Course Description: This course focuses on the mechanisms by which the amino acid sequence of polypeptide chains (proteins), determine their three-dimensional conformation. Topics in this course include sequence determinants of secondary structure, the folding of newly synthesized polypeptide chains within cells, folding intermediates aggregation and competing off-pathway reactions, and the unfolding and refolding of proteins in vitro. Additional topics covered are the role of helper proteins such as chaperonins and isomerases, protein recovery problems in the biotechnology industry, and diseases found associated with protein folding defects.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Biology/7-88JFall-2007/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction to the problem	Side-chain review + Sulfur redox chemistry	The Anfinsen experiments	Globular protein structure + Protein interiors	Using the Protein database (PDB)	Helix-helix packing in globular proteins
Beta-sheets + Beta-sheet packing	Experimental techniques: circular dichroism	Thermal denaturation + Coiled coils + Refolding of tropomyosin	Fluorescence spectroscopy	S-peptide helical folding	Detecting partially folded intermediates
Prolyl isomerization	Cytochrome c refolding pathway	2-D NMR techniques	Collagen structure and folding in vivo	Procollagen folding in vitro	Protein calorimetry: BPTI
Protein misfolding and aggregation	Ribosome channel + Nascent chains + Trigger factor	Scaffolding proteins in viral shell assembly	Amyloid fiber formation in neuro degenerative disease	Chaperonin assisted folding	Eukariotic chaperonins
Paper topic discussion and choices	Membrane protein (rhodopsin) folding and assembly	Prion diseases	Etiology of some human protein deposition diseases		

Brain and Cognitive Sciences

Neuroscience and Behavior

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-01Fall-2003/CourseHome/index.htm)

Course Description: This course covers the relation of structure and function at various levels of neuronal integration. Topics include functional neuroanatomy and neurophysiology, sensory and motor systems, centrally programmed behavior, sensory systems, sleep and dreaming, motivation and reward, emotional displays of various types, "higher functions" and the neocortex, and neural processes in learning and memory.

Audio Lectures: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-01Fall-2003/AudioLectures/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction to Brain-behavior Studies	History and Goals, II	History and Goals, III	History and Goals, IV	Cellular Mechanisms	Neuronal Conduction and Transmission
Synapses + Neuroanatomical Techniques	Introduction to CNS and its Evolution	Evolution (cont.) + Reflex and Cerebellar Channels	Brain Subdivisions + Channels of Conduction	Transection Effects + Neocortex	Spinal Cord + Autonomic NS
Hindbrain and Midbrain	Midbrain and Forebrain	Development of CNS, Introduction	Cell migration + Axon Growth Stages	Influences on Axon Growth	Axonal Sprouting and Regeneration
Motor System, 1	Motor System, 2	Motor System, 3	Motor 4: Rythmic Outputs	Rhythms of Activity + Sleep and Waking	Sleep and Waking (cont.)
Habituation, Novelty Responses	Visual System 1: Anatomy, Ablations	Visual System 2: Physiology (orig: Ablation Effects)	Visual System 3: Ablation Studies	Visual System 4: Ablations (cont.) (Orig: Electrophysiology)	Visual System Conclusion
Auditory System	Pain and Central Gray Area	Hypothalamus and Feeding	Drive, Reward + Agonistic Behavior	Higher Functions + Human Nature	Human Nature and Neuroscience

Neural Basis of Learning and Memory

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-03Fall-2007/CourseHome/index.htm)

Course Description: This course highlights the interplay between cellular and molecular storage mechanisms and the cognitive neuroscience of memory, with an emphasis on human and animal models of hippocampal mechanisms and function.

Selected Lectures Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-03Fall-2007/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Lecture 1: Brief History of Work in the Area of Learning and Memory Lecture 23: Emotional Learning and Memory	Lecture 2: Introduction; Cells and Synapses	Lecture 3: Neuroimaging Techniques	Lecture 4: Skill Memory	Lecture 6: Sensory, Short-Term, and Working Memory	Lecture 21: Observational Learning; Mirror Neurons

Neural Basis of Vision and Audition

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-04Fall-2006/CourseHome/index.htm)

Course Description: This course examines the neural bases of visual and auditory processing for perception and sensorimotor control, focusing on physiological and anatomical studies of the mammalian nervous system as well as behavioral studies of animals and humans. Visual pattern, color and depth perception, auditory responses and speech coding, and spatial localization are studied.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-04Fall-2006/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
The layout of the visual system, the retina, and	The visual cortex	The ON and OFF channels	The midget and parasol channels	Adaptation and color	Depth perception

the lateral geniculate nucleus					
Form perception	Illusions and visual prosthetics	The neural control of visually guided eye movements, subcortical control	The neural control of visually guided eye movements, cortical control	Motion perception and pursuit eye movements	Hair cells: Transduction, electrophysiology and "Cochlear Amplifier"
Auditory nerve; psychophysics of frequency resolution	Hearing loss and cochlear implants	Cochlear nucleus: Tonotopy, unit types and cell types	Brainstem reflexes: OC efferents and middle ear muscles	Sound localization I: Psychophysics and neural circuits	Sound localization II: Superior olivary complex and inferior colliculus
Auditory cortex I: General physiology and role in sound localization	Auditory cortex II: Language; Bats and echolocation	Eaton-Peabody lab tour at Massachusetts Eye and Ear Infirmary	Comparison of vision and audition, vision review		

Brain Mechanisms for Hearing and Speech

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-722JFall-2005/CourseHome/index.htm)

Course Description: An advanced course covering anatomical, physiological, behavioral, and computational studies of the central nervous system relevant to speech and hearing. Students learn primarily by discussions of scientific papers on topics of current interest. Recent topics include cell types and neural circuits in the auditory brainstem, organization and processing in the auditory cortex, auditory reflexes and descending systems, functional imaging of the human auditory system, quantitative methods for relating neural responses to behavior, speech motor control, cortical representation of language, and auditory learning in songbirds.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-722JFall-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Dorsal Cochlear Nucleus	Descending Systems	Cell Types and Circuits	Quantitative Methods	Thalamus and Cortex	Neuroimaging
Speech Motor Control	Motor Control	Cortical Language Processing			

Statistical Methods in Brain and Cognitive Science

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-07Spring-2004/CourseHome/index.htm)

Course Description: This course emphasizes statistics as a powerful tool for studying complex issues in behavioral and biological sciences, and explores the limitations of statistics as a method of inquiry. The course covers descriptive statistics, probability and random variables, inferential statistics, and basic issues in experimental design. Techniques introduced include confidence intervals, t-tests, F-tests, regression, and analysis of variance. Assignments include a project in data analysis.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-07Spring-2004/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction to Statistics	Describing Data + Graphs, Central Tendency, and Spread	Probability, I	Probability, I (cont.) + Probability, II	Random Variables	Sampling Theory
Confidence Intervals	Single-sample Hypothesis Testing, I	Single-sample Hypothesis Testing, II	Two-sample Hypothesis Testing, I	Two Sample t-Test	Two-sample Hypothesis Testing, II
Experimental Design, I	Experimental Design, II	Experimental Design, II (cont.) + Regression and Correlation, I	Regression and Correlation, II	Regression and Correlation, III	Chi-square Tests
One-way ANOVA, I	One-way ANOVA, II	Two-way ANOVA, I	Two-way ANOVA, II		

Human Memory and Learning

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-081Human-Memory-and-LearningFall2002/CourseHome/index.htm)

Course Description: Surveys the literature on the cognitive and neural organization of human memory and learning. Includes consideration of working memory and executive control, episodic and semantic memory, and implicit forms of memory. Emphasizes integration of cognitive theory with recent insights from functional neuroimaging (e.g., fMRI and PET).

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-081Human-Memory-and-LearningFall2002/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Lecture 1: What is Memory?	Lecture 3: Neuroimaging and Cognitive Control	Lecture 5: Episodic and PrimarycMemory	Lecture 9: Nondeclarative Memory		

Brain Structure and its Origins

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-14Spring-2005/CourseHome/index.htm)

Course Description: This course covers major CNS structures with emphasis on systems being used as models for experimental studies of development and plasticity. Topics include basic patterns of connections in CNS, embryogenesis, PNS anatomy and development, process outgrowth and synaptogenesis, growth factors and cell survival, spinal and hindbrain anatomy, and development of regional specificity with an introduction to comparative anatomy and CNS evolution. A review of lab techniques (anatomy, tissue culture) is also covered as well as the trigeminal system, retinotectal system development, plasticity, regeneration, neocortex anatomy and development, the olfactory system, corpus striatum, brain transplants, the limbic system and hippocampal anatomy and plasticity.

Audio Lectures: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-14Spring-2005/AudioLectures/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction: Brain Orientation, Primitive Cellular Activities	Introduction: Methods; Primitive Cellular Activities	Steps to the CNS of Chordates	Steps to the CNS of Chordates (cont.)	Specializations in CNS Evolution	Specializations in CNS Evolution (cont.)
Spinal Cord Development and Anatomy	Spinal Cord Development and Anatomy (cont.)	Differentiation of the Brain Vesicles	Differentiation of the Brain Vesicles (cont.)	Differentiation of the Brain Vesicles (cont.)	Differentiation of the Brain Vesicles (cont.)
Axon Growth	Axon Growth (cont.)	Motor Systems	Motor Systems (cont.)	Taste and Olfactory Systems	Taste and Olfactory Systems (cont.)
Visual Systems	Visual Systems (cont.)	Visual Systems (cont.)	Auditory Systems	Auditory Systems (cont.)	Forebrain Introduction
Hypothalamus, Limbic System	Hypothalamus, Limbic System (cont.)	Hypothalamus, Limbic System (cont.)	Hypothalamus, Limbic System (cont.)	Hypothalamus, Limbic System (cont.)	Corpus Striatum
Corpus Striatum (cont.)	Neocortex	Neocortex (cont.)	Neocortex (cont.)	Neocortex (cont.)	Plastic Systems: Cerebellum, Striatum, Cortex

Animal Behavior

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-20Fall-2005/CourseHome/index.htm)

Course Description: Most of the major categories of adaptive behavior can be seen in all animals. This course begins with the evolution of behavior, the driver of nervous system evolution, reviewed using concepts developed in ethology, sociobiology, other comparative studies, and in studies of brain evolution. The roles of various types of plasticity are considered, as well as foraging and feeding, defensive and aggressive behavior, courtship and reproduction, migration and navigation, social activities and communication, with contributions of inherited patterns and cognitive abilities. Both field and laboratory based studies are reviewed; and finally, human behavior is considered within the context of primate studies.

Audio Lectures: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-20Fall-2005/AudioLectures/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Animals in Human History + Amateur and Professional Studies	Introduction to Ethology + Tinbergen's Four Questions + Field Studies of Birds	Lorenz' Jackdaws	Ethology of Geese + Fixed Action Patterns and the Central Nervous System	Input and Output Sides of Innate Behavior + Motivation	Motivation (cont.)
Lorenz on Fixed Action Patterns	Lorenz on Innate Releasing Mechanisms	Models, Hierarchies and Chains of Action Patterns	Spatial Orientation + Multiple Motivations	Evolution of Behavior, Genes, Learning	Navigation, Migration, Communication
Communication (cont.)	Foraging	Anti-predator Behavior	Anti-predator Behavior (cont.)	Mating and Reproduction, Introduction	Sociobiology Introduction
Sociobiology Subject Matter	Genes and Behaviors	Sociobiology and Science	Discoveries of Sociobiology	Cultural Determinism and Sociobiology	Sociobiology and Culture
Practical Issues in Study of Adaptation	The Triumph of Sociobiology				

Neural Coding and Perception of Sound

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-723Spring-2005/CourseHome/index.htm)

Course Description: This course focuses on neural structures and mechanisms mediating the detection, localization and recognition of sounds. Discussions cover how acoustic signals are coded by auditory neurons, the impact of these codes on behavioral performance, and the circuitry and cellular mechanisms underlying signal transformations. Topics include temporal coding, neural maps and feature detectors, learning and plasticity, and feedback control. General principles are conveyed by theme discussions of auditory masking, sound localization, musical pitch, speech coding, and cochlear implants.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-723Spring-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Hearing and the Auditory System: An Overview	How the Ear Works (Functional Cochlear Mechanics)	Stimulus Coding in the Auditory Nerve	Masking and Frequency Selectivity	Masking and Nonlinearity	Masking and Nonlinearity (cont.)
Cochlear Implants	Intensity Perception and Cochlear Hearing Loss	Channels, Synapses and Neurotransmitters	Cellular Mechanisms in the Cochlear Nucleus	Cellular Mechanisms in the Cochlear Nucleus	Cellular Mechanisms in the Cochlear Nucleus
Binaural Hearing	Binaural Interactions in the Auditory Brainstem	Binaural Interactions	Binaural Interactions	Pitch of Pure and Complex Tones	Neural Processing of Pitch
Pitch and Temporal Coding	Pitch and Temporal Coding (cont.)	Auditory Cortex: Cortical organization	The Human Auditory System	Neural Maps and Plasticity	Neural Maps and Plasticity
Auditory Scene Analysis (ASA) and Object Formation	Scene Analysis				

Introduction to Computational Neuroscience

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-29JSpring-2004/CourseHome/index.htm)

Course Description: This course gives a mathematical introduction to neural coding and dynamics. Topics include convolution, correlation, linear systems, game theory, signal detection theory, probability theory, information theory, and reinforcement learning. Applications to neural coding, focusing on the visual system are covered, as well as Hodgkin-Huxley and other related models of neural excitability, stochastic models of ion channels, cable theory, and models of synaptic transmission.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-29JSpring-2004/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Examples of Neural Coding, Simple Linear Regression	Convolution and Correlation 1 + Firing Rate	Simple Statistics and Linear Regression	Convolution and Correlation 2 + Spike-triggered Average + Wiener-Hopf Equations and White Noise Analysis	Operant Matching 1	

Neural Plasticity in Learning and Development

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-301JNeural-Plasticity-in-Learning-and-DevelopmentSpring2002/CourseHome/index.htm)

Course Description: Roles of neural plasticity in learning and memory and in development of invertebrates and mammals. An in-depth critical analysis of current literature of molecular, cellular, genetic, electrophysiological, and behavioral studies. Discussion of original papers supplemented by introductory lectures.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-301JNeural-Plasticity-in-Learning-and-DevelopmentSpring2002/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Lecture 1: Introduction	Lecture 2: Behavior and Plasticity	Lecture 3: Synaptic Transmission	Lecture 4: Potentiation of Synaptic Transmission	Lecture 5: Expression of Plasticity	

Parkinson's Disease Workshop

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-458Summer-2006/CourseHome/index.htm)

Course Description: Parkinson's disease (PD) is a chronic, progressive, degenerative disease of the brain that produces movement disorders and

deficits in executive functions, working memory, visuospatial functions, and internal control of attention. It is named after James Parkinson (1755-1824), the English neurologist who described the first case.

This six-week summer workshop explored different aspects of PD, including clinical characteristics, structural neuroimaging, neuropathology, genetics, and cognitive function (mental status, cognitive control processes, working memory, and long-term declarative memory). The workshop did not take up the topics of motor control, nondeclarative memory, or treatment.

Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-458Summer-2006/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Cognition in Parkinson's Disease	Neuropathology and Structural Neuroimaging in Parkinson's Disease	Genetics of Parkinson's Disease	Cognitive Control Processes and Working Memory in Parkinson's Disease	A Systems Neuroscience Approach to Memory	Long-term Declarative Memory in Parkinson Disease

Scene Understanding Symposium

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-459Spring-2006/CourseHome/index.htm)

Course Description: What are the circuits, mechanisms and representations that permit the recognition of a visual scene from just one glance? In this one-day seminar on Scene Understanding, speakers from a variety of disciplines - neurophysiology, cognitive neuroscience, visual cognition, computational neuroscience and computer vision - will address a range of topics related to scene recognition, including natural image categorization, contextual effects on object recognition, and the role of attention in scene understanding and visual art. The goal is to encourage exchanges between researchers of all fields of brain sciences in the burgeoning field of scene understanding.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-459Spring-2006/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
From Zero to Gist in 200 msec: The Time Course of Scene Recognition	Feedforward Theories of Visual Cortex Predict Human Performance in Rapid Image Categorization	Latency, Duration and Codes for Objects in Inferior Temporal Cortex	From Feedforward Vision to Natural Vision: The Impact of Free Viewing, Task, and Clutter on Monkey Inferior Temporal Object Representations	Perception of Objects in Natural Scenes and the Role of Attention	Natural Scene Categorization: From Humans to Computers
Using the Forest to See the Trees: A Computational Model Relating Features, Objects and Scenes	Scene Perception after Those First Few Hundred Milliseconds				

Statistical Learning Theory and Applications

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-520Statistical-Learning-Theory-and-ApplicationsSpring2003/CourseHome/index.htm)

Course Description: Focuses on the problem of supervised learning from the perspective of modern statistical learning theory starting with the theory of multivariate function approximation from sparse data. Develops basic tools such as Regularization including Support Vector Machines for regression and classification. Derives generalization bounds using both stability and VC theory. Discusses topics such as boosting and feature selection. Examines applications in several areas: computer vision, computer graphics, text classification and bioinformatics.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-520Statistical-Learning-Theory-and-ApplicationsSpring2003/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
The Learning Problem in Perspective	Regularization and Reproducing Kernel Hilbert Spaces	Regression and Least-Squares Classification	Support Vector Machines for Classification	Generalization Bounds, Introduction to Stability	Stability of Tikhonov Regularization
Consistency and Uniform Convergence Over Function Classes	Necessary and Sufficient Conditions for Uniform Convergence	Bagging and Boosting	Computer Vision, Object Detection	Approximation Theory	RKHS, Mercer Thm, Unbounded Domains, Frames and Wavelets
Bioinformatics	Text	Regularization Networks	Morphable Models for Video	Leave-one-out Approximations	Bayesian Interpretations
Multiclass Classification	Math Camp 1: Functional Analysis	Math Camp 2: Lagrange Multipliers/ Convex Optimization	SVM Rules of Thumb		

Language Processing

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-591JFall-2004/CourseHome/index.htm)

Course Description: This course is a seminar in real-time language comprehension. It considers models of sentence and discourse comprehension from the linguistic, psychology, and artificial intelligence literature, including symbolic and connectionist models. Topics include ambiguity resolution and linguistic complexity; the use of lexical, syntactic, semantic, pragmatic, contextual and prosodic information in language comprehension; the relationship between the computational resources available in working memory and the language processing mechanism; and the psychological reality of linguistic representations.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-591JFall-2004/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Course Overview + Modularity	Resources and Sentence	Working Memory and	Resources and Ambiguity	Experience / Frequency and	Symbolic Computational Approaches

in Sentence Comprehension	Complexity in Sentence Comprehension + The Complexity of Unambiguous Sentences + The Dependency Locality Theory	Sentence Comprehension in Serial / Parallel Question	Resolution in Ambiguity Resolution		to Language Parsing + Parsing Strategies + Shift-reduce Parsing
Referential and Contextual Issues in Sentence Comprehension	Event-related Potentials (ERPs) and Other Brain-imaging Methods Investigating Sentence Comprehension				

Psycholinguistics

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-59JSpring-2005/CourseHome/index.htm)

Course Description: This course covers central topics in language processing, including: the structure of language; sentence, discourse, and morphological processing; storage and access of words in the mental dictionary; speech processing; the relationship between the computational resources available in working memory and the language processing mechanism; and ambiguity resolution. The course also considers computational modeling, including connectionist models; the relationship between language and thought; and issues in language acquisition including critical period phenomena, the acquisition of speech, and the acquisition of words. Experimental methodologies such as self-paced reading, eye-tracking, cross-modal priming, and neural imaging methods are also examined.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-59JSpring-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Syntax I	Syntax II	Syntax III	Sentence Parsing + Sentence Comprehension I	Sentence Comprehension II	Sentence Comprehension III
Sentence Processing IV	Semantic and Pragmatic Processing	Sentence and Discourse Comprehension	Discourse Comprehension	Neural Imaging and Language Processing	Speech
Speech (cont.)	Speech Perception and Production	Words: Visual Word Recognition	Language Acquisition		

Language Acquisition I

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-601JLanguage-Acquisition-ISpring2002/CourseHome/index.htm)

Course Description: Lectures, reading, and discussion of current theory and data concerning the psychology and biology of language acquisition. Emphasizes learning of syntax and morphology, together with some discussion of phonology, and especially research relating grammatical theory and learnability theory to empirical studies of children.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-601JLanguage-Acquisition-ISpring2002/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Development of the Morphosyntax of Verbal Inflections	The OI Stage in English				

Natural Language and the Computer Representation of Knowledge

(http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-863JSpring2003/CourseHome/index.htm)

Course Description: Natural Language and the Computer Representation of Knowledge is a laboratory-oriented course on the theory and practice of building computer systems for human language processing, with an emphasis on the linguistic, cognitive, and engineering foundations for understanding their design.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Electrical-Engineering-and-Computer-Science/6-863JSpring2003/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction, Organization, Laboratories, Course Overview: Introduction to NLP, Main Issues, fsa's	Linguistics: Phonology and Morphology I, 2-level morphology, Kimmo	Linguistics: Phonology and Morphology II	HMM Tagging, Statistical Transformation RuleBased Tagging, Precision, Recall, Accuracy	Part of Speech Tagging: The Brill Tagger	Introduction to Parsing, Linguistics: Syntax & Parsing
Shift-Reduce Parsers in Detail, Earley's Algorithm and Chart Parsing	Context-Free Parsing and Beyond: Efficiency Issues, Feature-Based Parsing, NL System Design	Shift-Reduce Parsers in Detail, Earley's Algorithm and Chart Parsing	Parsing with an Integrated Lexicon - The Question of Syntactic Features	Semantic Interpretation I: Compositionality	Semantic Interpretation II: Compositionality and Quantifiers
Semantics III: Lexical Semantics	Semantics IV: Lexical Semantics	Semantics V: Constraint-Based Systems	Machine Translation I	Machine Translation III	Machine Translation IV
Language Learning I	Language Learning II				

Laboratory in Cognitive Science

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-63Fall-2005/CourseHome/index.htm)

Course Description: Laboratory in Cognitive Science teaches principles of experimental methods in human perception and cognition, including design and statistical analysis. The course combines lectures and hands-on experimental exercises and requires an independent experimental project. Some experience in programming is desirable.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-63Fall-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Variables and Controls - Signal Detection Theory	Single Factor Design and Statistics (T-test)	Factorial Design and External Validity	Factorial Design and Statistical Analysis (ANOVA)	Experimental Paradigms in Cognitive Science	Cognitive Neuroscience Methods
Single Participant Experiments, Quasi-Experiments	Correlational Studies and Non Experimental Research	Writing a Paper	Experiments in Other Sciences	Ethics in Research	

Introduction to Neural Networks

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-641JSpring-2005/CourseHome/index.htm)

Course Description: This course explores the organization of synaptic connectivity as the basis of neural computation and learning. Perceptrons and dynamical theories of recurrent networks including amplifiers, attractors, and hybrid computation are covered. Additional topics include backpropagation and Hebbian learning, as well as models of perception, motor control, memory, and neural development.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-641JSpring-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
From Spikes to Rates	Lateral Inhibition and Feature Selectivity	Hamiltonian Dynamics	Antisymmetric Networks	Excitatory-Inhibitory Networks	VQ + PCA
Delta Rule	Conditioning + Backpropagation	More Backpropagation			

Computational Cognitive Science

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-66JFall-2004/CourseHome/index.htm)

Course Description: This course is an introduction to computational theories of human cognition. Drawing on formal models from classic and contemporary artificial intelligence, students will explore fundamental issues in human knowledge representation, inductive learning and reasoning. What are the forms that our knowledge of the world takes? What are the inductive principles that allow us to acquire new knowledge from the interaction of prior knowledge with observed data? What kinds of data must be available to human learners, and what kinds of innate knowledge (if any) must they have?

Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-66JFall-2004/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Foundations of Inductive Learning	Knowledge Representation: Spaces, Trees, Features	Knowledge Representation: Language and Logic 1	Knowledge Representation: Language and Logic 2	Knowledge Representation: Great Debates 1	Knowledge Representation: Great Debates 2
Basic Bayesian Inference	Graphical Models and Bayes Nets	Simple Bayesian Learning 1	Simple Bayesian Learning 2	Probabilistic Models for Concept Learning and Categorization 1	Probabilistic Models for Concept Learning and Categorization 2
Unsupervised and Semi-supervised Learning	Non-parametric Classification: Exemplar Models and Neural Networks 1	Non-parametric Classification: Exemplar Models and Neural Networks 2	Controlling Complexity and Occam's Razor 1	Controlling Complexity and Occam's Razor 2	Intuitive Biology and the Role of Theories
Learning Domain Structures 1	Learning Domain Structures 2	Causal Learning	Causal Theories 1	Causal Theories 2	

Special Topics: Genetics, Neurobiology, and Pathophysiology of Psychiatric Disorders

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-914Fall-2008/CourseHome/index.htm)

Course Description: The key topics covered in this course are Bipolar Disorder, Psychosis, Schizophrenia, Genetics of Psychiatric Disorder, DISC1, Ca++ Signaling, Neurogenesis and Depression, Lithium and GSK3 Hypothesis, Behavioral Assays, CREB in Addiction and Depressive Behaviors, The GABA System-I, The GABA System-II, The Glutamate Hypothesis of Schizophrenia, The Dopamine Pathway and DARPP32.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-914Fall-2008/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
General introduction	DISC1	Literature discussion: neurogenesis and depression	Literature discussion: the dopamine pathway and DARPP32		

Language and Mind

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-98Language-and-MindJanuary-IAP-2003/CourseHome/index.htm)

Course Description: This course will address some fundamental questions regarding human language: (1) how language is represented in our minds; (2) how language is acquired by children; (3) how language is processed by adults; (4) the relationship between language and thought; (5) exploring how language is represented and processed using brain imaging methods; and (6) computational modeling of human language acquisition and processing.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-98Language-and-MindJanuary-IAP-2003/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Why Study Language?	The Human Brain: Brain Areas	The Structure of Language	Relationship Between Language and Thought Beyond Cross-linguistic Differences		

Neuropharmacology

(http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-98January-IAP-2009/CourseHome/index.htm)

Course Description: The neuropharmacology course will discuss the drug-induced changes in functioning of the nervous system. The specific focus of this course will be to provide a description of the cellular and molecular actions of drugs on synaptic transmission. This course will also refer to specific diseases of the nervous system and their treatment in addition to giving an overview of the techniques used for the study of neuropharmacology.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Brain-and-Cognitive-Sciences/9-98January-IAP-2009/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Basics of neuroscience	The neurotransmitter systems	Neuropsychiatric disorders: anxiety, mood disorders	Neuropsychiatric disorders: schizophrenia		

Health Sciences and Technology

Musculoskeletal Pathophysiology

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-021January-IAP-2006/CourseHome/index.htm)

Course Description: This course covers the growth, development and structure of normal bone and joints, the biomechanics of bone connective tissues, and their response to stress, calcium and phosphate homeostasis.

Additional topics include regulation by parathyroid hormone and vitamin D, the pathogenesis of metabolic bone diseases and diseases of connective tissues, joints and muscle with consideration of possible mechanisms and underlying metabolic derangements.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-021January-IAP-2006/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Rheumatic Diseases (I) + Rheumatic Diseases (II)	Pathogenesis of Rheumatoid Arthritis + Rheumatic Diseases (III), Vasculitis				

Principle and Practice of Human Pathology

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-035Spring2003/CourseHome/index.htm)

Course Description: This course provides a comprehensive overview of human pathology with emphasis on mechanisms of disease and diagnostic medicine. Topics include:

•Cellular Mechanisms of Disease

•Molecular Pathology

•Pathology of Major Organ Systems

•Review of Diagnostic Tools from Traditional Surgical Pathology to Diagnostic Spectroscopy

•Functional and Molecular Imaging

•Molecular Diagnostics

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-035Spring2003/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction to Human Pathology and Diagnostic Medicine	Epithelial Structure and Function	The Immune System	Cell Injury, Adaptation and Death	Acute and Chronic Inflammation	Tissue Repair, Fibrosis and Healing
Infectious Diseases: "The Biological Conflict of Interest"	Transplantation: "Friendly Organs in a Hostile Environment"	Are We What We Eat? "The Link Between Diet and Disease Development"	Ischemia and Infarction	Genetic Disorders	The Liver

Human Reproductive Biology

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-071Fall-2005/CourseHome/index.htm)

Course Description: This course is designed to give the student a clear understanding of the pathophysiology of the menstrual cycle, fertilization, implantation, ovum growth development, differentiation and associated abnormalities. Disorders of fetal development including the principles of teratology and the mechanism of normal and abnormal parturition will be covered as well as the pathophysiology of the breast and disorders of lactation. Fetal asphyxia and its consequences will be reviewed with emphasis on the technology currently available for its detection. In addition the conclusion of the reproductive cycle, menopause, and the use of hormonal replacement will be covered.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-071Fall-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Male System Physiology	Male Fertility, Temperature and the Testes	Endometriosis	Clinical Pathological Conference: Female Reproductive System	Abnormalities of the Menstrual Cycle	Uterine Pathology: Fibroids
Ovarian Pathology	Non-hormonal Contraception	Hormonal Contraception	Phytoestrogens	The Placenta	Placental Pathology

	I + Non-hormonal Contraception II				
Clinical Pathological Conference: Menstrual Cycle	Cervical Pathology and Cancer	Clinical Pathological Conference: Cervix	Sexual Differentiation I + Sexual Differentiation II	Assisted Reproductive Technology	Maternal Physiology I + Maternal Physiology II
Hypertension in Pregnancy	Parturition	Polycystic Ovarian Syndrome (PCO)	Ovarian Failure	Toxoplasmosis	Isoimmunization
Ultrasound Prenatal Diagnosis	Energy and Radiation Impact on Pregnancy	Prenatal Genetic Diagnosis	Fetal Surveillance	Pregnancy Termination Technology	

Gastroenterology

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-121Fall-2005/CourseHome/index.htm)

Course Description: The most recent knowledge of the anatomy, physiology, biochemistry, biophysics, and bioengineering of the gastrointestinal tract and the associated pancreatic, liver and biliary tract systems is presented and discussed. Gross and microscopic pathology and the clinical aspects of important gastroenterological diseases are then presented, with emphasis on integrating the molecular, cellular and pathophysiological aspects of the disease processes to their related symptoms and signs.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-121Fall-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Overview of Embryology	Overview of Physiology	Gastroduodenal Pathophysiology and Disorders	Pathology of Esophagus and Stomach	Mucosal Immunology of the GI Tract	Lipid Digestion, Absorption and Malabsorption
Pathology of the Intestines	Gastrointestinal Neoplasms	Physiological Chemistry of GI Lipids	Pathology of Pancreas and Biliary Tract	Biliary Secretion, Cholestasis and	Pathology of the Liver

					Gallstone Formation
Jaundice and Disorders of Bilirubin Metabolism	Alcohol and Drug-Induced Liver Disease				

Principles of Pharmacology

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-151Spring-2005/CourseHome/index.htm)

Course Description: The object of the course is to teach students an approach to the study of pharmacologic agents. It is not intended to be a review of the pharmacopoeia. The focus is on the basic principles of biophysics, biochemistry and physiology, as related to the mechanisms of drug action, biodistribution and metabolism. Topics covered include: mechanisms of drug action, dose-response relations, pharmacokinetics, drug delivery systems, drug metabolism, toxicity of pharmacological agents, drug interaction and substance abuse. Selected agents and classes of agents are examined in detail.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-151Spring-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Pharmacokinetics I	Pharmacokinetics II	Cases: Anticholinesterase	Autonomic Pharmacology I and II	Antidysrhythmics	Anti-inflammatory Drugs
Vasoactive Drugs I	Vasoactive Drugs II: Heart Failure	Lipid Lowering Drugs	Immunosuppression for Solid Organ Transplantation	Neuropharmacology I: Drugs for Movement Disorders	Nitric Oxide
Neuropharmacology II: Anxiolytics and Antidepressants	Neuropharmacology III: Anticonvulsants	Antimicrobial Chemotherapy I and II	Chemotherapy I and II	Opioids I and II	

Cellular and Molecular Immunology

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-176Fall-2005/CourseHome/index.htm)

Course Description: This course covers cells and tissues of the immune system, lymphocyte development, the structure and function of antigen receptors, the cell biology of antigen processing and presentation, including molecular structure and assembly of MHC molecules, the biology of cytokines, leukocyte-endothelial interactions, and the pathogenesis of immunologically mediated diseases.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-176Fall-2005/LectureNotes/index.htm)

2005

Column1	Column2	Column3	Column4	Column5	Column6
Cells of the Immune System	Lymphocyte Homing	Antibodies and Antigens	Antigen Receptors and the Generation of Diversity	B Lymphocyte Development and Activation	Antigen Presentation
T Lymphocyte Development	Cell Mediated Immunity	Frontiers: Costimulation	Memory and Death	Tumor Immunology	Genetic Susceptibility to Disease

2002

Column1	Column2	Column3	Column4	Column5	Column6
Cells of Immune System and Innate Immunity	Antibodies	Antibody-dependent Protection Mechanisms	Antigen Receptors and Development of Diversity	T Lymphocyte Development	B Lymphocyte Dev and Activation
Cell-mediated Immunity	Lymphocyte Homing	MHC/ Antigen Presentation	Lymphocyte Activation, Cytokines, Costim	Transplantation Immunology	Immunology of HIV Disease
Costimulation	Memory and Death in Immune System	IgE System and Immediate Type Hypersens	Tumor Immunity	Immunodeficiency Syndromes	

Projects in Microscale Engineering for the Life Sciences

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-410JSpring-2007/CourseHome/index.htm)

Course Description: This course is a project-based introduction to manipulating and characterizing cells and biological molecules using microfabricated tools. It is designed for first year undergraduate students.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-410JSpring-2007/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Microfluidics	Microfabrication	Cells and membranes	Cells and membranes (cont.)	Models of diffusion and cell experiment	Laminar flow
Data analysis using MATLAB®	Research applications	Cell traps			

Statistical Physics in Biology

(http://ocw.mit.edu/OcwWeb/Physics/8-592JSpring-2005/CourseHome/index.htm)

Course Description: Statistical Physics in Biology is a survey of problems at the interface of statistical physics and modern biology. Topics include: bioinformatic methods for extracting information content of DNA; gene finding, sequence comparison, and phylogenetic trees; physical interactions responsible for structure of biopolymers; DNA double helix, secondary structure of RNA, and elements of protein folding; considerations of force, motion, and packaging; protein motors, membranes. We also look at collective behavior of biological elements, cellular networks, neural networks, and evolution.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Physics/8-592JSpring-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction to Course	Molecular Evolution	Mutations	Gene Annotation and Similarity Detection	Substitution Matrices	Dynamic Programming and Transfer Matrices
Sequence Alignment and	Biomolecular Forces and Energies	Electrostatics	Polymer Theory	Proteins	The Random Energy Model

Statistical Physics					
Fluctuating DNA	RNA	Protein-DNA Complexes	Microtubules and Filaments	Molecular Motors	Membranes
Cell Motility	Networks	Biological Patterns			

Survival Skills for Researchers: The Responsible Conduct of Research

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-502Survival-Skills-for-Researchers--The-Responsible-Conduct-of-ResearchSpring2003/CourseHome/index.htm)

Course Description: This course is designed to provide graduate students and postdoctoral associates with techniques that enhance both validity and responsible conduct in scientific practice. Lectures present practical steps for developing skills in scientific research and are combined with discussion of cases. The course covers study design, preparation of proposals and manuscripts, peer review, authorship, use of humans and non-human animals in research, allegations of misconduct, and intellectual property. Also discussed are mentoring relationships and career options. Aspects of responsible research conduct are integrated into lectures and case discussion as appropriate to the specific topic.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-502Survival-Skills-for-Researchers-The-Responsible-Conduct-of-ResearchSpring2003/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Professional Ethics and Bias in Research Design; Lab Animals in Research	Study Design	Human Subjects in Research	Data Acquisition, Management, and Sharing	Credit and Responsibility in Science	Literature Review and Preparing Proposals and Manuscripts
Peer Review	Allegations of Misconduct	Advisors and Mentors	Career Pathways		

Genomics and Computational Biology

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-508Genomics-and-Computational-BiologyFall2002/CourseHome/index.htm)

Course Description: This course will assess the relationships among sequence, structure, and function in complex biological networks as well as progress in realistic modeling of quantitative, comprehensive, functional genomics analyses. Exercises will include algorithmic, statistical, database, and simulation approaches and practical applications to medicine, biotechnology, drug discovery, and genetic engineering. Future opportunities and current limitations will be critically addressed.

Lecture Notes (Audio available): (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-508Genomics-and-Computational-BiologyFall2002/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
Intro 1: Computational Side of Computational Biology. Statistics; Perl, Mathematica	Intro 2: Biological Side of Computational Biology. Comparative Genomics, Models & Applications	DNA 1: Genome Sequencing, Polymorphisms, Populations, Statistics, Pharmacogenomics; Databases	DNA 2: Dynamic Programming, Blast, Multi-alignment, Hidden Markov Models	RNA 1: Microarrays, Library Sequencing and Quantitation Concepts	RNA 2: Clustering by Gene or Condition and Other Regulon Data Sources Nucleic Acid Motifs; The Nature of Biological "proofs"
Protein 1: 3D Structural Genomics, Homology, Catalytic and Regulatory Dynamics, Function & Drug Design	Protein 2: Mass Spectrometry, Post-synthetic Modifications & Quantitation of Proteins, Metabolites, & Interactions	Networks 1: Systems Biology, Metabolic Kinetic & Flux Balance Optimization Methods	Networks 2: Molecular Computing, Self-assembly, Genetic Algorithms, Neural Networks	Networks 3: The Future of Computational Biology: Cellular, Developmental, Social, Ecological & Commercial Models	

Quantitative Genomics

(http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-508Fall-2005/CourseHome/index.htm)

Course Description: This course provides a foundation in the following four areas: evolutionary and population genetics; comparative genomics; structural genomics and proteomics; and functional genomics and regulation.

Selected Lecture Notes: (http://ocw.mit.edu/OcwWeb/Health-Sciences-and-Technology/HST-508Fall-2005/LectureNotes/index.htm)

Column1	Column2	Column3	Column4	Column5	Column6
The Basic Forces of Evolution: Mutation, Recombination and Mating, Migration, Neutral Evolution and Drift, Effective Population Size	Selection, Fitness, Probability of Fixation, Coalescent Theory	Selection, Fitness, and Diffusion Models	Medical Lecture: Human Variations Genes, Genotypes and Generations	Overview of Protein Structures, Domain Architecture	Structure-based Substitution Matrices
Gene Regulation and Function, Conservation, Detecting Regulatory Elements	RNA Expression: Clustering and Classification	RNA Expression: Classification, 2-way Clustering, Regulatory Modules			

Genomics and Computational Biology

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-508-genomics-and-computational-biology-fall-2002/)

Course Description: This course will assess the relationships among sequence, structure, and function in complex biological networks as well as progress in realistic modeling of quantitative, comprehensive, functional genomics analyses. Exercises will include algorithmic,

statistical, database, and simulation approaches and practical applications to medicine, biotechnology, drug discovery, and genetic engineering. Future opportunities and current limitations will be critically addressed.

Lecture Notes (Audio Lectures also available): (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-508-genomics-and-computational-biology-fall-2002/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Intro 1: Computational Side of Computational Biology. Statistics; Perl, Mathematica	Intro 2: Biological Side of Computational Biology. Comparative Genomics, Models & Applications	DNA 1: Genome Sequencing, Polymorphisms, Populations, Statistics, Pharmacogenomics; Databases	DNA 2: Dynamic Programming, Blast, Multi-alignment, Hidden Markov Models	RNA 1: Microarrays, Library Sequencing and Quantitation Concepts	RNA 2: Clustering by Gene or Condition and Other Regulon Data Sources Nucleic Acid Motifs; The Nature of Biological "proofs"
Protein 1: 3D Structural Genomics, Homology, Catalytic and Regulatory Dynamics, Function & Drug Design	Protein 2: Mass Spectrometry, Post-synthetic Modifications & Quantitation of Proteins, Metabolites, & Interactions	Networks 1: Systems Biology, Metabolic Kinetic & Flux Balance Optimization Methods	Networks 2: Molecular Computing, Self-assembly, Genetic Algorithms, Neural Networks	Networks 3: The Future of Computational Biology: Cellular, Developmental, Social, Ecological & Commercial Models	

Genomics, Computing, Economics, and Society

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-510-genomics-computing-economics-and-society-fall-2005/)

Course Description: This course will focus on understanding aspects of modern technology displaying exponential growth curves and the impact on global quality of life through a weekly updated class project integrating knowledge and providing practical tools for political and business decision-making concerning new aspects of bioengineering, personalized medicine, genetically modified organisms, and stem cells. Interplays of economic,

ethical, ecological, and biophysical modeling will be explored through multi-disciplinary teams of students, and individual brief reports.

Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-510-genomics-computing-economics-and-society-fall-2005/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Exercise - A Quantitative Definition of Life	New Energy Sources and Personalized Medicine	Biosphere Facts	Metabolic Networks and Learning Perl		

Genomic Medicine

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-512-genomic-medicine-spring-2004/)

Course Description: This course reviews the key genomic technologies and computational approaches that are driving advances in prognostics, diagnostics, and treatment. Throughout the semester, emphasis will return to issues surrounding the context of genomics in medicine including: what does a physician need to know? what sorts of questions will s/he likely encounter from patients? how should s/he respond? Lecturers will guide the student through real world patient-doctor interactions. Outcome considerations and socioeconomic implications of personalized medicine are also discussed. The first part of the course introduces key basic concepts of molecular biology, computational biology, and genomics. Continuing in the informatics applications portion of the course, lecturers begin each lecture block with a scenario, in order to set the stage and engage the student by showing: why is this important to know? how will the information presented be brought to bear on medical practice? The final section presents the ethical, legal, and social issues surrounding genomic medicine. A vision of how genomic medicine relates to preventative care and public health is presented in a discussion forum with the students where the following questions are explored: what is your level of preparedness now? what challenges must be met by the healthcare industry to get to where it needs to be?

Audio Lectures (Selected Lecture Notes also available): (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-512-genomic-medicine-spring-2004/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Genomic Introduction	Introduction to Biology and Genomic Measurement	Measurement Techniques	Microarray - Massively Parrallel Measuremment	Limits of Technologies	Information Science at the Center of Genomic Medicine
Informational Resources	Complex Traits: What to Believe	Machine-learning Approach	Association with Markers	The Importance of Data Representation	Pharmacogenomics
Case Hx: Complex Traits	Individualized Pharmacology	Microarray Disease Classification	Microarray Disease Classification II	Direct Prediction of Outcome / Mortality	Case Hx: Cancer Diagnostics
Modelling and Reverse Engineering	Practical Genomic Medicine				

Biomaterials-Tissue Interactions

(http://ocw.mit.edu/courses/biological-engineering/20-441-biomaterials-tissue-interactions-be-441-fall-2003/)

Course Description: This course is an introduction to principles of materials science and cell biology underlying the design of medical implants, artificial organs, and matrices for tissue engineering. Topics include methods for biomaterials surface characterization and analysis of protein adsorption on biomaterials. Molecular and cellular interactions with biomaterials are analyzed in terms of unit cell processes, such as matrix synthesis, degradation, and contraction. It also covers mechanisms underlying wound healing and tissue remodeling following implantation in various organs. Other areas include tissue and organ regeneration; design of implants and prostheses based on control of biomaterials-tissue interactions; comparative analysis of intact, biodegradable, and bioreplaceable implants by reference to case studies. Also addressed are criteria for restoration of physiological function for tissues and organs.

Selected Lecture Notes: (http://ocw.mit.edu/courses/biological-engineering/20-441-biomaterials-tissue-interactions-be-441-fall-2003/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Survey of Clinical Cases of	Tissue Structures, Unit Cell	Unit Cell Processes Comprising	Irreversible Healing Behavior	Biochemistry of the ECM	Scaffolds Based on ECM

Biomaterials-Tissue Interactions	Processes, and Integrins	the Healing Response	of the Extracellular Matrix (ECM) of Organs		Analogs Used in Organ Synthesis
Organ Replacement by Induced Regeneration and Tissue Engineering	Principles and Practice of Tissue Engineering	Characteristics of the Surfaces of Biomaterials	Linear vs. Cooperative Cell-Matrix Interactions	Cell-Matrix Interactions During Spontaneous Healing	Contraction-Blocking Theory of Regeneration in Adults
Joints and Dental Tissues: Prosthetic Replacement	Joints and Dental Tissues: Regeneration 1	Joints and Dental Tissues: Regeneration 2	Rules for Synthesis of Tissues and Organs	In Vivo Synthesis of Skin	In Vivo Synthesis of Peripheral Nerves

Cell-Matrix Mechanics

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-523j-cell-matrix-mechanics-spring-2004/)

Course Description: Mechanical forces play a decisive role during development of tissues and organs, during remodeling following injury as well as in normal function. A stress field influences cell function primarily through deformation of the extracellular matrix to which cells are attached. Deformed cells express different biosynthetic activity relative to undeformed cells. The unit cell process paradigm combined with topics in connective tissue mechanics form the basis for discussions of several topics from cell biology, physiology, and medicine.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-523j-cell-matrix-mechanics-spring-2004/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Clinical Examples of the Roles of Mechanical Forces in Tissues and Organs: The Working Paradigms	Tissue Structures and Unit Cell Processes	Cell-Matrix Interactions: Extracellular Matrix Molecules, Adhesion Proteins and Integrins	Models for the Mechanical Behavior of Porous Scaffolds	Response of Cells to Substrate Strain	Measuring Cell Contraction + Cell Force Monitor

Endogenous Mechanical Force Generation by Cells	Models for Cell Contraction In Vitro and In Vivo	Mechanical Coupling of Cells with Matrix	Cell-matrix Interactions During Wound Closure	Blockade of Contraction During Induced Organ Regeneration	Review of Principles of Linear Elastic Mechanics
Nonlinear Elasticity: Tendon and Skin	Linear Viscoelastic Behavior	Mechanical Behavior of Ligament, Meniscus and Intervertebral Disc	Mechanical Behavior of Bone	Response of Bone to Mechanical Loading	

Tumor Pathophysiology and Transport Phenomena

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-525j-tumor-pathophysiology-and-transport-phenomena-fall-2005/)

Course Description: Tumor pathophysiology plays a central role in the growth, invasion, metastasis and treatment of solid tumors. This class applies principles of transport phenomena to develop a systems-level, quantitative understanding of angiogenesis, blood flow and microcirculation, metabolism and microenvironment, transport and binding of small and large molecules, movement of cancer and immune cells, metastatic process, and treatment response.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-525j-tumor-pathophysiology-and-transport-phenomena-fall-2005/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Delivery of Molecular Medicine to Tumors I: Vascular Transport and the Normalization Hypothesis	Delivery of Molecular Medicine to Tumors II: Interstitial and Lymphatic Transport	Role of Bone Marrow-Derived Cells in Cancer			

Principles and Practice of Tissue Engineering

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-535-principles-and-practice-of-tissue-engineering-fall-2004/)

Course Description: The principles and practice of tissue engineering (and regenerative medicine) are taught by faculty of the Harvard-MIT Division of Health Sciences and Technology (HST) and Tsinghua University, Beijing, China. The principles underlying strategies for employing selected cells, biomaterial scaffolds, soluble regulators or their genes, and mechanical loading and culture conditions, for the regeneration of tissues and organs in vitro and in vivo are addressed. Differentiated cell types and stem cells are compared and contrasted for this application, as are natural and synthetic scaffolds. Methodology for the preparation of cells and scaffolds in practice is described. The rationale for employing selected growth factors is covered and the techniques for incorporating their genes into the scaffolds are examined. Discussion also addresses the influence of environmental factors including mechanical loading and culture conditions (e.g., static versus dynamic). Methods for fabricating tissue-engineered products and devices for implantation are taught. Examples of tissue engineering-based procedures currently employed clinically are analyzed as case studies.

(Archived webcast lecture videos for the Fall 2008 version of this class can be found at the HST.535 Fall 2008 website.)

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-535-principles-and-practice-of-tissue-engineering-fall-2004/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction to Tissue Engineering in China	Scaffolds: Introduction	Scaffolds: Collagen-GAG Analogs of Extracellular Matrix	Cells: Liver Cells	Scaffolds: Free-Form Manufacturing	Scaffolds: Self-Assembled Proteins
Cells: Differentiated versus Stem Cells	Scaffolds: Biomimetics Design	Cells: Effects of Culture Conditions	Regulators: Gene Transfer Wedded to Tissue Engineering	Applications: Skin and Peripheral Nerve Regeneration	Nerve Repair

Discussion: Clinical Applications	Discussion: Comparative Analysis of Tissue Engineering Strategies	Bone Regeneration	Cartilage Repair	Federal Regulatory Issues for Tissue Engineering Products in the U.S., China, and Other Countries

Fields, Forces, and Flows in Biological Systems

(http://ocw.mit.edu/courses/biological-engineering/20-430j-fields-forces-and-flows-in-biological-systems-be-430j-fall-2004/)

Course Description: This course covers the following topics: conduction, diffusion, convection in electrolytes; fields in heterogeneous media; electrical double layers; Maxwell stress tensor and electrical forces in physiological systems; and fluid and solid continua: equations of motion useful for porous, hydrated biological tissues. Case studies considered include membrane transport; electrode interfaces; electrical, mechanical, and chemical transduction in tissues; electrophoretic and electroosmotic flows; diffusion/reaction; and ECG. The course also examines electromechanical and physicochemical interactions in biomaterials and cells; orthopaedic, cardiovascular, and other clinical examples.

Lecture Notes: (http://ocw.mit.edu/courses/biological-engineering/20-430j-fields-forces-and-flows-in-biological-systems-be-430j-fall-2004/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Continuity of Chemical Species, Flux, Reaction Rates, Boundary Conditions	Diffusion + Begin Reaction + Damkohler + Scaling and Approximations	Example Problems: Separation of Variables Method	Example Problems: Separation of Variables Method (cont.) + Case Study: IGF Problem from Lecture L1 using Matrix Continuum	Diffusion/ Reaction + Add Cell Related (Receptor) Binding	Diffusion/ Reaction + Examples of Numerical Approaches to Nonlinear Problems

			Distribution of IGF Binding Proteins + Numerical Considerations		
IGF + E-field and Transport + Maxwell's Equations	Define Potential, Conservation of Charge + Electroquasistatics	Laplacian Solutions via Separation of Variables + Electrical Boundary Conditions, Ohmic Transport and Electrochemical Systems	Charge Relaxation + Electrical Double Layers + Poisson Boltzmann	Donnan Equilibrium in Tissues, Gels, Polyelectrolyte Networks	Charge Group Ionization and Electro-diffusion Reaction in Molecular Networks
Ligand Binding to Cell Receptors	Diffusion in Heterogeneous Media	Conservation of Mass and Momentum in Fluids	Newtonian, Fully Developed Low Reynold's Number Flows + Examples	Capillary Electroosmosis-Electrophoresis in MEMs and Microfluidics	Streaming Potentials + Begin Electrophoresis
Convective Solute Transport	Hindered Transport in Membranes and Tissues	Coupled Fluid and Electrical Shear Stresses: Cell/ Molecular Electrophoresis	Convective and Charge Relaxation Effects in Double Layers: Electrokinetics	DLVO Theory - Double Layer Repulsion and Molecular Interactions (Proteins, DNA, GAGs	Tissue/ Molecular Swelling Stresses: Donnan (Macro) vs. Poisson Boltzmann (Nano)

Principles of Radiation Interactions

(http://ocw.mit.edu/courses/nuclear-engineering/22-55j-principles-of-radiation-interactions-fall-2004/)

Course Description: The central theme of this course is the interaction of radiation with biological material. The course is intended to provide

a broad understanding of how different types of radiation deposit energy, including the creation and behavior of secondary radiations; of how radiation affects cells and why the different types of radiation have very different biological effects. Topics will include: the effects of radiation on biological systems including DNA damage; in vitro cell survival models; and in vivo mammalian systems. The course covers radiation therapy, radiation syndromes in humans and carcinogenesis. Environmental radiation sources on earth and in space, and aspects of radiation protection are also discussed. Examples from the current literature will be used to supplement lecture material.

Selected Lecture Notes: (http://ocw.mit.edu/courses/nuclear-engineering/22-55j-principles-of-radiation-interactions-fall-2004/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Radiation Interactions	Radiation Interactions	Radiation Chemistry/ LET/Tracks	Effects on Chromosomes/ DNA	Dose Response in Vitro: Cell Survival Curves	RBE/ Clustered Damage
Protons and Alphas of same LET	Dose Response in Vivo	Chemical Modification of Radiation Response	Cell, Tissue and Tumor Kinetics	Radiation Therapy: Tumor Radiobiology	Radiation Therapy (contd.): Fractionation
Acute Effects of Whole Body Exposure	Late Effects: Chronic Exposure/ Low Doses	Radiation Protection/ Background Radiation/ Radon	Alpha Particles/ Bystander Effect	Microbeams	BNCT/Other Modalities

Biomedical Signal and Image Processing

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-582j-biomedical-signal-and-image-processing-spring-2007/)

Course Description: This course presents the fundamentals of digital signal processing with particular emphasis on problems in biomedical research and clinical medicine. It covers principles and algorithms for processing both deterministic and random signals. Topics include data acquisition, imaging, filtering, coding, feature extraction, and modeling. The focus of the course is a series of labs that provide practical experience in processing physiological data, with examples from cardiology, speech processing, and medical imaging. The labs are done in MATLAB® during weekly lab sessions that take place in an electronic

classroom. Lectures cover signal processing topics relevant to the lab exercises, as well as background on the biological signals processed in the labs.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-582j-biomedical-signal-and-image-processing-spring-2007/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Data acquisition	Digital filtering	ECG	DTFT	DFT	Sampling revisited
Speech signals	Speech coding	Image processing I	PDFs	Image processing II	Estimating PDFs
Segmentation	Image registration I	Image registration II	Imaging modalities	Random signals I	Random signals II
Blind source separation					

Functional Magnetic Resonance Imaging: Data Acquisition and Analysis

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-583-functional-magnetic-resonance-imaging-data-acquisition-and-analysis-fall-2008/)

Course Description: This team-taught multidisciplinary course provides information relevant to the conduct and interpretation of human brain mapping studies. It begins with in-depth coverage of the physics of image formation, mechanisms of image contrast, and the physiological basis for image signals. Parenchymal and cerebrovascular neuroanatomy and application of sophisticated structural analysis algorithms for segmentation and registration of functional data are discussed. Additional topics include: fMRI experimental design including block design, event related and exploratory data analysis methods, and building and applying statistical models for fMRI data; and human subject issues including informed consent, institutional review board requirements and safety in the high field environment.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-583-functional-magnetic-resonance-imaging-data-acquisition-and-analysis-fall-2008/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
MRI physics I	MRI physics II	MRI physics III	Imaging physiology I: brain at the baseline	Imaging physiology II: brain activation	Imaging physiology III: BOLD imaging
Imaging physiology IV: BOLD (cont.) and non-BOLD techniques	Stats 2: level 1	Stats 5: correction for multiple measures	Stats 7: causality	Quantitative neuroimaging biomarkers	Spatial normalization for group analysis

Biomedical Engineering Seminar Series: Developing Professional Skills

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-590-biomedical-engineering-seminar-series-developing-professional-skills-fall-2006/)

Course Description: This course consists of a series of seminars focused on the development of professional skills. Each semester focuses on a different topic, resulting in a repeating cycle that covers medical ethics, responsible conduct of research, written and oral technical communication, and translational issues. Material and activities include guest lectures, case studies, interactive small group discussions, and role-playing simulations.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-590-biomedical-engineering-seminar-series-developing-professional-skills-fall-2006/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Kick-off with an Introductory Workshop on CVs	You Applied for that Dream Job, and You got an Interview. Good Job! Now What?	Congratulations! You've Got the Job of Your Dreams- The Swanky Office, the Sweet Lab, the Dutiful Graduate Students. Now, You Have to	The Day My Grant Got Rejected		

Bring in the Grant Money to Support it All

Speech Communication

(http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-541j-speech-communication-spring-2004/)

Course Description: Sppech Communication surveys the structural properties of natural languages, with special emphasis on the sound pattern. Topics covered include: representation of the lexicon; physiology of speech production; articulatory phonetics; acoustical theory of speech production; acoustical and articulatory descriptions of phonetic features and of prosodic aspects of speech; perception of speech; models of lexical access and of speech production and planning; and applications to recognition and generation of speech by machine, and to the study of speech disorders.

Lecture Notes: (http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-541j-speech-communication-spring-2004/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction and Background	Methods of Approach to Study of Speech and Language: Speech Production, Acoustics, Perception, Segments and Features, Phonology, Syntax	Phonetic Transcription	Signal Processing for Speech	Survey of Speech Anatomy, Respiratory System, Airflows and Pressures	Auditory System and Human Response to Sound
Some Basic Acoustics of Resonators and Sources,	Vowels	Acoustic Source at the Glottis	Mechanism of Vocal-fold Vibration	Source Characteristics for Females and Males	Different Vocal-tract Shapes: Articulatory Attributes,

Source-filter Concepts					Acoustic Consequences
Features High, Low, Back, and their Articulatory and Acoustic Correlates	Other Vowel Features: Rounding, Nasalization, Tense-lax	Laryngeal Variations for Vowels	Breathy and Pressed Voicing	Tones	Stress
Auditory Processing of Vowels	Consonants	Aerodynamics of the Vocal Tract, Turbulence Noise, Abrupt Release, Bursts	Place of Articulation for Consonants: Articulatory Attributes, Acoustic Consequences, Formant Transitions, Classification in Terms of Features	Aspiration and Voicing	Models of Stop, Nasal, and Fricative Consonant Production
Perception of Consonants	Liquids, Glides, Clicks, Other Features	Consonants and Consonant Sequences in Various Contexts	Introduction to Syntax, Morphology and Phonology	Review of Features and Feature Hierarchies; Feature Geometry and its Relation to Speech Production	Phonological Evidence for Distinctive Features
Lexical Representation	Examples from English and Other Languages	Prosody	Models of Speech Planning; Evidence from Speech Errors	Modification of Features and Acoustic Properties in Fluent Speech	Gestural Overlap, Reduction, Enhancement
Approaches to Lexical Access	Models of Human and Machine Recognition of Speech	Impaired Speech Production and Perception	Hearing Loss, Aphasia, Neurogenic Disorders,	Aids for Speech and Hearing-impaired	Speech and Language Development in Children

			Laryngeal Disorders, Other Impairments		
Acoustic Analysis of Children's Speech					

Acoustics of Speech and Hearing

(http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-551j-acoustics-of-speech-and-hearing-fall-2004/)

Course Description: The Acoustics of Speech and Hearing is an H-Level graduate course that reviews the physical processes involved in the production, propagation and reception of human speech. Particular attention is paid to how the acoustics and mechanics of the speech and auditory system define what sounds we are capable of producing and what sounds we can sense. Areas of discussion include:

1.the acoustic cues used in determining the direction of a sound source, 2.the acoustic and mechanical mechanisms involved in speech production and 3.the acoustic and mechanical mechanism used to transduce and analyze sounds in the ear.

Selected Lecture Notes: (http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-551j-acoustics-of-speech-and-hearing-fall-2004/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Sound Measurement: Amplitude, Frequency and Phase of Simple and Complex Sounds (rms vs peak, FFT and Spectrum, Relationship between	Lumped Elements and Waves	Sound Propagation in Space 1: Plane Waves, Characteristic Impedance, Traveling Waves, Trading of Time and Space	Sound Propagation in Space 2: Spherical Waves, Multiple Sources	Diffraction of Sound, Localization Cues	Circuits 1: Lumped Elements

Time Waveform, FFT and Impulse Response)					
Circuits 2: Combinations of Elements	Circuits 3: Equivalent Circuits	Circuits 4: The Loudspeaker	Circuits 5: Microphones and Middle Ears	The Normal and Diseased Middle Ear	Tubes 1: Dimensional Equations, Natural Frequencies
Tubes 2: Perturbation Theory	Tubes 3: Non-Uniformities and Losses	Speech Production 1: Vowels	Speech Production 2: Fricative Sources and Consonants	Speech Sound Production 3: More Consonants	Speech Perception

Brain Mechanisms for Hearing and Speech

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-722j-brain-mechanisms-for-hearing-and-speech-fall-2005/)

Course Description: An advanced course covering anatomical, physiological, behavioral, and computational studies of the central nervous system relevant to speech and hearing. Students learn primarily by discussions of scientific papers on topics of current interest. Recent topics include cell types and neural circuits in the auditory brainstem, organization and processing in the auditory cortex, auditory reflexes and descending systems, functional imaging of the human auditory system, quantitative methods for relating neural responses to behavior, speech motor control, cortical representation of language, and auditory learning in songbirds.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-722j-brain-mechanisms-for-hearing-and-speech-fall-2005/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Dorsal Cochlear Nucleus	Quantitative Methods	Neuroimaging	Speech Motor Control		

Music Perception and Cognition

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-725-music-perception-and-cognition-spring-2004/)

Course Description: Survey of perceptual and cognitive aspects of the psychology of music, with special emphasis on underlying neuronal and neurocomputational representations and mechanisms. Basic perceptual dimensions of hearing (pitch, timbre, consonance/roughness, loudness, auditory grouping) form salient qualities, contrasts, patterns and streams that are used in music to convey melody, harmony, rhythm and separate voices. Perceptual, cognitive, and neurophysiological aspects of the temporal dimension of music (rhythm, timing, duration, temporal expectation) are explored. Special topics include comparative, evolutionary, and developmental psychology of music perception, biological vs. cultural influences, Gestaltist vs. associationist vs. schema-based theories, comparison of music and speech perception, parallels between music cognition and language, music and cortical action, and the neural basis of music performance.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-725-music-perception-and-cognition-spring-2004/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Overview of the Structure of Music	Overview of Auditory Perception and the Time Sense: Pitch, Timbre, Consonance/ Roughness, Loudness, Rhythm, Auditory Grouping, Event Structure	Overview of the Auditory System: Representation and Processing of Sounds in the Auditory Pathway	Representation of Pitch in the Auditory System	Neurocomputational Models for Pitch	Tonal
Scales and Tuning Systems	Harmony II: Chords and Keys	Melody	Rhythm II: Computational Models		

Molecular Biology for the Auditory System

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-730-molecular-biology-for-the-auditory-system-fall-2002/)

Course Description: An introductory course in the molecular biology of the auditory system. First half focuses on human genetics and molecular biology, covering fundamentals of pedigree analysis, linkage analysis, molecular cloning, and gene analysis as well as ethical/legal issues, all in the context of an auditory disorder. Second half emphasizes molecular approaches to function and dysfunction of the cochlea, and is based on readings and discussion of research literature.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-730-molecular-biology-for-the-auditory-system-fall-2002/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Basic Molecular Biology (part 1)	Basic Molecular Biology (part 2)	Molecular Biology Techniques and Lab Intro	Genetics and Genomics	Inner Ear Development	Overview of Genetic Hearing Loss
Myosins	Embryonic Stem Cells				

Information Technology in the Health Care System of the Future

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-921-information-technology-in-the-health-care-system-of-the-future-spring-2009/)

Course Description: This innovative, trans-faculty subject teaches how information technologies (IT) are reshaping and redefining the health care marketplace through improved economies of scale, greater technical efficiencies in the delivery of care to patients, advanced tools for patient education and self-care, network integrated decision support tools for clinicians, and the emergence of e-commerce in health care. Student tutorials provide an opportunity for interactive discussion. Interdisciplinary project teams comprised of Harvard and MIT graduate students in medicine, business, law, education, engineering, computer science, public health, and government collaborate to design innovative IT applications. Projects are presented during the final class.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-921-information-technology-in-the-health-care-system-of-the-future-spring-2009/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Evolution of cybermedicine	Industry overview: the future of healthcare	eHRs, pHRs & xHRs!	The role of innovation in enterprise computing	From disease management to population health management	An investor's view of startups
Starting up: funding sources for for-profit and social entrepreneurship	Global perspective on health informatics business				

Designing and Sustaining Technology Innovation for Global Health Practice

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-939-designing-and-sustaining-technology-innovation-for-global-health-practice-spring-2008/)

Course Description: Innovation in global health practice requires leaders who are trained to think and act like entrepreneurs. Whether at a hospital bedside or in a remote village, global healthcare leaders must understand both the business of running a social venture as well as how to plan for and provide access to life saving medicines and essential health services.

Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-939-designing-and-sustaining-technology-innovation-for-global-health-practice-spring-2008/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Expanding global access to life saving vaccines: HPV vaccine case study	New systems for drug delivery	Microfluidics and global health practice	Alternative energy sources	R&D for resource poor settings	Medical device development
Electronic medical records and research systems	BioPharmaceuticals	Vaccines development	Technology innovation	Venture philanthropy	

Medical Artificial Intelligence

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-947-medical-artificial-intelligence-spring-2005/)

Course Description: This course provides an intensive introduction to artificial intelligence and its applications to problems of medical diagnosis, therapy selection, and monitoring and learning from databases. It meets with lectures and recitations of 6.034 Artificial Intelligence, whose material is supplemented by additional medical-specific readings in a weekly discussion session. Students are responsible for completing all homework assignments in 6.034 and for additional problems and/or papers.

Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-947-medical-artificial-intelligence-spring-2005/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Search	CSP and Games	Learning Introduction	Machine Learning I	Machine Learning II	Machine Learning III
Machine Learning IV	Logic I	Logic II	Logic Programming	Language Understanding	

Computational Evolutionary Biology

(http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-877j-computational-evolutionary-biology-fall-2005/)

Course Description: Why has it been easier to develop a vaccine to eliminate polio than to control influenza or AIDS? Has there been natural selection for a 'language gene'? Why are there no animals with wheels? When does 'maximizing fitness' lead to evolutionary extinction? How are sex and parasites related? Why don't snakes eat grass? Why don't we have eyes in the back of our heads? How does modern genomics illustrate and challenge the field?

This course analyzes evolution from a computational, modeling, and engineering perspective.

Selected Lecture Notes: (http://ocw.mit.edu/courses/electrical-engineering-and-computer-science/6-877j-computational-evolutionary-biology-fall-2005/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction: The Basic Dynamical Systems of Evolution	Evolution at the Molecular Level I	Host-parasite Interactions and Disease Models			

Engineering Biomedical Information: From Bioinformatics to Biosurveillance

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-950j-engineering-biomedical-information-from-bioinformatics-to-biosurveillance-fall-2005/)

Course Description: This course provides an interdisciplinary introduction to the technological advances in biomedical informatics and their applications at the intersection of computer science and biomedical research.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-950j-engineering-biomedical-information-from-bioinformatics-to-biosurveillance-fall-2005/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction: Brief Introduction to Biomedical Informatics and Outline of the Course	Bioinformatics: Introduction to the Bioinformatics Module	Central Dogma of Molecular Biology	Human Genome Project	The Role of Computational Sciences in the New Biology	Genomics: Human Variations
Genetic and Genomic Studies	Evolutionary Pressure and Selection	SNPs and Haplotypes	Haplotype-tagging	Human Variations: Human Variations	Analysis of Human Variations
Association Studies	Complex Traits	The Genomic Study of the Future	Functional Genomics	Expression Microarrays: Meta Elements of Transcriptome Profiling	Decision Support Systems: Introduction to Decision Support Systems and

Artificial Intelligence Applications in Biomedical Sciences

Patient Confidentiality: Slightly Controlled Information Exhibitionism in the Genetic Age

Medical Computing

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-950j-medical-computing-spring-2003/)

Course Description: The focus of the course is on medical science and practice in the age of automation and the genome, both present and future.

It includes an analysis of the computational needs of clinical medicine, a review systems and approaches that have been used to support those needs, and an examination of new technologies.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-950j-medical-computing-spring-2003/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Introduction: Nature of Modern Medicine and Medical Practice	Nature of Medical Data: Where it is and Where it is Not	Patient Identification	Countering Bioterrorism	Diagnosis, Standards, Codification	Patient Data Confidentiality and Security
Decreasing Variability in Health Care	Genomic Medicine I: Population Genetics in the Post Genomic Era	Advanced Expert Systems	Patient Monitoring	Genomic Medicine IV: Linking Genotypes and Phenotypes	Genomic Medicine V: Reverse Engineering

Medical Decision Support

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-951j-medical-decision-support-fall-2005/)

Course Description: This course presents the main concepts of decision analysis, artificial intelligence, and predictive model construction and evaluation in the specific context of medical applications. The advantages and disadvantages of using these methods in real-world systems are emphasized, while students gain hands-on experience with application specific methods. The technical focus of the course includes decision analysis, knowledge-based systems (qualitative and quantitative), learning systems (including logistic regression, classification trees, neural networks), and techniques to evaluate the performance of such systems.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-951j-medical-decision-support-fall-2005/lecture-notes/)

Column1	Column2	Column3	Column4	Column5	Column6
Decision Analysis 1	Decision Analysis 2, Linear Regression	Logistic Regression, MLE	Evaluation	Ensemble Models	PCA, LDA
Unsupervised Learning	Neural Networks	Survival Analysis	Statistical Learning Theory	Model Construction Schemas 1	Analysis of Problems, Complexity
Bioinformatics 1 (Hypothesis Generation, Sequence Alignment)					

Computing for Biomedical Scientists

(http://ocw.mit.edu/courses/health-sciences-and-technology/hst-952-computing-for-biomedical-scientists-fall-2002/)

Course Description: This course introduces abstraction as an important mechanism for problem decomposition and solution formulation in the biomedical domain, and examines computer representation, storage, retrieval, and manipulation of biomedical data. As part of the course, we will briefly examine the effect of programming paradigm choice on problem-solving approaches, and introduce data structures and algorithms. We will also examine knowledge representation schemes for

capturing biomedical domain complexity and principles of data modeling for efficient storage and retrieval. The final project involves building a medical information system that encompasses the different concepts taught in the course.

Selected Lecture Notes: (http://ocw.mit.edu/courses/health-sciences-and-technology/hst-952-computing-for-biomedical-scientists-fall-2002/)

Column1	Column2	Column3	Column4	Column5	Column6
Algorithms and Object Oriented Programming	Java® Constructs	Built-in Operators, Built-in Java Classes, and Classes, Objects & Methods	Recursion and Iteration, Imperative & Declarative Programming, Abstract Data Types (ADTs), Arrays, and Classes, Object & Methods (continued)	Designing Methods, Wrapper Classes, Arrays, Packages, Inheritance, Derived Classes, and Dynamic Binding	Information Hiding, Exceptions
Vectors, Streams, Input and Output	Searching and Sorting	Time Complexity of Algorithms	Logic and Medical Ontology	Boolean Algebra and Predicate Knowledge	Ontology and Data Model
Medical Vocabulary Representation and Survey of Medical Coding Systems	Medical Coding Systems (continued) and UMLS	Major KR Schemes	Process		