



Anatomy and Neurobiology

GMS AN 700 (MED MS 123) Medical Histology Prereq: CLA BI203 and consent of instructor. Study of cell, tissue, organ and system histology. Emphasis is on functional morphology at the light and electron microscope levels. Computer-based virtual microscopy in laboratory exercises and discussions supplements companion lectures. *Vaughan, staff.* 6 c., 2nd sem.

GMS AN 700S Medical Histology Prereq: CLA BI203 and consent of instructor. Study of cell, tissue, organ, and system histology. Emphasis is on functional morphology at the light and electron microscope levels. Computer-based virtual microscopy in laboratory exercises and discussions supplement companion lectures. *Vaughan, staff.* 6 cr, Summer sem. beginning in June.

GMS AN 701 Gross Anatomy Prereq: consent of instructor. Human anatomy in three units: locomotion, which includes arms, legs, and back; head and neck; thorax, abdomen, and pelvis. *Hoagland, staff.* variable cr, 1st sem.

GMS AN 702 Neurobiology of Learning and Memory Prereq: consent of instructor. This course covers the neurobiological bases of learning and memory from the cellular to the systems level. Initial sessions cover the behavioral aspects of learning and memory--how it is operationally defined and what are the different theoretical concepts from cognitive psychology that are current. Subsequent sessions investigate the neurophysiological, neuroanatomical, and

neurochemical mechanisms of memory at the cellular level and then move on to the study of systems that function at the level of the whole organism. Concentration is on studies in mammals, particularly primates. *Moss, Rose.* 2 cr, 2nd sem.

GMS AN 704 Experimental Design and Statistical Methods Prereq: consent of instructor. This course provides a working understanding of experimental design and statistical analyses. Each class consists of lectures, examples of problems and discussion of theoretical issues underlying a particular experimental design. Both parametric and non-parametric approaches to data analysis will be explored. *Killiany.* 2 cr, 2nd sem.

GMS AN 705, Medical Histology A Prereq: consent of instructor. Study of basic cells and tissues followed by study of the histology of circulatory system and the gastrointestinal system and its associated glands. Emphasis is on functional morphology at the light and electron microscope levels. Computer-based virtual microscopy in laboratory exercises and discussions supplements companion lectures. *Vaughan, staff.* 3 cr, 1st sem.

GMS AN 706 Medical Histology B Prereq: GMS AN 705. Includes study of the histology of respiratory, lymphoid, and renal systems, male and female reproductive systems, integument, cartilage and bone, and endocrine organs. Emphasis is on functional morphology at the light and electron microscope levels. Computer-based virtual microscopy in laboratory exercises and discussions supple-

ments companion lectures. *Vaughan, staff.* 3 cr, 2nd sem.

GMS AN 707 Neurobiology of Aging Prereq: consent of instructor. With growing awareness of an accelerating increase in the size of the elderly population, there has been increasing interest in the neuropsychology of normal aging. Similarly, since aging is a major risk factor for many dementia states, interest has also focused on the neuropsychology of age-related disorders such as Alzheimer's disease, Parkinson's disease and the Dementias of the frontal lobe type. This course attempts to summarize what is known about cognitive and related changes associated with normal aging and age-related disease. The course is divided into four major sections. The first considers the cognitive changes associated with normal aging; the second deals with the most common causes of cognitive decline seen in the elderly; the third reviews the current data concerning neuro-imaging in aging and dementia, and the fourth part covers future directions in the study of normal aging. *Moss.* 2 cr, 2nd sem.

GMS AN 708 Clinical Anatomy Prereq: Gross Anatomy. An advanced anatomy course consisting of both guided laboratory dissection and related lectures on clinical anatomy by physicians in a variety of clinical specialties. Laboratory dissections are based on actual surgical approaches; whenever possible, and the relationship between gross anatomy radiographic anatomy is continually emphasized. *Van Houten, Hoyt, Nandy.* 2 cr, 2nd sem.

GMS AN 709 Neural Development and Plasticity Prereq: GMS MS 703 and consent of instructor. Lectures, discussion, and readings on current issues relating to neural changes during development and how the nervous system is modified by interactions of the organism with the environment, and how the nervous system responds to injury. Emphasis on cellular and systems levels of organization. *TBA*. 2 cr, 2nd sem.

GMS AN 711 Introduction to Neurobiology Prereq: consent of instructor. This course surveys the biological basis of behavior starting at the level of the neuron and synapse and building to the cortical integration of the human mind. It provides an introduction to the issues, problems and current research findings that related the form and function of the nervous system. *TBA*. 2 cr, 1st sem.

GMS AN 712 Biostatistics This course will provide you with a working understanding of experimental design and statistical analyses that are appropriate for various types of relatively small sample based experiments such as those used in the biological, medical, pharmacological, psychological, and social sciences in general. *Killiany*. 4 cr, 2nd sem.

GMS AN 713 Autism: Clinical and Neuroscience Perspectives Prereq: consent of instructor and neuroscience background. This course will provide an overview of the clinical feature of autism; review current research on genetic and other causes of the disorder, and the neurobiological basis of the main behavioral and cognitive symptoms, and will briefly explore different treatments currently available. *Tager-Flusberg*. 4 cr, 1st sem

GMS AN 714 Human Reproduction and Sexuality Various aspects of reproduction are addressed include male and female anatomy, reproductive hormonal control, sex and the brain, contraception, abortion,

reproductive cancers, sexually transmitted diseases, and infertility. *Zoller*. 3 cr, 2nd sem.

GMS AN 715 Professional Skills for Students in the Biomedical Sciences Prereq: consent of instructor. This courses discusses many of the professional skills and ethical issues that are part of an academic biomedical career. Some of the topics include funding mechanisms, determination of authorship, intellectual property, conflict of interest, human and animal subject protection, reviewing responsibilities and mentoring. *Sandell*. 2 cr, 2nd sem.

GMS AN 716 Developmental Cognitive Neuroscience Prereq: background in neuroscience background. This course will provide an overview of the current literature on the neurobiological underpinnings of cognitive development. Several domains will be explored (e.g., visual perception, knowledge of objects and faces, language acquisitions and theory of mind) using evidence from a variety of populations. *Tager-Flusberg*, 4 cr, 2nd sem.

GMS AN 718 Methods in Neuroscience Preq: Systems Neuroscience and consent of instructor. This course will provide a general overview of major techniques and methods used in contemporary neuroscience research. It is designed to provide students with knowledge to understand methods to probe the brain from molecules to behavior. *Luebke/ Soghomonian*, 4 cr, 2nd sem.

GMS AN 720 Introduction to the Neurobiology of Education Prereq: consent of instructor. This introductory course surveys the basic neurology of learning. Brain structure and function will be discussed and neural system principles will be applied to the problems of learning in the classroom and in the developing mind of K-college students and education. *Bergethon/DeRosa*. 2 cr, SS I.

GMS AN 721 The Neurobiology of Trauma This course provides the neurobiological basis in stress and trauma and is a prerequisite for the purpose of designing treatment and prevention programs, at both the individual and national levels in the event of catastrophic disasters. *Staff*. 2 cr, 1st sem.

GMS AN 801, 802 Seminar: Research Colloquium Oral presentation and discussion by students and staff members of topics of interest in anatomy and allied fields. *TBA*. 2 cr each, 1st & 2nd sem.

GMS AN 803, 804 Special Topics in Anatomy Presentation of problems of current interest in anatomical science offered to small groups of students at the instigation of either interested faculty or students. Examples of topics that might be discussed are: differentiation; aging in specific areas of the brain; electron microscopy; fine structure of neurons; biology of the lung; and retinal biology. *Hoagland*. 2 cr, each, 1st & 2nd sem.

GMS AN 805 Vesalius Module Teaching Practicum Prereq: GMS AN804, and consent of mentor and Teaching Oversight Committee, and prior enrollment in the course being taught. Students, putting theory into practice, work in collaboration with a selected faculty mentor in one of the following formats: large lecture, small lecture or seminar, or proposing a new course. Students may enroll in this course multiple times for different mentored experiences. *Vaughan, Hoagland*. var cr, 1st & 2nd sem.

GMS AN 807 Neurobiology of the Visual System Prereq: GMS MS 703 or consent of instructor. This is a seminar for graduate students in all departments who have had a basic neuroscience course and are interested in the anatomical and physiological substrates of vision. Study of the visual system progresses from the retina through the thalamus and brainstem to cortical visual areas and associated structures

such as the hippocampus, amygdala, and basal ganglia. Students present primary journal articles and occasional reviews with guidance from faculty who are presently engaged in research involving the structures under discussion. *Sandell*. 2 cr, 2nd sem.

GMS AN 808 Neuroanatomical Basis of Neurologic Disorders Prereq: Medical Neuroscience course or equivalent, and consent of instructor. Localization of specific anatomical changes in the brain in such disorders as autism, dyslexia, schizophrenia, olivopontocerebellar atrophy and selected neurodegenerative diseases such as Alzheimer's and ALS. Developmental mechanisms leading to neuroanatomical alterations are discussed when appropriate. Lectures, discussion of classical and current literature, and guest speakers. *Blatt, Kemper*. 2 cr, 2nd sem.

GMS AN 810 Systems Neurobiology Prereq: consent of instructor; undergraduate course in biological aspects of neuroscience (neuro-physiology and neuroanatomy) or GMS MS 703. This course will cover the major sensory, motor, regulatory, and associative/integrative neural systems in depth as well as a review of the basic neurocytology, neurophysiology, and neurochemistry of the brain. *Rosene*. 4 cr, 1st sem.

GMS MS 811 Cognitive Neuroscience Prereq: consent of instructor. This course will cover topics in the various domains of higher cortical function, including attention, language, visuospatial abilities, memory and executive function. It will also cover topics in learning, sleep, addiction, and behaviors under the influence of circadian rhythms. *Moss*. 4 cr, 2nd sem.

GMS AN 820S Introduction to Interdisciplinary Systems Science: Dynamic Modeling Prereq: consent of instructor. This course in interdisciplinary science will provide students with a hands-on experience in

the development and use of systems dynamic and computer based models to study biological systems in research areas such as neurobiology *Bergethon*. 2 cr, SS.

GMS AN 901, 902 Anatomy Research Variable cr

GMS AN 904 Research Practicum Varied topics. *Staff*. 2 cr, 2nd sem

Behavioral Neuroscience

GMS BN 775 Human Neuropsychology I Prereq: consent of instructor. Relationship of the field of neuropsychology to other medical and scientific disciplines. Includes electrical activity of the brain, the study of consciousness and emotions, cerebral dominance, and the pathologies of language. *Oscar-Berman, staff*. 4 cr, 1st sem.

GMS BN 776 Human Neuropsychology II Prereq: consent of instructor. Relationship of the field of neuropsychology to other medical and scientific disciplines. Includes psychiatric aspects of neurological disease and the pathologies of memory, intelligence, perception, and motor function. *Oscar-Berman, staff*. 4 cr, 2nd sem.

GMA BN 777 Basic Neurosciences This course is the same as GMS BN 778 (4 cr) and GMS BN 779 (2 cr), providing with students with 30 hours of required course time. For Mental Health and Behavioral Medicine students. *Oscar Berman*. 3 cr, 1st sem.

GMS BN 778 Basic Neurosciences Survey Prereq: consent of instructor. Overview to include neurophysiology, neurochemistry, neuroanatomy, neurobehavior, and neuropsychopharmacology. Processes occurring at the cellular and physiological levels are related to known central nervous system dysfunction. May not be taken concurrently with GMS BN 779. *Oscar-*

Berman, Zucker, staff. 4, cr, 1st sem.

GMS BN 779 Beginning Basic Neurosciences Prereq: consent of instructor. Overview to include neurophysiology, neurochemistry, neuroanatomy, neurobehavior, and neuropsychopharmacology. Processes occurring at the cellular and physiological levels are related to known central nervous system dysfunction. May not be taken concurrently with GMS BN 778. *Oscar-Berman, Zucker*. 2 cr, 1st & 2nd sem.

GMS BN 780 Behavioral and Biological Aspects of Stress and Trauma Prereq: consent of instructor. This course provides an overview of theory and research on stress and trauma, with attention to biological, psychological, and social factors. Special emphasis placed on gender issues, developmental factors, psychopathology, and physical health. *Keane, staff*. 2 cr, on demand.

GMS BN 782 Forensic Practice in Neuropsychology and Neuroscience Prereq: Human Neuro-psychology course or some other introduction to the study of brain-behavior relations, consent of instructor. This course is taught by both neuroscience and legal professionals and will provide students with an introduction to the emerging role in the courtroom and judicial proceedings of research and clinical findings from the behavioral neurosciences. *Oscar Berman, staff*. 4cr, 2nd sem.

GMS BN 793 Adult Neurologic Communication Disorders Prereq: consent of instructor. An overview of acquired, adult neurologic communication disorders for purposes of identification and differential diagnosis. Discussion of the neuronatomical bases for communication (within a cognitive framework) will be followed by a review of aphasia, dysarthria, apraxia, alexia, agraphia, stuttering, palilalia, and mutism, as well as disorders associated with right hemisphere strokes, closed head injury, and

progressive diseases. *Helm-Estabrooks, Albert*. 1st sem.

GMS BN 794 Brain Asymmetry: Functional and Structural Differences Between Hemispheres Prereq: consent of instructor. The distinctive roles of the left and right hemispheres are reviewed; first by examining alterations in language and nonverbal behavior under conditions of brain damage; and second, by examining techniques used to investigate functional asymmetry in the normally intact brain. *Prather*. 2 cr, 2nd sem.

GMS BN 795 Neuropsychology of Perception and Memory Prereq: consent of instructor. The study of normal and abnormal perception and memory is related to brain structure and function. *Albert*. 4 cr., 2nd sem.

GMS BN 796 Neuropsychological Assessment I Prereq: consent of instructor. Overview of structure and function of the central nervous system. Emphasis on quantitative and qualitative analyses of standardized and experimental tests of cognitive functions useful in differential diagnosis of neurological syndromes. *Oscar-Berman*. 4 cr, 1st sem.

GMS BN 797 Neuropsychological Assessment II Continuation of GMS BN 796 Neuropsychological Assessment I. *Kaplan*. 4 cr., 2nd sem.

GMS BN 798 Functional Neuroanatomy in Neuropsychology Prereq: consent of instructor. Overview of central nervous system, structure and function; basic understanding of neurobehavioral symptoms and their relationship to neuropathology, including vascular infections, and congenital, degenerative, and toxic insults to the central nervous system. Appropriate for psychologists, speech pathologists, or other students in the behavioral sciences. *LaVecchia*. 4 cr, 1st & 2nd sem.

GMS BN 821 Seminar in Neuroimaging Prereq: consent of instructor. Overview of neuroimaging

techniques available as adjuncts to neuropsychological measures of human brain damage. *Oscar-Berman, staff*. 2 cr, on demand.

GMS BN 891, 892 Case Studies in Neuropsychology Prereq: consent of instructor. Individual patients with perceptual/cognitive/affective symptomatology concomitant with brain damage are examined intensively through the use of a variety of behavioral assessment procedures. Test results are reviewed for the differential diagnosis of neurological syndromes. Emphasis on qualitative and quantitative analyses of standardized and experimental tests. *Kaplan, White*. 2 cr, 1st & 2nd sem.

GMS BN 893 Child Clinical Neuropsychology Prereq: consent of instructor. Covers general theoretical issues, e.g., intrauterine and postnatal development of the brain, handedness and lateralization of function, and recovery of function and neurobehavioral plasticity; diagnostic entities, e.g., attention deficit disorder, effects of early brain damage, developmental language disorders, dyslexia, and effects of malnutrition; and assessment and treatment. *Kinsbourne, Kaplan*. 4 cr, on demand.

GMS BN 991, 992 Research in Behavioral Neuroscience variable cr

Biochemistry

GMS BI751 Biochemistry and Cell Biology Prereq: consent of instructor. Basic principles and concepts of medical school Biochemistry and Cell Biology in a one-semester course. Topics include protein structure and function; mechanisms of enzyme action; nutrition and metabolism; membrane structure and receptor signaling; cell cycle regulation; DNA and RNA structure and function; regulation of gene expression and techniques in molecular medicine. Clinical cor-

relations are provided throughout the course. *Offner*. 6 cr, 1st sem.

GMS BI 751 Biochemistry Prereq: consent of instructor. Basic principles and concepts of graduate-level biochemistry in a one-semester course. Instruction includes protein structure and function; mechanisms of enzyme action; carbohydrate and lipid metabolism; bioenergetics; metabolism of amino acids and nucleotides; DNA and RNA synthesis, structure and function; and regulation of gene expression. *Offner*. 6 cr, 1st sem.

GMS BI 755/756 Biochemistry A, B Prereq: organic chemistry or equivalent, and consent of instructor. This two-semester course provides the biochemical foundation for advanced studies in basic and clinical sciences. Topics presented in the first semester include the structure and function of macromolecules, the mechanisms of enzyme action, the metabolism of carbohydrates and lipids, as well as bioenergetics. The second semester continues with the metabolism of lipids, amino acids and nucleotides, the control of metabolic processes, the function of hormones, biochemical genetics, and transcriptional and translational events. *Kandrór, Polgar*. 4 cr, 1st and 2nd sem.

GMS BI 759 Integrative Biochemistry Prereq: Consent of instructor, BI755, BI756, MS753, BI782. This course is an advanced required course to follow the first year basic courses which include Biochemistry (BI755, BI756), Cell Biology (MS 753) and Molecular Biology (BI782). The goal is to present an integrated view of biochemistry and control of cellular functions. The course will explore the role of proteins, protein assemblies, hormones and peptides in controlling how cells accomplish their functions and how/why these go awry in certain diseases. *Pilch*. 4 cr, 1st sem.

GMS BI 776 Gene Targeting in Transgenic Mice Prereq: BI 755, 756; MS 753; and consent of instructor. Introduction to the basic theory and practice of an approach applicable to many cell biology problems. Covers the following topics: early mouse development; gene targeting into mouse embryos; homologous recombination in embryonic stem cells; review of practical aspects of the transgenic technology; review of selected studies employing transgenic mice and chimeric (gene knockout) mice. Offered alternate years. *Ravid*. 2 cr, 2nd sem.

GMS BI 778 Mechanisms of Cardiovascular Disease This course is designed to give the student an overview and understanding of selected disorders of the cardiovascular system and of important questions currently being studied. Emphasis will be placed on molecular and cellular mechanisms of normal vascular function and of vascular dysfunction leading to disease. Clinical relevance and treatment modalities will also be discussed. Appropriate experimental techniques will be considered in the context of important concepts. Offered alternate years. TBA. 2 cr, 2nd sem.

GMS BI 780 Control of Metabolic Processes Prereq: GMS BI 755, 756 or equivalent and consent of instructor. Detailed consideration of metabolic pathways and major sites of metabolic regulation. Catalytic properties, cofactors, and methods of regulation functioning in the pathways of intermediary metabolism are studied. Topics include: carbohydrate and lipid metabolism, alternate pathways, photosynthesis, and amino acid metabolism. Offered alternate years. *Tornheim*. 2 cr, 2nd sem.

GMS BI 782 Molecular Biology Prereq: GMS BI 755, 756 or equivalent and consent of instructor. Advanced molecular biology using the current literature as a source of information. Emphasis is placed on relevant

research techniques. Topics include DNA/RNA/protein synthesis and function analysis of genetic disorders, gene therapy, molecular biology of important cellular processes, and regulation of gene expression. *Kirsch*. 4 cr, 2nd sem.

GMS BI 783 Structure and Function of Proteins Prereq (or may be taken simultaneously): GMS BI 755 and 756 or equivalent and consent of instructor. This course correlates the structure of proteins with their function. It considers the universality of certain regions, such as zinc fingers, calcium binding regions, DNA liganding sequences, in terms of their three dimensional structure, and considers the effect of site specific mutations in these regions on the function of the protein containing them. Apoproteins, apolipoproteins, glycoproteins, structural proteins, and adhesion molecules are used as examples of the correlation between structure and function of these entities. Offered alternate years. *Simons*. 2 cr, 2nd sem.

GMS BI 786 Biochemical Mechanisms of Aging Prereq: consent of instructor. Current issues and key research advances in the understanding of the biochemical processes involved in aging of mammals are discussed. Theories on aging are analyzed, and age-related changes in gene structure and expression are presented. Alterations in the function of the neuroendocrine and immune systems with aging are also discussed. Offered alternate years. *Polgar*. 2 cr, 2nd sem.

GMS BI 787 Molecular Mechanisms of Growth and Development Prereq: GMS BI 755, 756 or equivalent and consent of instructor. Examines the most recent advances in the molecular mechanisms involved in regulation of cell proliferation, differentiation, and development. Control of the cell cycle and regulation of the expression of differentiated function are discussed.

The role of extra cellular growth factors and nuclear transcriptional regulatory proteins are explored. Students present and actively discuss recent primary research articles. Offered alternate years. *Symes, Smith*. 2 cr, 1st sem.

GMS BI 788 Enzyme Catalysis Prereq: GMS BI 755, 756 or equivalent and consent of instructor. Advanced aspects of chemical, thermodynamic and kinetic principles of catalytic mechanisms. Topics include genetic, kinetic, and chemical methods of analysis of enzyme mechanisms; transition state and mechanism-based inhibitors in the control of metabolic reactions; allosteric regulation; enzymes as chemotherapeutic targets in human disease. Offered alternate years. *Kagan*. 2 cr, 2nd sem.

GMS BI 789 Methods and Modeling in Molecular Biochemistry Prereq: consent of instructor. This course teaches the concepts and approach necessary to model and treat molecular/cellular processes using physical tools and methods including computational strategies. Competence in research methods and modeling approaches enabling exploration and quantification of biological systems is the goal. *Bergethon*. 2 cr, 2nd sem.

GMS BI 790 Receptors and Signal Transduction Prereq: GMS BI 755, 756 or equivalent and consent of instructor. The goal of this course is to provide an in-depth description of the molecular mechanisms of ligand-receptor binding and signal transduction. Emphasis is placed on the mechanism of action of hormones, neurotransmitters, and growth factors. Individual components of receptor-induced signaling pathways are investigated in detail and integrated into models of cellular control. Relies heavily on current literature and student-directed discussion. Offered alternate years. *Kandror*. 2 cr, 2nd sem.

GMS BI 793 Mass Spectrometry and Functional Genomics Prereq: BMS BI751 or BI755, consent of instructor. The application of mass spectrometry to protein, glycoconjugate and carbohydrate structures has propelled developments in proteomics and functional genomics. This course describes how to use mass spectrometry to answer structural and functional questions in biomedical research. *Costello*, 2 cr, 2nd sem.

GMS BI 851, 852 Special Topics in Biochemistry Prereq: GMS BI 755, 756 or equivalent and consent of instructor.

GMS BI 854 Biochemistry Seminar Required for all first- and second-year post-bachelor's PhD biochemistry students and for all first-year MA, post-master's PhD, and MD/PhD biochemistry students. Students present seminars on current topics in biochemistry. The emphasis of this course is on effective use of the biochemical literature and methods of improving oral presentations. *Abraham, Panchenko*. 2 cr

GMS BI 951 Research in Biochemistry Variable cr

Bioimaging

GMS IM 600 Bioimaging Foundations Prereq: consent of instructor. The physical, mathematical, and experimental foundations of bioimaging are studied with historical context and are presented in the following sequence: bioimaging, principles, bioimaging mathematics, and bioimaging physics, leading to the study of the different bioimage generation techniques (modalities). *Jara*. 4 cr, 1st sem.

GMS IM 610 Magnetic Resonance: Principles, Methods, and Applications in Biomedical Research Prereq: consent of instructor. This course will provide an overview of the underlying principles of nuclear magnetic resonance (NMR) and the various methodologies used in magnetic resonance imaging

(MRI) and magnetic resonance spectroscopy (MRS) with emphasis on methods applied in biomedical research. The course will emphasize the connection between the basic manipulation of the spin system via the sequence of RF and gradient pulses (the pulse sequence) and the information that can be retrieved from the observed object, be it a solution of an isolated protein of the human brain. *Ronen*. 4 cr, 1st sem.

GMS IM 620 Bioimaging Theory & Imaging Processing Prereq: consent of instructor. The main theoretical aspects of bioimaging are studied, including image meaning, image generation, image quality (analysis, improvement, and limits), image information content (generation and extraction), and image assisted modeling of biologic systems. Mathematical foundations and basic techniques for digital image processing are studied theoretically as well as in a hands-on approach in the Image Processing Laboratory. *Jara*. 4cr, 2nd sem.

GMS IM 630 Methods of Functional Imaging of the Brain. Prereq: consent of instructor This course will provide an overview of the various existing methods for detecting and mapping brain function *in vivo*. A brief introduction will provide the necessary background to brain physiology: electrical activity, synaptic transmission, cell metabolism and haemodynamic response associated with neuronal activity. *Ronen*. 2 cr, 2nd sem.

GMS IM 640 Post-processing Images of the Brain Prereq: consent of instructor. This course is designed to give the student a knowledge of the various procedures for post-processing various images of the brain. Examples will be highlighted about how these various techniques have been used to identify markers for disease states. *Killiany*. Var cr, 2nd sem.

GMS IM 650 Bioimaging Practicum Prereq: consent of instructor. Students participate directly

in day-to-day imaging activities including clinical (radiology daily noon conferences) as well as research activities (hands-on imaging experiments with phantoms and animals). *Norbash, Jara, & Ronen*. 4 cr, 2nd sem.

GMS IM 651 Statistical Analysis of Neuroimaging Data Prereq: consent of instructor. This course is designed to give the student a working knowledge of the parametric and non-parametric statistical procedures that are commonly used to analyze data generated from *in vivo* imaging techniques such as CT, MRI, PET and SPECT. *Killiany*. 2 cr, SS I.

GMS IM 660 Radiation Protection & Ethics Prereq: consent of instructor. Many of the established and state-of-the-art modalities in diagnostic imaging rely upon radiation as the imaging agent. However, radiation in itself is considered a hazard that must be controlled. This course will introduce the fundamentals of understanding radiation, the risks of radiation exposure, and the methods of minimizing its harmful potential while maximizing its beneficial qualities. *Norbash & Sandell*. 2 cr, 1st sem.

GMS IM 670 Special Topics in Bioimaging Prereq: consent of instructor. Imaging has come to increasingly serve as a substrate and necessary ingredient for progressively more complex diagnoses and therapy. The increasing significance of the imaging components has been classically appreciated in fields such as radiation therapy, where planning of treatment based on images is integral to the therapy itself, and has spread beyond the boundaries of such disciplines to numerous surgical fields such as neurosurgery, orthopedics, and ear, nose, and throat surgery. *TBA*. 2 cr., on demand.

GMS IM 680 Professional Development Prereq: consent of instructor. This is a preparatory course for students making the transition from a formal academic program into the dynamic

work place. It will cover those fundamental skills required to facilitate searching, locating, and qualifying for the job of one's choice. It will cover topics such as building a portfolio, networking, resume writing, and interviewing skills. Speakers in the various fields of imaging will be invited to discuss how he or she made the transition into the workplace and students will have the opportunity to discuss and discover the various pitfalls on the paths of entry into the field of his or her choice. *Moss, Norbash, & Kim*. 1st sem, 2 cr.

GMS IM 690 Imaging of Neurological Disorders of the Brain

Prereq: consent of instructor. This course will look at the role played by modern, minimally invasive imaging techniques in the detection, management, research and testing of treatment efficacy of various neurological diseases that affect the brain. Each week a different disorder will be presented. *Killiany*. 2 cr, 2nd sem.

GMS IM 700 Thesis Research I

Prereq: consent of instructor. First phase of a three-semester directed research project, the MBI project in the field of bioimaging during which students will choose an area of concentration in bioimaging, select a faculty member in the greater Boston area who will agree to serve as thesis/project advisor, identify a line of research and define the specific objectives of a project to be conducted in the following three semesters. *Jara and Ronen*. 2 cr, 1st sem..

GMS IM 710 Thesis Research II

Prereq: consent of instructor. Second phase of a three-semester thesis research project in the field of bioimaging during which students postulate a hypothesis, design an experimental protocol to test the hypothesis, acquire data (pilot and final). *Ronen & Hara*. 2 cr, 2nd sem.

GMS IM 730 Thesis Research III

Prereq: consent of instructor. Third phase of a three-semester thesis project in the field of bioimaging during which student

finish data analysis and primarily concentrate on writing a comprehensive technical report describing in detail their work in Phases I and II. *Jara & Ronen*. 2 cr, SS I, II.

Biomedical Forensics

GMS FS 701 Crime Scene Investigation Prereq: consent of instructor. This course will provide students with a basic overview of general crime scene processing techniques and methods of evidence collection and processing. *Brodeur*. 3 cr, 1st sem.

GMS FS 702 Forensic Biology Prereq: consent of instructor. Provides an introduction to the procedures of sample recovery, identification, and analysis of biological fluids. *Brodeur*, 3 cr, 2nd sem.

GMS FS 703 Forensic Chemistry Prereq: consent of instructor.

This course will provide an in-depth overview of laboratory procedures used in a forensic chemistry laboratory. *Barry*. 3 cr, 1st sem.

GMS FS 704 Forensic Biology Laboratory Prereq: consent of instructor. Provides hands-on experience in the identification, recovery, and analysis of biological fluids. *Brodeur*. 2 cr, 2nd sem.

GMS FS 706 Pattern Evidence Analysis Prereq: consent of instructor. This course will provide an overview of the identification, collection, and preservation of pattern evidence from a crime scene it its transport to the crime laboratory. The techniques and methodologies employed in the analysis of pattern evidence will be covered. *Brodeur*. 2 cr, 2nd sem.

GMS FS 707 Trace Evidence Analysis Prereq: consent of instructor. This course will provide an overview of the identification, collection, and preservation of trace evidence and its transport to the crime laboratory. The techniques and methodologies employed in the analysis of

trace evidence will also be covered. *Kraatz*. 3 cr, 1st sem, **GMS FS 708 Forensic Instrumental Analysis Laboratory** Prereq: GMS FS 703 and consent of instructor. Overview of analytical methods utilized in forensic chemistry laboratories. Designed to teach the student to confidently make decisions regarding the analysis of unique forms of evidence, including those pertaining to controlled substances, arson/explosion investigations and general unknown chemical substances. *Hall*. 2 cr, 2nd sem.

GMS FS 709 Medicolegal Death Investigation Prereq: consent of instructor.

This course will cover topics in forensic pathology and medicolegal death investigation. The curriculum will provide the necessary training to pass the certification examination offered by the American Board of Medicolegal Death Investigators.

The curriculum was formed based on the guidelines from the National Institute of Justice for Medicolegal Death Investigations. *Laposata*. 3 cr, 1st sem.

GMS FS 711 Forensic Medicine: Anatomy & Osteology Prereq: consent of instructor.

This course will provide an overview of basic human anatomy and osteology with an emphasis on understanding the processes underlying traumatic and unexpected deaths encountered in forensic pathology. *Laposata and Moore*. 2 cr, 1st sem.

GMS FS 712 Forensic Pathology Prereq: consent of instructor.

This course will provide students knowledge of forensic/medicolegal terminology and the scientific techniques used in medicolegal investigations, the different manners and causes of death, the guidelines for determining timing of injuries and an in-depth review of the autopsy processes for numerous types of deaths typically attended by a forensic pathologist. *Laposata*. 3 cr, 1st sem.

GMS FS 713 Bloodstain Pattern Analysis Prereq: GMS FS701 and consent of instructor. An

intensive hands-on course designed to teach students the procedures and methods for the recognition, documentation, and interpretation of bloodstain patterns, and the principles of crime scene reconstruction based on bloodstain pattern analysis.

Brodeur and Martin. 2 cr, SS I, **GMS FS 716 Homicide Investigation** Prereq: consent of instructor. This course will introduce the student to policies and procedures used by investigators in homicide cases. *Harrington.* 2 cr, 2nd sem.

GMS FS 718 Special Topics: Techniques in Firearms Investigation Prereq: consent of instructor. A primarily lecture-based survey course discussing various aspects of firearms-related investigations including general firearm construction/operation, toolmark comparison, shooting reconstruction, trajectory analysis, chemical analysis of gunshot residues and serial number restoration. Some hands-on techniques will be performed in the laboratory. *Brodeur.* 2 cr, 2nd sem.

GMS FS 720 Forensic DNA Analysis Prereq: consent of instructor. Discussion of the application of human genetics and molecular biology techniques to the DNA analysis of biological evidence. Review of forensic DNA analysis procedures, instrumentation and application to different types of evidence. *R. Cotton,* 3 cr, SSI.

GMS FS 721 Forensic DNA Analysis Laboratory Prereq: GMS FS720 and consent of instructor. Introduction to typical DNA extraction procedures, real time PCR quantitation methods, capillary electrophoresis instrumentation, data analysis procedures, reporting of results and familiarization with proper laboratory procedures for PCR testing and contamination prevention. *R. Cotton.* 2 cr, SS I.

GMS FA 722 Anatomy for the forensic Anthropologist Prereq: consent of instructor. The central emphasis of this course will be on the gross morphological

features of the human body with a modest treatment of function. Although forensic anthropologists typically deal with soft tissues post-mortum and/or skeletonized remains, this course will expose students to preserved tissues and the "normal" appearance of these tissues. *D. Siwek and T. Moore.* 4 cr, 1st sem.

GMS FS 730 Advanced Forensic DNA Analysis Prereq: GMS FS 720 and consent of instructor.

This course covers DNA profile interpretation concentrating on mixtures and compromised samples. Also covered are current and historical methods for presentation of profile frequency information. The role of accreditation, quality assurance and validation as well as experimental approaches to validation will be covered. *Cotton.* 2 cr, SS I.

GMS FS 735 Analysis of Ignitable Liquids and Explosives

Prereq: GMS FS 703 and consent of instructor. Overview of analytical methods utilized in forensic chemistry laboratories; designed to teach the student to confidently make decisions regarding the analysis of unique forms of evidence pertaining to arson/explosion investigations and general unknown chemical substances. *Hall.* 2 cr, SSI.

GMS FS 740 Analysis of Controlled Substances Prereq: consent of instructor. A primarily lecture-based analytical chemistry course that demonstrates how controlled substances are analyzed in a modern forensic laboratory. Topics include drug classification, physical appearances, clandestine laboratories, usage trends and impact on society. Some hands-on laboratory analysis will be performed. *Hebard.* 2 cr, SS II.

GMS FS 800 Criminal Law II – Mock Court Prereq: consent of instructor. This course will provide the students with an opportunity to present evidence as an expert witness in a mock court setting. *Rosen.* 2 cr, 1st sem.,

GMS FS 803 Advanced Forensic Chemistry Prereq: FS 703 and consent of instructor. Overview of advanced instrumental techniques and analytical methods utilized in modern forensic laboratories, designed to teach the student to confidentially make decisions regarding the analysis of unique forms of evidence, including those pertaining to arson/explosion investigations and terrorism related activities. *Hall.* 2 cr, SS II.

GMS FS 806 Advanced Crime Scene Investigation Prereq: GMS FS 701 and consent of instructor. Lectures and exercises relating to the methods and principles of crime scene processing involving the search and recovery of surface and/or buried human remains, forensic etymology, the mechanisms of human decomposition, and crime scene reconstruction. *Brodeur and Martin.* 2 cr, 2nd sem.

GMS FS 807 Trace Evidence Analysis Laboratory Prereq: GMS FS 707 and consent of instructor. An overview of microscopy and other instrumentation as they relate to the examination of trace evidence. Course will include in-depth examinations, chemical analyses, and comparisons of soil, tape, fabric, cosmetics and other miscellaneous trace evidence. *Kraatz,* 2 cr, SSI.

GMS FS 830 Forensic Toxicology Prereq: consent of instructor. This course will cover topics in forensic toxicology including the role of toxicology in death investigation, techniques employed to differentially extract drugs, blood alcohol concentration calculations, toxicology in forensic entomology and the forensic toxicologist as an expert witness. *R. Cotton.* 3 cr, 1st sem.

GMS FS 870 Directed Studies in Biomedical Forensic Sciences Prereq: consent of instructor. Students in this course will have the opportunity to develop a directed study project in a specialized area of forensic sciences.

TBA, var cr, 1st, 2nd, SSI, and SSII.

GMS FS 871 Internship in Biomedical Forensic Sciences Prereq: consent of instructor. Students in this course will be required to complete an approved internship in a forensic setting.

TBA, var cr, 1st, 2nd, SSI, and SSII.

GMS FS 970 Research in Biomedical Forensic Sciences Prereq: consent of instructor. Students registered in this course will be expected to conduct and develop a research project, the results of which are to be incorporated into a thesis. TBA. var cr, 1st, 2nd, SSI, and SSII.

Biophysics

GMS BY 760 Foundations of Biophysics and Structural Biology Prereq: consent of instructor. The course provides thorough grounding in theory and practice of the major, fundamental methods of biophysics and structural biology. The course covers thermodynamics, spectroscopy, electron microscopy, x-ray diffraction and crystallography, and nuclear magnetic resonance from the standpoint of modern molecular and structurally based research. *Atkinson*. 6 cr, 2nd sem.

GMS BY 771 Biophysics of Macromolecular Assemblies Prereq: GMS BI 751 or GMS BI 755, 756, and consent of instructor. Advanced course. Assembly of biomacromolecules, their structure and stabilizing forces; biological function as related to structure, with examples drawn from assemblies of proteins, lipids, lipoprotein systems, and membranes. *Shiely*. 4 cr, 2nd sem.

GMS BY 772 Nuclear Magnetic Resonance Spectroscopy in Biology and Biochemistry Prereq: consent of instructor. An introduction to the basic theory and the fundamental measurements of NMR spectroscopy using the predominant biological nuclei, ¹H, ²H, ¹³C, and ³¹P, and ap-

plications to structure and metabolism; NMR studies of pathological processes and NMR imaging. *Hamilton*. 2 cr, 2nd sem.

GMS BY 774 Metabolism and Cellular Functions of Complex Lipids Prereq: consent of instructor. In-depth description of selected areas of lipid metabolism. Emphasis on functional roles of specific lipid species in cellular processes (e.g., cell activation, protein transport and function). Use of timely articles to discuss newly developed techniques and concepts. *Zoeller*. 2 cr, 2nd sem.

GMS BY 871, 872 Biophysics Special Topics/Student Seminar A weekly program in which first and second year students present seminars on assigned or selected current topics in biophysics and structural biology. Emphasis is placed on class participation by all students. *Atkinson & Members of Department*. 2 cr, 1st & 2nd sem.

GMS BY 945, 946 Research Biophysics var cr

Cell & Molecular Biology

GMS CM 753 Cell Biology Prereq: consent of instructor. Morphology of organelles, biochemical consideration of receptors, responses to extra cellular matrices, vesicles within the cell, and secretion; regulation of gene expression. Behavior of cells in culture and the cell cycle. Cellular differentiation, embryogenesis, biochemistry of fertilization, cell movement, and control of cell differentiation. *Trinkaus-Randall*. 4 cr, 1st sem.

GMS CM 761, 762 Critical Thinking in Cell and Molecular Biology The purpose of this course is to train students in the art of reasoning and critical thinking in the pursuit of answers to biological questions. An in-depth study of the process of refinement and reasoning which leads to the acceptance or rejection of biological models. TBA. 2 cr, 1st and 2nd sem.

GMS CM 765, 766 Mini-Courses in Cell and Molecular Biology

Two six-week mini-courses on specialized current topics in cell and molecular biology will be presented. Topics will vary from semester to semester and from year to year. Current journal articles will be read and discussed. 2 cr, 1st and 2nd sem.

Clinical Investigation

GMS CI 630 Introductory Pharmacology Prereq: consent of instructor. Principles of pharmacology are covered and mechanisms of action and clinical pharmacology are addressed, including the drug development process, drug delivery systems, and population variability in drug response. Learning objectives include competency in evaluating studies of clinical pharmacokinetics and efficacy. *Walsh*. 4 cr, 2nd sem.

GMS CI 631 Clinical Trials Management Prereq: consent of instructor. This course is an integrative learning experience, combining a comprehensive review of the good clinical practice core principles with explanation and analysis of selected portions of the Code of Federal Regulations (CFR), applicable to clinical research during the new drug development process. The case study approach is used in this course since the drug development industry translates these regulations into both written and unwritten standards, practices, and guidelines. Each session will use activities to expand the interpretation of the regulations, further integrating real-life issues into the classroom. In order to ensure that classroom learning is linked with the students' work experiences, there will be an outside project required which will incorporate the course work with the on-the-job situations, and a final presentation to share the learning with the entire class. *Halloran*. 4 cr, 1st sem.

GMS CI 640 Regulatory Compliance Issues (GMS CI 640 and

GMS CI 640 OL *Course explains the regulatory requirements for healthcare products, that is, drugs, biologics, diagnostics, and devices. Intended for those interested in regulatory affairs or in the clinical evaluation, development, manufacture, testing and/or commercialization of these products. Provides in-depth review of pertinent FDA regulations and guidelines and relationship to scientific and logistical activities involved in taking a product from research to market. Content and preparation of regulatory submissions, including an Investigation New Drug Application (IND), and Investigational Device Exemption (IDE), a New Drug Application (NDA), a Biologic License Application (BLA), a Pre-Market Approval Application (PMA), and a 510K Pre-Market Notification are described. International requirements for health care products are also reviewed. 4 cr. CI 640 Gloff, Fall / CI 640 OL Dautuil, Spring

GMS CI 660 Good Clinical Practices in Clinical Research [CI 660 and CI 660OL] *Prereq: consent of instructor. Introduces regulatory responsibilities of sponsors, monitors, and investigators conducting clinical trials. Practical information and exercises are designed on GCP compliance from an industrial perspective. Topics include: selecting qualified investigators; obtaining ethical approval for patients, and initiating sites successfully. Group discussions and guest speakers help students learn practical skills. 4 cr. CI 660 Oommen, Summer II / CI 660 OL Gilmartin, Fall

GMS CI 670 Biostatistics with Computer Prereq: consent of instructor. This course is designed for Clinical Research Associates and other students with no prior experience with statistics who want to utilize computer software in performing statistical analysis. Topics include the collection, classification, and presentation of descriptive data; the

rationale of hypothesis testing; experimental design; t-tests; correlation and regression analysis; and analysis of contingency tables. Laboratory course. Rose 4 cr, 1st sem.

GMS CI 675 Designing Clinical Research Studies (GMS CI 675 and GMS CI 675 OL) Prereq: Consent of instructor. This course covers important epidemiologic principles necessary for designing clinical research studies. Topics include bias, confounding, developing the research question, defining an appropriate study population, choosing outcome measures, clinical research ethics and regulation, sample size determination, and statistical analysis issues. Students will design and present a clinical research study during the course. CI 675 Fish & McNair. 1st sem, 4 cr, Fall. / CI 675 OL Hess Pino, Fall, 4 c

GMS CI xxx OL Critical Evaluation of the Medical Literature

*Prereq: CI 675 OL. The goal of this course will be to provide students experience in the reading and evaluation of recent basic science literature that may be pertinent to the origination and design of clinical trials. It will consist of the evaluation of assigned readings of recent literature which may be relevant to the treatment of human diseases and which might be expected to lead to further animal experiments and to culminate in human trials. This format will provide an opportunity to learn to critically evaluate basic science literature and to develop oral presentation skills essential to function as a manager of clinical trials. 4 cr, Hess Pino Spring

GMS CI 680 Legal and Ethical Issues in Clinical Research This course examines evolving ethical and legal issues in the biosciences. Students will study the legal and ethical issues pertaining to work with human subjects both existing and historical. They will go through the historical background that set the standard for today's existing

regulations and how those regulations are still in flux. Each student will do a presentation on a topic that relates to his or her own interest or existing research. Legal cases that have come from clinical research (such as Moore v. Regents of CA) will also be covered. Class discussions, student presentations, case analyses and in-class lectures will be supplemented with online activities as well as the composition of a legal brief. Yashon 4 cr, Sum

GMS CI 691, 692 Directed Studies in Clinical Investigation TBA, 4cr, 1st and 2nd sem.

GMS MS 790 Seminar in Clinical Investigation *Prereq: consent of instructor. The goal of this course will be to provide students experience in the reading and evaluation of recent basic science literature that may be pertinent to the origination and design of clinical trials. The course will be a seminar format. It will consist of the evaluation of assigned readings of recent literature which may be relevant to the treatment of human diseases and which might be expected to lead to further animal experiments and to culminate in human trials. This format will provide an opportunity to learn to critically evaluate basic science literature and to develop oral presentation skills essential to function as a manager of clinical trials. 2 cr. Fish & Hess Pino, Spring

GMS MS 961, 962 Clinical Investigation Practicum var cr, 1st and 2nd sem.

Forensic Anthropology

GMS FA 705 Forensic Anthropology Techniques Prereq: consent of instructor. This course will provide a detailed history of forensic anthropology, including pioneers in the field, bone growth and development, and a knowledge of protocols, methods and procedures used by forensic anthropologists.

Students will be provided hands-on experience in casework and will prepare several forensic anthropology case reports.

Prince 3 cr, 1st sem.

GMS FA 706 Forensic Anthropological Procedures Prereq: FA 705 and consent of instructor.

This course provides in-depth knowledge of the protocols, methods and procedures used in the recovery, analysis, and identification of human skeletal remains and the techniques used to identify and analyze skeletal trauma, pathologies, and the stages and processes of soft tissue decomposition. *Prince* 3 cr, 2nd sem.

GMS FA 740 Seminar in Forensic Anthropology Prereq: FA 705 and consent of instructors.

Students will take this class concurrently with FA 706. This course will provide students with an extensive knowledge of past and current research within the field of forensic anthropology. In addition, this course will foster critical thinking skills for students preregistered for this course.

Prince 2 cr, 2nd sem.

GMS FA 760 Research in Forensic Anthropology. Prereq:

consent of instructor. This course is designed to facilitate the students thesis research.

Marks. var cr, 1st and 2nd sem.

Genetic Counseling

GMS GC 600 Genetic Diagnosis & Laboratory Methods Prereq:

consent of instructor. This interactive course will provide students with the opportunity to learn laboratory techniques and methodologies in a hands-on setting. It will combine didactic lectures with observational rotations in the cytogenetic, molecular, mass spectrometry, maternal serum screening, and research laboratories. *Ito, Wang, Wyand*, 3 cr, 2nd sem.

GMS GC 602 Clinical Genetics

Prereq: consent of instructor.

This course will provide information regarding etiology, features, testing, and treatment for a variety of genetic conditions. The

topics are arranged by organ system to expand on the material covered in Embryology. Clinical case studies and presentations will supplement. *J. Milunsky, Whalen*. 3 cr, 2nd sem.

GMS GC 601 Professional Issues in Genetic Counseling Prereq:

consent of instructor. This two-semester course addresses topics related to the development of a competent genetic counselor. Instructional content, combined with group discussions and student presentations, will cover the history and development of the profession, care across the lifespan, and ethical/social issues. *A. Milunsky, Whalen*, 3 cr, 1st sem.

GMS GC 603 Embryology, Teratology, and Prenatal Genetics

Prereq: consent of instructor.

This course will review human embryology, the teratogenic factors leading to abnormal development, and the common indications for prenatal genetic counseling, including advanced maternal age, abnormal serum screening, ultrasound anomalies, diagnostic procedures, and prenatal complications. *Flynn, Hoagland, Whalen*. 3 cr, 1st sem.

GMS GC 604 Cancer Genetic Counseling Prereq: consent of

instructor. This course introduces students to the subspecialty of cancer genetics, through topics such as the biology of cancer, current statistics and technology, inherited cancer syndromes, cancer risk assessment, testing for cancer susceptibility genes, treatment options, and ethical/legal issues. *Flynn, Ito*. 3 cr, 2nd sem.

GMS GC 605 Clinical Applications in Human Genetics Prereq:

consent of instructor. This course will introduce students to the basic concepts and principles of human genetics and their clinical applications. Topics include the chromosomal, molecular, and biochemical basis of disease, prenatal diagnosis, genetic counseling, bioinformatics, and congenital ano-

malies. *J. Milunsky*. 4 cr, 1st sem.

GMS GC 711 Advanced Genetic Counseling (Genetic Counseling II) Prereq: GMS GC601. This

course will cover advanced topics in genetic counseling, including research project design and implementation, personal growth, and professional development. It will build upon the students' previous course work and clinical training to enhance their growing skill set as genetic counselors. *Whalen*. 1st sem, 4 cr.

GMS GC 712 Metabolic Genetics/Advanced Risk Assessment

Prereq: consent of instructor.

Section A covers the diagnosis, recurrence risk, treatment and prognosis for biochemical genetic disorders. Screening and prevention will be addressed.

Section B emphasizes mathematical techniques necessary for accurate genetic counseling, including empiric risk, probability, linkage, mapping, and Bayesian analysis. *Ito, J. Milunsky, Whalen*. 3 cr, 2nd sem.

GMS GC 714 Advanced Topics in Medical Genetics Prereq:

consent of instructor. This course will build from the basic genetic concepts covered in GMS MS 781, Introduction to Human Genetics. Some of the topics addressed include mitochondrial disorders, immunogenetics, microdeletions and duplications, trinucleotide repeats, methylation, imprinting, and pharmacogenetics. *J. Milunsky*, 3 cr, 2nd sem.

GMS GC 700, 702S, 703, 704 Genetic Counseling Clinical Rotation I, II, III, and IV Prereq:

consent of instructor. The clinical rotations will provide student interaction with a wide array of genetic specialists. Direct patient contact in prenatal, pediatric, adult, cancer, and specialty genetics clinics will allow students to acquire a minimum of 50 logbook cases for ABGC certification. *Flynn, Whalen*, 2 cr, 1st, 2nd, sum sem.

Genetics and Genomics

GMS GE 701 Principles of Genetics and Genomics Prereq: consent of instructor. This course will serve as a foundation for understanding the heritable basis of numerous biological traits, the relationships among genes, and the regulation of their expression. Focus on the ability to use genetic systems to probe these problems, and therefore will heavily explore the experimental aspects of these investigations. Includes discussion of the impact of the genome sequences on the practice of modern science. Use of case study approach to investigate the rich variety of scientific insights gained through genetic studies. *Dasgupta*. 4 cr, 1st sem.

GMS GE 702 Advanced Topics in Genetics Prereq: GMS GE 701 and consent of instructor. This course will focus on the mechanisms of biological processes that influence the inheritance and regulation of genes. In particular, the molecular details of genetic, epigenetic, and genomic processes will be explored. In addition we will discuss the possibilities of utilizing these technologies in medical treatments. *Dasgupta*. 4 cr, 2nd sem.

GMS GE 703 Genetics and Genomics Colloquium I Prereq: consent of instructor. The Genetics and Genomics Colloquium will be a highly participatory journal club where the students will be asked to give presentations on cutting edge research with the focus on communication skills rather than scientific content. This approach will allow students to become more comfortable with public speaking while developing the skills necessary for effective communication of scientific ideas. *Dasgupta*. 2 cr, 1st sem.

GMS GE 704 Genetics and Genomics Colloquium II Prereq: consent of instructor. The Genetics and Genomics Colloquium will be a highly participatory journal club where the students will be asked to give presenta-

tions on cutting edge research with the focus on communication skills rather than scientific content. This approach will allow students to become more comfortable with public speaking while developing the skills necessary for effective communication of scientific ideas. *Dasgupta*. 2 cr, 2nd sem.

GMS GE 705 Critical Thinking in Genetics and Genomics Prereq: consent of instructor. This class is designed to chronologically follow the development of a field of study, the cell cycle, to allow students to explore the logical evolution of a coherent line of scientific inquiry. The individual meetings build on the background studies discussed in previous meetings, examine apparent discrepancies in experimental results, critique the approaches employed by the authors, and consider the logical follow-through experiments for the results at hand. *Vaziri*. 2 cr, 2nd sem.

GMS GE 900, 901 Research in Genetics and Genomics var cr, 1st and 2nd sem.

Healthcare Emergency Management

GMS BC 600 Biology, Chemistry, and Physics of Natural and Man-made Hazards Prereq: consent of instructor. This course will cover the biology, chemistry, and physics behind natural and man-made disasters, including emerging diseases, earthquakes, and explosives. *Hallock*. 3 cr, 1st sem.

GMS BC 610 Medical Consequences of Natural and Man-Made Hazards Prereq: consent of instructor. This course will cover the medical consequences of natural and man-made disasters, including emerging diseases, earthquakes, and explosives with an emphasis on their ability to impact health services. *Singer*. 3 cr, 1st sem.

GMS BC 620 Psychology and Sociology of Disasters and Methods of Risk Communication. Provides a survey of psychological and social factors affecting community and individual responses to disasters with emphasis on at risk groups. Methods of risk communications to diverse audiences (including subjectivity of risk and translating complex concepts) are addressed. *Yip*. 3 cr, 1st sem.

GMS BC 630 Ethical & Policy Issues in Health and Medical Services Emergency Management Prereq: consent of instructor. Explores the complex issues surrounding ethical, legal, and policy issues concerning health and health care delivery under crisis conditions. Issues evaluated include end-of-life decision making, implications of triage, medical malpractice, insurance company regulation and liability. *Thomas*. 3 cr, 1st sem.

GMS BC 650 Community Health and Emergency Management Prereq: consent of instructor. Community Health aims to prevent disease and death, advancing the health and safety of the greatest amount of people. This course will explore the multiple concentrations of public health, focusing its relationship with emergency management. *Thomas*. 3 cr, 2nd sem.

GMS BC 700 The Disaster Lifecycle Prereq: consent of instructor. This course focuses on examining health needs and health care delivery methods to prepare for, respond to, recover from, and mitigate impacts of crises. *Thomas*. 3 cr, 2nd sem.

GMS BC 710 Methods and Practices of Incident Command Examines command and control processes, including incident and unified command structures, under crisis/disaster management situations for health and medical services. Simulation tools will be used based on Federal Emergency Management Agency (FEMA) the National Incident Management System. *Thomas*. 3 cr, 2nd sem.

GMS BC 720 Preparedness and Mitigation Examines health care delivery methods to prepare for and mitigate impacts of crisis. This course addresses the cycle of planning, training, equipping, exercising, and mission continuity processes through case studies of current and past governmental and private actions. *Thomas*. 3 cr, 2nd sem.

GMS BC 730 Principles, Methods, and Practices of Modeling and Simulation Instructs in methods/practices of modeling/simulation applicable to biomedical health and medical services crisis management to provide unique hands-on experience in the development and use of computer-based models to study policy- and decision-making. *Woodcock*. 3 cr, 2nd sem.

GMS BC 971 Research Practicum and Thesis I – Designing Crisis Management Research This is the first phase of a directed research and development project in biomedical crisis management. During this course students identify an area of the crisis management process on which to perform research and design a modeling and simulation exercise. *TBA*. 2 cr, SS.

GMS BC 972 Research II This is the capstone course for the Program. Utilizing the base of knowledge gained throughout the previous year, and applying learned methods in modeling and simulation, this practicum provides the student with an opportunity to perform a guided research activity focused on health care under crisis. *TBA*. 2 cr, SS.

Medical Anthropology & Cross Cultural Practice

GMS MA 700 History and Theory of Medical Anthropology (Part I) This course introduces the history of the field of medical anthropology and of theoretical orientations related to understanding and analyzing health and medi-

cine in society and culture. Readings will exemplify interpretive strategies applied to health-related experiences, discourse, knowledge, and practice. *Barnes*. 3 cr, 1st sem.

GMS MA 701 History and Theory of Medical Anthropology (Part II) Course will address theoretical traditions in medical anthropology, focusing on orientations developed and applied within the field over the past two decades to interpretations of health-related phenomena. *Barnes*. 3 cr, 2nd sem.

GMS MA 705 A Social History of Medical Pluralism in the United States This course explores issues in the social history of medical pluralism in the United States. It examines relations between medical concepts, therapies, and currents in social thought, including the roles of class, race, and gender. *Barnes*. 4 cr, 2nd sem.

GMS MA 710 Medical Anthropology & Qualitative Research Methods and Design Introduction to methodology for ethnographic field research in medical anthropology, and qualitative research methods. This course examines issues in designing anthropological research, and reviews theoretical approaches to research ethics, designing research, framing questions and questionnaire design, and data collection techniques. *Laird*. 3 cr, 1st sem.

GMS MA 720 World Religions and Healing An introduction to approaches to healing integral to Hindu, Buddhist, Jewish, Christian, Muslim, African, African-descended, Latin American, Chinese, Native American traditions, and to some of the outcomes of their interactions, in relation to the experience of affliction and suffering. *Barnes*. 4 cr, 1st sem.

GMS MA 721 Theory and Methods in Religion and Healing An examination of the aim, function, justification and critique of classical and contemporary “theories” of religious traditions (social-scientific, psychological,

phenomenological, theological, historical) using, as an organizing focus, the cross-cultural study of healing traditions. *Barnes*. 3 cr, 1st sem.

GMS MA 722 Religion and Public Health This course will explore relationships between religion and health in the context of public health projects. We will examine historical developments, examples of faith-based public health organizations, and current research on “religious health assets,” both locally and internationally. *Laird*. 3 cr, 2nd sem.

GMS MA 724 Ethnographies of Immigrants and Immigration Pre-req: Consent of instructor. This course presents different ways of studying cultural pluralism in the United States through ethnographies. We will analyze transformations of ethnicity, gender, race and national identity that have marked both historical and contemporary migrations of people to the United States. *Barnes*, 3 cr, 2nd sem.

GMS MA 730 Medical Anthropology and the Cultures of Biomedicine This course examines biomedicine as a cultural system with local and national variations worldwide, all of which have undergone changes over time. Topics include acculturation, medicalization, the patient-doctor relationship, understandings of interventions, and chronicity. *Barnes*. 3 cr, 1st sem.

GMS MA 740 The Cultural Formation of the Clinician: Its Implications for Practice This course will provide a context for exploring and reflecting on the culture of biomedicine; the values one brings into the profession, and how the interaction of both influence one’s personal and professional life, including responses to diverse patient cultures. *Barnes*. 3 cr, 1st sem.

GMS MA 750 Society, Healthcare, and the Cultures of Competence This course examines the development of a system of health care professions and key “professional competencies” in the context of American society.

It interrogates the place of “cultural competency” in the cultures of each profession. *Laird*. 3 cr, 2nd sem.

GMS MA 770 IRB Proposal Development and Writing Students will learn to write a medical anthropology research proposal and related Institutional Review Board Proposal, through the structure provided by the IRB of BUSM. We will address theory and methods related to the design and review process.

Barnes. 3 cr, 2nd sem.

GMS MA 777 Topics in Medical Anthropology: HIV/AIDS This seminar develops a critique of topics in medical anthropological theory. It revisits significant legacies from classic anthropology, joining them with insights from current theory and ethnography, to analyze selected issues in medical anthropology. *Barnes*. 3 cr, 2nd sem.

GMS MA 780 Culture, Migration, and Mental Health Prereq: consent of instructor. This course explores the historical intersections of cultural anthropology and psychiatry. Drawing on this heritage, the course examines contemporary issues in the development of programs for treatment of refugee and immigrant mental health. *Laird* 3 cr, 1st sem.

Medical Nutrition Sciences

GMS NU 600 Medical Nutrition Sciences Prereq: Organic Chemistry, Basic Nutrition, Cell Biology, Human Physiology, and consent of instructor. This course examines the interrelationship between cellular molecular biology, nutrient metabolism, and human clinical nutrition. It emphasizes the metabolic basis of nutrition as related to the maintenance of optimal nutritional status as well as health and well-being throughout the human life cycle. *S. Fried*, 4 cr, 1st sem.

GMS NU 601 Molecular, Biochemical and Physiologic Bases of Nutrition II: Metabolism Prereq: at least one semester of

Biochemistry and Physiology, and consent of instructor. Regulation of lipid, carbohydrate, and protein digestion, absorption, transport, tissue and cellular metabolism. Integration of macronutrient metabolism in response to alteration in nutritional status (e.g., starvation, obesity) on a whole body and tissue-specific basis. Mechanism regulating macronutrient metabolism in response to stresses such as exercise and aging and disease. A discussion session will teach students to critically evaluate research papers, provide knowledge of seminal papers in the field, and introduce students to research approaches and state of the art methods in metabolic research (e.g., assessment of metabolic flux using stable isotopes, euglycemic clamps, metabolomics.) *S. Fried*, 4 cr, 2nd sem.

GMS NU 610 Research Methods in Medical Nutrition Sciences Prereq: Medical Nutrition Sciences, Statistical Methods, consent of instructor. This course examines research approaches and techniques used in medical nutrition research in a variety of settings: basic and laboratory investigation; nutritional epidemiology; population and individualized clinical research trials; population-based nutrition promotion or educational campaigns; and community nutrition interventions and programs. *Krall*. 4 cr, 1st sem.

GMS NU 620 Research, Clinical and Public Policy Applications in Medical Nutrition Sciences Prereq: Medical Nutrition Sciences, Human Physiology, consent of instructor. This course examines how researchers, clinicians and public policy experts translate nutrition research into practice—into new directions for basic and clinical research; into public health nutrition policies, programs, and social marketing campaigns; and into guidelines for clinical nutrition practice. *Kimokti*. 4 cr, 1st sem.

GMS NU 700 Medical Nutrition Sciences Seminar Prereq:

Medical Nutrition Sciences, consent of instructor. This course provides a forum for discussion between students and expert nutrition faculty who are leading scientists in the field of medical nutrition sciences. The seminar will enable students to develop critical inquiry skills related to the design and interpretation of nutrition-related research. *S. Fried*, var cr, 1st and 2nd sem.

GMS NU 701 Advanced Methods in Medical Nutrition Research Prereq: GMS NU 160, GMS MS 700 or equivalent. This course is designed to develop advanced analytical and interpretive skills by exploring selected statistical topics (ANOVA, ANCOVA, multiple linear, logistic, and proportional hazards regression and providing directed experiences in statistical analysis of large nutrition research data sets (NHANES, etc.). *Krall, Nunn*. 4 cr, 2nd sem.

GMS NU 710 Advanced Methods in Medical Nutrition Research Prereq: GMS NU 610, GMS MS 700, or equivalent. This course is designed to develop advanced analytical and interpretive skills by exploring selected statistical topics (ANOVA, ANCOVA, multiple linear, logistic, and proportional hazards regression and providing directed experiences in statistical analysis of large nutrition research data sets (NHANES, etc.) *Kaye, Nunn*. 4 cr, 2nd sem.

GMS NU 804 Directed Studies in Medical Nutrition TBA. 4 cr, 2nd sem.

GMS NU 901, 902 Research in Medical Nutrition Sciences TBA. var cr, 1st and 2nd sem.

Medical Sciences

GMS MS 506S Clinical Laboratory Genetics I Prereq: Biology or Genetics course. Advanced course designed for those considering a clinical or research career in human genetics. Emphasis is on clinical cytogenetics (chromosome testing). Course will cover types of chromosome abnormalities, methodology,

nomenclature and clinical significance in pregnancy, birth defects, and cancer. Laboratory work will include basic blood culture, chromosome preparation, banding, identification and karyotyping. Provides updated review of latest cytogenetic methodology and applications, such as FISH, comparative genomic hybridization (CGH) and array CGH. *Wyand*. SS I, 4 cr.

GMS MS 610 Ethico-legal Issues of Bioscience Prereq: consent of instructor. This course examines evolving ethical and legal issues in the biosciences. Students will study existing laws and legal cases pertaining to topics such as genetic testing, gene therapy, and forensic uses of DNA. Class discussions, student presentations, case analyses and in-class lectures will be supplemented with online activities as well as the composition of a legal brief. *Yashon*. 4 cr, 1st sem.

GMS MS 612 Introduction to Computer Applications in Health Care and Biomedicine Prereq: consent of instructor. An overview of the field of medical informatics, combining perspectives from medicine, computer science, and social science. Use of computers and information in health care and the biomedical sciences, covering specific applications and general methods, current issues, capabilities and limitations of medical informatics. Medical informatics studies the organization of medical information, the effective management of information using computer technology, and the impact of such technology on medical research, education, computer technology, and the impact of such technology on medical research, education, and patient care. The field explores techniques for assessing current information practices, determining the information needs of health care and biomedical research practices, determining the information needs

of health care and biomedical research professionals and other workers and patients, developing systems using computer technology, and evaluation of the impact of these systems. The course covers a wide range of medical informatics applications relevant for health care delivery organizations, governmental agencies, biomedical researchers and commercial entities. The course provides a comprehensive overview of major medical informatics techniques aimed to optimize the use of information in order to improve the quality of health care, reduce cost, provide better education for providers and patients, and to conduct medical research more effectively. *TBA*. 4 cr, on demand.

GMS MS 620 Technology Commercialization The subject of this course is the innovative transformation of knowledge into commercial products and services. Cross-disciplinary teams of students will assess real technologies for their commercial potential in terms of licensing and/or for venture development. *A. Stevens*. 4 cr, 1st sem.

GMS MS 621 Bench-to-Bedside—Translating Biomedical Innovation from the Laboratory to the Marketplace Prereq: consent of instructor. This course covers intellectual property, licensing, and the core aspects of planning, creating, funding, and building new entrepreneurial ventures. Cross-disciplinary teams are formed to evaluate current BU translational research projects and their potential as the basis for a start-up company. *A. Stevens*. 4 cr, 1st sem.

GMS MS 625 Inclusion of Students with Disabilities in Laboratory Science Prereq: consent of instructor. This course explores the pedagogical, scientific, and legal bases for including students with disabilities in science laboratory experiences. Emphasis on collaboration strategies for special and science educa-

tors in inclusive settings through cross-training experiences, including practical implementation. *C. Romney, D. DeRosa, L. Katzman*. 4 cr, SS II.

GMS MS 640 Introduction to Biomedical Information (Required course for M.A. in Medical Sciences students). This course teaches how to find, use, and contribute to biomedical literature while supporting the graduate thesis through lectures and hands-on instruction. Topics include the retrieval, evaluation and management of information, Evidence Based Medicine, and the ethical use of research. *Flynn, Bresnahan, Harzbecker, and Blanchard*. 2 cr, 2nd sem.

GMS MS 642 Current Issues in Assisted Reproduction and Infertility A steady rise in infertility has forced medical science to develop Assisted Reproductive techniques. This course will look closely at the legal and ethical questions raised by assisted reproduction and infertility as well as look toward the future. *Yashon*. 2 cr, 2nd sem.

GMS MS 700 Elementary Biostatistics for the Biomedical Sciences Topics include collection, classification, and presentation of descriptive data; the rationale of hypothesis testing; experimental design; t-tests; simple correlation analysis; and analysis of contingency tables. Special attention is directed to the ability to recognize and interpret statistical procedures in articles from current literature. *Killiany*. 2 cr, 1st & 2nd sem.

GMS MS 703 Neuroscience Prereq: consent of instructor. Integrated treatment of anatomy and physiology of the nervous system. In anatomy classes, brains and spinal cords are dissected and microscope slides examined to study cytology and projections of neurons. Other practical classes and demonstrations cover physiology, neurology, ophthalmology and otolaryngology. *Rosene*. 4cr, 2nd sem.

GMS MS 706 Introduction to Computer Applications in Health Care and Biomedicine Prereq: consent of instructor. An overview of the field of medical informatics, combining perspectives from medicine, computer science and social science. Use of computers and information in health care and the biomedical sciences, covering specific applications and general methods, current issues, capabilities and limitations of medical informatics. Medical Informatics studies the organization of medical information, the effective management of information using computer technology, and the impact of such technology on medical research, education, and patient care. The field explores techniques for assessing current information practices, determining the information needs of health care and biomedical research professionals and other workers and patients, developing systems using computer technology, and evaluation of the impact of these systems. The course covers a wide range of medical informatics applications relevant for health care delivery organizations, governmental agencies, biomedical researchers, and commercial entities. The course provides a comprehensive overview of major medical informatics techniques aimed to optimize the use of information in order to improve the quality of health care, reduce cost, provide better education for providers and patients, and to conduct medical research more effectively. *TBA*. 4 cr, on demand.

GMS MS 711 Research Seminar in Medical Informatics Prereq: consent of instructor. The goal of this course will be to provide students with experience in the reading and evaluation of recent scientific publications that may be pertinent to the development and assessment of computer applications for health care and biomedicine. The course will be in a seminar format. It will consist of the evaluation of assigned

readings of recent literature that may be relevant to the field of medical informatics that might be expected to lead to further computer use in medicine and biology. This format will provide an opportunity to learn to critically evaluate medical informatics literature and to develop oral presentation skills essential to function as a leader in medical informatics projects. *Bickmore*. 2 cr, 1st sem.

GMS MS 783 Molecular Basis of Neurologic Diseases Molecular mechanisms of stroke, multiple sclerosis, Huntington's disease, Alzheimer's disease, amyotrophic lateral sclerosis, muscular dystrophy, and neoplasia re considered. Fundamentals and current research of molecular biology are reviewed. Current publication seminar discussion is held with student participation. Distinguished guest speakers give keynote lectures monthly. *Abraham*. 2 cr, 1st sem..

Medical Sciences – Oral Health Sciences

GMS OH 751 Biochemistry/Dental Prereq: Consent of Instructor; must be in Oral Health track. This course is designed to acquaint the student with the basic principles of modern biochemistry. The topics to be covered include proteins, enzymes, DNA, RNA, and protein synthesis, metabolism, lipids, connective tissue, and hormones and second messengers. *Schreiber*. 6 cr, 1st sem.

GMS OH 730 Physiology A/Dental Prereq: Consent of instructor; must be in Oral Health track. This course presents the physiology of cells, tissues, organs and integrated body functions, including the physiological basis for the understanding of clinical conditions. An integrated approach is taken to endocrinology and reproduction. Hormonal aberrations and their end results in human are presented in clinical

correlations. *Lehman*. 6 cr, 1st sem.

GMS OH 731 Physiology B/Dental Prereq: GMS OH 730 and consent of instructor. Must be in Oral Health track. *Lehman*, 2 cr, 2nd sem. *This course is a continuation of GMS OH 730. Students will be given the same grade for each course upon completion of both courses.*

GMS OH 740 Microbiology and Immunology/Dental Prereq: Consent of Instructor. Must be in Oral Health track. Presentations of bacteriology, parasitology, virology, mycology, and immunology prepare students for a detailed study of infectious diseases, general characteristics of pathogenic bacteria, viruses, rickettsiae, and fungi causing infections in humans. Laboratory instruction covers the elements of bacteriological and immunological technique and observation of the characteristic properties of common microorganisms, including their biochemical activity and genetics. *Oberhaus*. 4 cr, 2nd sem.

GMS OH 750 Prevention and Health Promotion in Dentistry Prereq: Consent of Instructor; must be in Oral Health track. Introduces the concepts and techniques of dental public health, disease prevention and health promotion in dentistry and health. Emphasizes caries, periodontal diseases, and oral cancer prevention in the individual and community. *W. Wright*, 3 cr, 2nd sem.

GMS OH 760 Prevention and Health Promotion Prereq: consent of instructor. Provides an understanding of the general concepts on which health promotion and disease prevention are based. Students will learn approaches to promote oral health and prevent oral disease and related conditions, and be able to demonstrate knowledge of planning, implementation, and evaluation of oral health promotion and disease prevention programs. Students will be able to

critically evaluate preventive technologies for adoption and use in oral health programs and be familiar with current research activities in oral health promotion and disease prevention. *Mascarenhas*. 2 cr, SS II.

GMS MS 791 Essential Readings in Translational Research The goal of this course is to provide students with tools, skills and experience in critically reading and evaluation of current advances in basic and clinical sciences published in the literature which are pertinent to understanding the basis of disease mechanisms and treatment. Acquisition of knowledge and skill in critical analysis, statistical inference and experimental design will provide students with the ability to read the medical and scientific literature and to examine it critically to achieve lifelong learning.

The course format will be based on presentation of chosen topics. It will consist of evaluation of assigned readings of recently published articles in basic and clinical sciences which are relevant to diseases. This format will provide students an opportunity to learn how to critically read and evaluate basic and clinical skill literature and be able to present their critical analysis for discussion by peers. This is an important skill needed for their future endeavors in medical research and clinical settings. *Broitman, Franzblau, and Traish*. 2 cr, 2nd sem.

Mental Health Counseling and Behavioral Medicine

GMS MH 701 Counseling Theory Prereq: consent of instructor. This course will review the foundations of counseling theory including psycho-analytic theory, Rogerian theory, self psychology, behavioral theory, and cognitive approaches to counseling. Techniques and strategies such as Rational-Emotive therapy, Dialectical Behavior theory and group therapy will also be ex-

amined. *Berger-Greenstein*. 3 cr, 1st semester.

GMS MH 702 Professional Orientation & Ethics Prereq: consent of instructor. Provides an overview of professional ethics, psychology and the law, ethical decision-making, confidentiality, forensic involvement of clients in counseling and commitment statutes. *Berger-Greenstein*. 3 cr, 2nd sem.

GMS MH 703 Counseling Techniques: Helping Relationships, Skills & Procedures. Prereq: Consent of instructor. Provides an overview of diagnoses, demonstrates techniques for building a helping relationship, and treatment approaches for a wide range of disorders including depression, trauma, anxiety disorders, and problems of living. *Berger-Greenstein*. 3 cr, 1st sem.

GMS MH 704 Group Work Dynamics & Process Prereq: consent of instructor. Provides an overview of the basic principles of group treatment/counseling including how to recruit and teach a group and modalities such as dynamic therapy groups, behavioral and skill-based groups for special populations. *Brady*. 3 cr, 2nd sem.

GMS MH 705 Psychopathology Prereq: consent of instructor. Provides an overview of the biopsychosocial influences over severe psychiatric illnesses as well as more common disorders diagnosed. *Brady*. 3 cr, 1st sem.

GMS MH 706 Social & Cultural Foundations Prereq: consent of instructor. Provides an overview of professional and ethical issues related to multi-cultural counseling, theories of racial/ethnic identity, gay/lesbian issues in therapy, multi-cultural personal and career counseling and ethnocultural factors which influence treatment. *Tal*. 3 cr, 2nd sem.

GMS MH 707 Research & Evaluation Prereq: consent of instructor. Describes the lan-

guage of experimentation, the development of psychological testing principles and the design of quasi-experimental and experimental research as they apply to counseling and therapy. *Stonkus*. 3 cr, 1st sem.

GMS MH 708 Human Growth & Development Prereq: consent of instructor. Provides an overview of human growth and development across the life-cycle. Course will review Piaget's work on childhood stages, Erickson's theories related to adult development, theories of language acquisition and cognitive development, and development challenge in geriatric and other special populations. *Brady, Tager-Flusberg*. 3 cr, 2nd sem.

GMS MH 709 Neuroscience for Mental Health Professionals Prereq: consent of instructor. This course is intended for M.A. and Ph.D. students specializing in the mental health delivery fields of mental health counseling, social work, and psychology. The course objective is to provide a foundation in the understanding of the central nervous system structure and function and the relationship of brain to behavior. *Moss*. 3 cr, 2nd sem.

GMS MH 710 Basic Mental Health Assessment This course will introduce students to basic principles of test and measure construction, selection, administration, and interpretation. Students will be exposed to representative aptitude, achievement, interest, personality, cognitive and neuropsychological inventories. *Livshits*. 3 cr, 1st sem.

GMS MH 711 Health and Exercise Psychology Prereq: consent of instructor. This course has been designed to introduce students to central concepts of applied health and exercise psychology which draw interdependently from psychology, behavioral medicine, exercise physiology, and psychoneuroimmunology. Incorporates a biopsychosocial approach and presents major theories and

techniques of health behavior change and health behavior assessment. *Ritchie*. 3 cr, 1st sem.

GMS MH 712 Child & Family Therapy Prereq: consent of instructor. This course will describe counseling techniques and strategies related to marriage, relationships, family, children, and career counseling. This course will focus on life span development with an emphasis on counseling children. *Kates*. 3cr, 1st sem.

MH 713 Human Sexuality Prereq: consent of instructor. This course will explore physiological, psychological, socio-cultural aspects of human sexuality, focusing on trends in the field, including teen sexuality, pregnancy, and early sexual experiences, sexual assault, HIV/AIDS and other sexually-transmitted diseases, sex addiction, sexuality across the lifespan, and ethics. *Brady, Kates*. 3 cr, 1st sem.

GMS MH 714 Behavioral Medicine Prereq: MH711. This course takes a biopsychosocial approach introducing students to common behavioral health interventions. The course emphasizes approaches to exercise promotion, smoking cessation, weight control, and stress management and relaxation training as they apply to chronic disease and pain. *TBA*. 3cr, 2nd sem.

GMS MH 716 Career and Vocational Counseling Prereq: consent of instructor. This course will review the history, theory, and models of career and vocational counseling. Standardized protocols for conducting a vocational interview and qualitative and objective measurement of personality, achievement, and interests will be emphasized. *Brady*. 3 cr, 2nd sem.

GMS MH 810 Psychopharmacology Prereq: consent of instructor. Provides an overview of psychopharmacology for the non-medical mental health provider. There will be an overview of the Neurobiology of Mental

Disorders and the medications that are commonly used in their treatment. *Erdos*. 3 cr, 1st sem.

GMS MH 812 Addictions Prereq: consent of instructor. Reviews diagnostic criteria for substance abuse and dependence and treatment strategies utilized in the treatment of alcoholism and drug abuse. *Devine*. 3 cr, 1st sem.

GMS MH 814 Addiction Research Field Work Seminar Prereq: consent of instructor. Students in this practicum will become part of a multi-disciplinary clinical research team working to identify effective agents for treating alcohol and drug dependence. Training will include readings, presentations, observation, web-based training, and direct experience working with research participants. *Devine*. Var cr, 1st sem.

GMS MH 901, 902 Clinical Practicum I and II Prereq: consent of instructor. The practicum is a supervised clinical experience that provides direct mental health service work for clientele. Supervision during the practicum will include direct observation or review of audiotapes/videotapes of sessions by an approved faculty member/supervisor. In addition, there will be group supervision with other trainees in the program. *Berger-Greenstein, Levy-Bell*. 3cr, 1st and 2nd sem.

GMS MH 921, 922 Internship Prereq: consent of instructor. This course is a distinctly defined clinical training experience during the 2nd year of studies in the M.A. in Mental Health and Behavioral Medicine Program. Students provide 600 hours of clinical experience of which 250 are direct clinical care of clients. *Berger-Greenstein, Levy-Bell*. Var cr., 1st and 2nd sem.

GMS MH 971, 972 Directed Studies in Mental Health and Behavioral Medicine Var cr., 1st and 2nd sem.

Microbiology

GMS MI 700 Concepts in Microbiology Prereq: consent of instructor. This course provides a fundamental understanding of the world of microbes and the concepts and mechanisms involved as microbes interact/adapt in changing environments. Lectures are taught in an interactive manner and are supplemented through discussions and analyses of the primary literature. *Fisher*. 4 cr, 1st sem.

GMS MI 713 Comprehensive Immunology Prereq: consent of instructor. Comprehensive introduction to immunologic principles and applications. This course consists of both interactive lectures and discussion sessions. Emphasis is placed on analysis and interpretation of data from the primary literature. Prior coursework in genetics and biochemistry is strongly recommended. *Corley*. 4 cr, 1st sem.

GMS MI 715 Immunological Basis of Disease Journal article-based survey of mechanisms underlying diseases caused by abnormal immune system function. Emphasis will be on normal vs. pathological immune system processes towards reinforcing how basic immunological concepts have immediate clinical significance, *Nikolajczyk*. var cr, 2nd sem.

GMS MI 716 Bacterial Physiology Prereq: consent of instructor. Advanced topics discussed in a seminar format. The focus is on the physiological and molecular aspects of bacterial growth and metabolism. Topics include energy transduction, nutrient transport, and regulatory mechanisms involved in cell responses to changing environmental conditions. *Staff* 4 cr, 1st sem.

GMS MI 717 Growth Control and Cell Transformation Prereq: one biochemistry or cell biology course or consent of instructor. This is a discussion-oriented course covering current topics in: growth factors and their receptors, signal transduction pathways, oncogenes and tumor

suppressor genes, apoptosis, cytoskeleton, cellular and molecular basis of transformation, the biochemistry of transformation, the biochemistry of transformed cells, tumorigenicity, metastasis, and multiple drug resistance, with students leading the discussion of selected research papers. *Staff*. 4 cr, 2nd sem.

GMS MI 718 Virology Prereq: consent of instructor. Current topics in virology are discussed. An emphasis is placed on the regulation of viral gene transcription and other processes of the viral replicative cycle. *Viglianti, Zamansky*. 4 cr, 1st sem.

GMS MI 811, 812 Microbiology Seminar Presentation and discussion of problems of current interest. *Corley*. 2 cr, 1st and 2nd sem.

GMS MI 823 Special Topics in Microbiology *TBA*. 2 cr, on demand.

GMS MI 911, 912 Research Microbiology Variable cr

Molecular Medicine

GMS MM 701 Genetics and Epidemiology of Disease Prereq: consent of instructor. This course will address the genetic basis of human disease and the techniques for investigation within this area of research. Topics will include molecular genetics, developmental genetics, population genetics, cancer genetics, genetic epidemiology, and clinical genetics from the perspective of research study design and disease mechanisms. *Farrer*. 2 cr, 1st sem.

GMS MM 703 Cancer Biology Prereq: consent of instructor. This course will begin with an historical perspective; review the major mechanistic pathways relating to oncogenes, antioncogenes, cell cycle control, repair, and apoptosis; discuss standard and experimental principles of cancer treatment; and conclude with a discussion of cancer epidemiology and health policy is-

suues that affect all basic and translational cancer research. *Seldin*. 2 cr, 1st sem.

GMS MM 705 Immunity and Infection Prereq: consent of instructor. The Immunity and Infection course is designed to highlight the application of basic immunological concepts and molecular mechanisms that underlie conditions of immune dysfunction and immune responses to specific microorganisms and viruses. Measurements of immune system integrity that provide the basis for diagnosis will be examined in detail. Immunotherapies that encompass vaccine strategies, cytokine administration, bone marrow transplantation, peptide administration, oral tolerance, anti-idiotypic treatment, and gene therapy will be discussed. *Genco*. 2 cr, 1st sem.

GMS MM 707 Organ System Diseases Prereq: consent of instructor. The Organ System Diseases block is devoted to an exploration of contemporary research on the molecular basis of diseases that do not clearly fit into the rubrics of the first three blocks. *Cohen*. 2 cr, 1st sem.

GMS MM 710 Molecules to Molecular Therapeutics Prereq: consent of the instructor. This course is designed to provide instruction in all aspects of the translation of basic research observations into clinical applications, using a case study model. The first case study will focus on sickle cell anemia. Lectures will review the molecular genetics of the disease and explore animal models for study of sickle cell anemia and will include laboratory exercises as appropriate. The course will address treatment strategies for sickle cell disease, including pharmacologic manipulation of globin gene expression, structural biology and rational drug design, and gene therapy. Additional topics related to clinical trials development will be covered including ethical issues, regulatory affairs, statistical considerations in clinical research,

and outcome analysis. Required of all molecular medicine graduate students. *Seldin, Steinberg*. 4 cr, 2nd sem.

GMS MM 720 Nanomedicine: Principles and Applications Prereq: MET BI 105 and PY 212 or consent of instructor. The use of nanoscience and technology for biomedical problems has spawned a field of applications ranging from nanoparticles for imaging and therapeutics, to biosensors for disease diagnostics. Nanomedicine is a growing field that exploits the novel properties of nanoscale materials and techniques, and has the potential to revolutionize the practice of medicine. This course will focus on applications of nanomedicine to the medical field, including: cancer, cardiovascular disease, and infectious disease detection. Specific technologies include: micro- and non-particles for drug delivery and imaging, microfluidics for in-vitro diagnostics, label-free high-throughput sensing, materials for nonbiological applications, and nanofabricated substrates for cellular studies. *Ravid and Cabodi*. 2 cr, 2nd sem.

Oral Biology

GMS OB 700 Biostatistics Introduces the concepts and techniques of biostatistics used in dental research. Emphasizes the fundamentals of statistical logic and presents the basic principles of experimental design, statistical inference, and probability. Examples from current basic sciences research, survey research, and clinical trials augment the presentation of statistical theory. *TBA*. 2 cr, 1st sem.

GMS OB 761 Oral Microbiology Distribution, ecology, and pathogenic potential of oral microbiota. Pathogenicity of components of bacterial plaque and their role in the development of oral diseases. Mechanisms of local and systematic resistance to pathogenic oral microbiota. *Hughes*. 2 cr, 2nd sem.

GMS OB 763, 764 Basic Processes in Oral Biology An introductory survey course that examines biological processes at the cellular and molecular levels. Provides a basis to understand the events that regulate inflammation; wound healing; bone formation and resorption; salivary proteins and physiology; tooth development, eruption, and movement; and fluoride action. *Graves*. 2 cr each, 1st and 2nd sem.

GMS OB 800 Advanced Oral Biology Prereq: GMS OB 763 and 764; GMS BI 755 and 756. This advanced course will explore in-depth current topics in oral biology research. The format of the course consists primarily of formal didactic lectures, but students will also be challenged to analyze experimental approaches and methods from current literature in a group-discussion "journal" club format in which papers from current literature are assigned and discussed. This course is designed to provide students with basic knowledge and to develop critical thinking abilities. Topics will include host molecular, cellular, and genetic bases of periodontal diseases; microbiology of periodontal diseases; molecular events in inflammation, wound healing, and periodontal tissue regeneration; molecular components and function of the periodontal ligament, cementum, and attachment structures; extracellular matrix accumulation and turnover in mineralized and non-mineralized tissues; the etiology and complications of diabetes, with emphasis on oral tissue pathology and mechanisms, biosynthesis and functions of oral mucins, endocrine-dependent periodontal changes, effects of growth factors on periodontal tissues and cells, biosynthesis and structure of salivary proteins, and mechanisms of non-immune antibacterial processes in the oral cavity. *Trackman*. 4 cr, 1st sem.

GMS OB 805, 806 Oral Biology Seminar All PhD candidates will attend a weekly seminar series organized by the Department of Oral Biology. Faculty and invited speakers will give seminars, as will students nearing completion of their thesis research projects. Students will be encouraged to suggest invited speakers. Enrollment in this course will be required for two years (2 credits per semester, for a total of eight credits). All PhD candidates are required to attend all seminars for their entire period of study. *Helmerhorst, Leone*. 2 cr each, 1st and 2nd sem.

Pathology and Laboratory Medicine

GMS PA 510 Medical Immunology Prereq: Biochemistry. Basic principles of immunology, with emphasis on their medical relevance, presented through lectures and independent reading followed by a discussion session. The lectures and the major examination coincide with those offered to the first-year medical students. *Sharon*. 2 cr, 2nd sem.

GMS PA 600 Introduction to Pathology and Pathophysiology of Disease Prereq: consent of instructor. Lectures and discussion sessions presenting the basic morphologic and functional changes of major disease processes: cell injury and death, inflammation, cell and tissue response to microbial organisms, atherosclerosis, cancer, etc. *Christenson, Flomenbaum*. 4 cr, 2nd sem.

GMS PA 800 Pathology Seminar Weekly research seminar presented by faculty, students, and guests. *Blusztajn, Murnane*. 2 cr, 1st & 2nd sem.

GMS PA 801 Special Topics in Pathology Detailed examination of one specific area of research each term, presented in readings, discussions, and lectures. Presents significant background information, current knowledge, research approaches, and laboratory methodology in each area. *Pathology faculty*. 2 cr, 1st & 2nd sem.

laboratory methodology in each area. *Pathology faculty*. 2 cr, 1st & 2nd sem.

GMS PA 900 Laboratory Rotations in Pathology

GMS PA 901 Research in Pathology

Pharmacology and Experimental Therapeutics

GMS PM 700 Molecular Neurobiology and Pharmacology Prereq: consent of instructor. Examines a spectrum of topics ranging from the regulation of gene expression in the nervous system to the structure and function of receptors and ion channels. Emphasis is placed on theoretical foundations of pharmacological methods in neurobiology. *Farb, Gibbs*. 4 cr, 2nd sem.

GMS PM 710 Laboratory Techniques in Modern Pharmacology Prereq: consent of instructor. Supervised laboratory rotation emphasizing modern research techniques in molecular, cellular, and behavioral pharmacology. Problems of collection, summary, and interpretation of data are addressed. *Russek, staff*. 2 cr, 1st and 2nd sem.

GMS PM 720 General Medical Pharmacology Prereq: GMS BI 751, GMS PH 740, GMS MS 703 or equivalent, and consent of instructor. Pharmacologic principles and properties of chemical agents of interest to human medicine are presented in lectures and workshops. Lectures provide a complete survey of drug classes affecting organ systems such as the nervous system, as well as antimicrobial and cancer chemotherapeutic agents. Workshops emphasize interpretation of pharmacologic data and patient-oriented problem solving. *Walsh, staff*. 8 cr, 1st sem.

GMS PM 730 Introduction to Medical Pharmacology Prereq: Premedical courses in the sciences. Principles of pharma-

ology are covered and several major classes of therapeutic agents, with attention to their mechanisms of action. Issues of current and future concern in medical pharmacology are addressed including problems of drug abuse, the ethics of human experimentation, the pricing of new drugs, and new biotechnological approaches to drug design and development. *Walsh, staff*. 4 cr, 1st sem.

GMS PM 800 Advanced General Pharmacology Prereq: consent of instructor. Lectures and discussions on the major classes of pharmacologic agents, with special attention to molecular, cellular, and physiological mechanisms of therapeutic effects. *Wolozin*. 2 cr, 1st sem.

GMS PM 810 Current Topics in Pharmacological Sciences Prereq: consent of instructor. Given in conjunction with the weekly seminar program of the department. Students present and discuss research papers with the visiting scientist working on the cutting edge of pharmacology. *Leeman*. 2 cr, 2nd sem.

GMS PM 820 Behavioral Pharmacology Prereq: consent of instructor. Emphasizes pharmacologic basis of drug action in the central nervous system, stressing aspects of behavioral pharmacology and problems of drug addiction. *Kornetsky, Pierce*. 2 cr, 1st sem.

GMS PM 830 Principles of Pharmacokinetics Prereq: consent of instructor. Lectures and discussion on basic factors determining absorption, distribution, biotransformation, and excretion of drugs. Includes methods of analysis and interpretation of pharmacokinetic data. *Walsh*. 2 cr, 2nd sem.

GMS PM 832 Pharmacogenomics Prereq: consent of instructor. Focuses on genetic differences among individuals and the relevance to drug discovery and development and pharmacotherapies. Biomarkers and technologies used to identify genetic

variation will be discussed. Students will develop an understanding of the potential of personalized medicine based on genetically determined phenotypes. *Farb, Walsh, and Martin*. 2 cr, 1st sem.

GMS PM 840 Neuroendocrine Pharmacology Prereq: consent of instructor. Covers the basic principles of neuroendocrinology with special emphasis on pharmacologic aspects. Topics include the biochemistry, physiology, and pharmacology of the neural hormones, as well as selected topics in the interrelationship of neurohormones and the immune system. *Leeman*. 2 cr, 1st sem.

GMS PM 843 Pharmacologic Intervention in Inflammatory Responses Prereq: consent of instructor. Although acute inflammation is a fundamental physiologic response of virtually all-multicellular organisms to infection and injury, unresolved and chronic inflammation can have significant pathophysiologic consequences. This course examines the cellular components, inflammatory mediators and their mechanisms of action, and therapeutic modulation of inflammation. The format includes lectures on inflammatory components of selected diseases and student lead discussions of review and research papers. *Leeman*. 2 cr, 2nd sem.

GMS PM 850 Biochemical Aspects of Neurotransmitters and Chemical Mediators Prereq: consent of instructor. Lectures and discussions on biosynthesis, inactivation, receptors, and signaling mechanisms of neurotransmitters and chemical mediators including GABA, glutamate, acetylcholine, catecholamines, purines, peptides, prostaglandins, and histamines. *TBA*. 2 cr, 2nd sem.

GMS PM 860 Electrophysiology and Pharmacology of the Synapse Prereq: GMS PM 700, MS 703, PH 742, or consent of instructor. Examines electrophysiologic, pharmacologic, and opti-

cal studies of transmission at central synapses. Lectures and discussions based on research publications will cover basic and more novel concepts in synaptic transmission. Emphasis will be placed on critical evaluation of journal articles and on scientific writing skills. *TBA*. 2 cr, 2nd sem.

GMS PM 880 Gene Regulation and Pharmacology Prereq: consent of instructor. Focuses on fundamental aspects of gene control with emphasis on the dual role of RNA as both an informational and a catalytic molecule. Topics range from discussions of gene transcription and RNA splicing, to discussions of ribozymes as therapeutic agents. The relevance of these topics to the understanding, and potential treatment, of disorders that result from altered patterns of gene expression is stressed. *TBA*. 2 cr, 1st sem.

GMS PM 881 Drug Discovery and Development Prereq: consent of instructor. This course will address the discovery and development process for small molecule and protein drug products. Topics will include target identification and validation, lead optimization and selection of drug candidates for clinical testing, and the objectives and design of clinical trials. *Farb and Walsh*. 2 cr, 2nd sem.

GMS PM 892 Molecular and Neural Bases of Learning Behaviors Prereq: consent of instructor. Lectures and student presentations on literature in learning and memory research with special emphasis on integrated approaches from molecular, genetic, pharmacological levels to circuitry, systems, computational, and behavioral levels. *Tsien*. 2 cr, 2nd sem.

GMS PM 931, 932 Research in Pharmacology var cr.

Physiology

GMS PH 730 Human Physiology A Prereq: consent of instructor. Cellular and organ physiology. Lectures and discussions examine the function of nerves, muscles, blood and the cardiovascular and digestive systems. Emphasis is placed on the regulation of organ function and on integrative aspects of human physiology. *Garcia-Diaz, staff.* 4 cr, 1st sem.

GMS PH 731 Human Physiology B Prereq: GMS PH 730 or consent of instructor. Lectures, laboratories and discussions examine function and regulation of the respiratory and renal systems with emphasis on integrative aspects. *Garcia-Diaz, staff.* 2 cr, 2nd sem.

GMS PH 740 (MED MS 134) Medical Physiology This course covers transport mechanisms, muscle function and the function and regulation of the cardiovascular, gastrointestinal, respiratory and renal systems, with emphasis on integrative aspects. We use a lecture format, a few laboratory sessions and numerous small group discussions of problems and clinical cases that encourage conceptual understanding of course material. *Saide, staff.* 6 cr, 2nd sem.

GMS PH 741 Experimental Methods in Physiology I Prereq: consent of instructor. Current research methods in cellular and molecular physiology, as applied to the study of macromolecular function, motility, ligand binding phenomena, and membrane function. Develops problem-solving skills and awareness of current approaches to research problems. *Staff.* 2 cr, 1st sem.

GMS PH 742 Experimental Methods in Physiology II Prereq: consent of instructor. A practical approach to electrophysiology techniques. *Garcia-Diaz, staff.* 2 cr, 2nd sem.

GMS PH 745, 746 Special Topics in Physiology Prereq: consent of instructor. Current and classical papers in a given area of physiology are assigned for

reading and later discussion with students. Topics include mechanics of muscle, cell motility, membrane transport, sensory physiology, and instrumentation in physiological research. *TBA.* Var cr, 1st & 2nd sem.

GMS PH 748 (MED MS 128) Endocrinology Prereq: biochemistry or physiology, and consent of instructor. This is an integrated treatment of human endocrinology: biosynthesis of hormones, regulation, receptor interactions, and physiological effects. The course is presented in lecture format and in small group discussion sessions where clinical cases are used to exemplify the mechanisms of endocrine function. *Head.* 2 cr, 2nd sem.

GMS PH 841, 842 Physiology Seminar Students present seminars on their research and/or review literature related to their research. Students attend the seminars presented by staff and other students. *Levy, staff.* 2 cr each, 1st & 2nd sem.

GMS PH 843, 844 Cellular Physiology I and II Prereq: consent of instructor. Lectures and discussion on: (1) membrane transport, thermodynamic and kinetic analysis; (2) electrophysiology of cell membranes, excitable membrane properties, electrical coupling, synaptic transmission; and (3) cell motility, molecular mechanism, and regulation of contraction of muscle and other cells; mechanisms of transduction of photoreceptors. *Garcia-Diaz, staff.* 4 cr, 1st & 2nd sem.

GMS PH 750 Endocrinology Prereq: biochemistry or physiology, and consent of instructor. This is an integrated treatment of human endocrinology: biosynthesis of hormones, regulation, receptor interactions, and physiological effects. The course is presented in lecture format and in small group discussion sessions where clinical cases are used to exemplify the mechanisms of endocrine function. *Head.* 2 cr, 2nd sem.

GMS PH 941, 942 Research Physiology Variable cr.