DGP 401-0 Biochemistry I (1 Unit)
Structures and properties of proteins, nucleic acids, and polymers, complex and simple carbohydrates, and lipids; thermodynamic principles applied to biologic systems; molecules; structural correlates and functional expressions.

DGP 403-0 Advanced Immunology (1 Unit)
Topics in immunology. Discussion of current experimental papers.

DGP 405-0 Cell Biology (1 Unit)
Structure and function of cells and their organelles. Morphological, molecular, and physiological approaches to solving cell-biological problems.

DGP 410-0 Molecular Biology (1 Unit)
Topics in molecular biology and the mechanisms of gene and cellular regulation.
Prerequisites: Past or simultaneous enrollment in IGP 401-0 or equivalent.

DGP 420-0 Introduction to Pharmacology (1 Unit)
This lecture-based course begins with an introduction to the basic principles of pharmacology, namely pharmacodynamics (what the drug does to the body) and pharmacokinetics (what the body does to the drug). The subsequent topics apply these basic pharmacological principles to a discussion of the normal physiology, the pathophysiological processes that produce disease, and the targeted pharmacological treatment of disease. This integrated physiological, pharmacological and clinical approach will be applied to the following global topics in sequence: Neuropharmacology (Peripheral and Central Nervous Systems), Antimicrobial and Anticancer Chemotherapy, Cardiovascular and Renal Physiology and Pharmacology, Endocrine and Immunopharmacology.

DGP 422-0 Introduction to Translational Research (1 Unit)
This course is intended to introduce basic life sciences and clinical research graduate students to the thought processes involved in human disease research and its translation into therapy by providing an overview of disease processes, how they are treated, how basic biological science is used to develop those treatments, and the role of various stakeholders in the translational research pipeline. At the end of the course the student should understand the medical rationale for studying basic pathomechanisms and how to utilize that rationale to design studies and grant proposals. In addition, the student will obtain background knowledge for further, disease- or organ-specific upper-level courses.

DGP 425-0 Topics in Drug Discovery (1 Unit)
Key precedents and contemporary topics in drug discovery research in academia and industry. Principles of drug design and action, pharmacogenetics, macromolecular target identification and characterization, bioassays and animal models of disease, study design and information management.

DGP 430-0 Genetics (1 Unit)
Genetics of prokaryotic and eukaryotic organisms; gene regulation and variation; chromosome structure and behavior; linkage and recombination; quantitative and population genetics; biochemical and developmental genetics; and manipulation of genes in organisms, including humans.

DGP 433-0 Advanced Microbial Pathogenesis (1 Unit)
Properties of microorganisms important in the pathogenesis genesis of infectious diseases. Emphasis on molecular aspects of virulence as they relate to host-parasite interactions.

DGP 435-0 Signal transduction and human diseases (1 Unit)
Integrated discussion of different superfamilies of signaling receptors and their effectors. Pathways discussed include G-protein linked, growth factors and cytokines, nuclear receptors and transcription factors.

DGP 436-1 Drugs and the Brain (1 Unit)
Graduate neuropharmacology course with a mix of didactic instruction (33%) and in-depth classroom discussion of primary research papers (66%). The course is not a survey course, but rather will cover selected topics in neuropharmacology with the goals of 1) informing the student of the latest neuropharmacology knowledge, 2) inculcating a rigorous approach to examination of the scientific literature, and 3) encouraging best practices in experimental design.

DGP 440-0 Immunology (1 Unit)
An integrated view of contemporary immunology: antigens, antibodies, humoral and cell-mediated immune responses, cellular interactions, and regulation of immune responses.

DGP 442-0 Microbiology (1 Unit)
Structure and function, taxonomy and replication of infectious agents. Host-parasite interactions and microbial diseases.
Prerequisites: IGP 405-0, IGP 410-0, and IGP 401-0 or equivalent.

DGP 450-0 Tumor Cell Biology (1 Unit)
Basic aspects of the neoplastic phenotype, including morphologic, biochemical, genetic, cytogenetic, and other features; regulation of cell proliferation and differentiation; basic concepts in molecular mechanisms of chemical, viral, and radiation carcinogenesis; solid tumor growth, progression, and metastasis; tumor immunology.

DGP 456-0 Topics in Developmental Biology (1 Unit)

DGP 460-0 Pharmacovigilance in Early Drug Development (1 Unit)
Pharmacovigilance is the science dealing with the collection, assessment, monitoring, and prevention of adverse effects of drugs and pharmaceutical products and is a fast-growing area in industry, health sciences, and in regulatory agencies. The course will address the fundamentals of pharmacovigilance especially in the context of early drug development. Topics covered will include causality assessment and management of drug safety during drug discovery, benefit-risk analysis, signal management, and product safety monitoring in clinical trials. Students will learn about how to monitor, recognize, and manage adverse drug reactions, medication errors, issues related to misuse and abuse of drugs, as well as drug safety during pregnancy and pediatric populations. The lectures will be given by experts in the field affiliated with Northwestern University and Abbvie, Inc. A key aspect of the course will include Case studies, which will discuss real published data on assessment of a specific drug or pharmaceutical products. Upon completion of this course, graduate students will demonstrate an understanding of pharmacovigilance and patient safety in the context of early drug development.

DGP 466-0 Structural Basis of Signal Transduction (1 Unit)
The structural and thermodynamic basis by which protein-protein or protein-nucleic acid interactions mediate signal transduction. Signaling pathways used to explore how the structural biological mechanisms underlying these pathways can be experimentally determined and understood.
DGP 475-0 Virology (1 Unit)
Mechanisms of genome replication, control of gene expression, and protein functions are analyzed in RNA and DNA viruses.

DGP 480-0 Molecular Mechanisms of Carcinogenesis (1 Unit)
Current literature relating experimental approaches and recent discoveries in the fields of cell biology, virology, and molecular genetics to mechanisms of carcinogenesis. Advanced level.

DGP 484-0 Quantitative Biology: Statistics and Data Analysis for Life Scientists (1 Unit)
Parametric statistics (such as the familiar t test); nonparametric and simulation approaches (such as permutation tests) better suited to "real" data; and a conceptual survey of more sophisticated data-mining/machine-learning techniques.

DGP 485-0 Data Science For Biomedical Researchers (1 Unit)
Introduction to the data and analysis tools from several areas of study within the Biomedical Informatics research spectrum. Didactic instruction as an introduction to the topics followed by hands-on demonstrations and exercises to reveal practical use of relevant software tools.

DGP 486-0 Advance Bioinformatics and Genome Informatics (1 Unit)
The course will be oriented towards graduate students in HSIP, DGP and related programs. It will consist of lectures/seminars, each two hours in duration. The course will introduce various high-throughput technologies, such as microarray and Next Generation Sequence data, for measuring and analyzing gene expression, chromosomal deletions and amplifications, methylation patterns and genome architecture. Further, various algorithms and bioinformatics tools for analyzing the produced high-dimensional data will be discussed. The course begins with couple of introductory lectures in the biology part (Experimental/Technology part - 2 hours duration - no laboratory) followed by presentations on algorithms and data analysis (Bioinformatics part - 2 hours duration). Finally some recently published articles using these technologies will be discussed. At the end of the course, the students will be expected to gain an overview of the current highthroughput technologies and use of associated bioinformatics algorithms and analytical methods. Students will gain experience in genomic data visualization tools to analyze multi-omics data for gene expression, genome rearrangement, somatic mutations and copy number variation. The course will conclude with analyzing and conducting pathway analysis on the resultant cancer gene lists and integration of clinical data.

DGP 493-0 Molecular Basis of Natural History (0 Unit)
The molecular basis of natural history course will examine important examples from Nature and use the approaches of biochemistry, molecular biology and genetics to categorize and analyze the natural products produced by bacteria, plants and animals and examine how they have impacted human history. Most 2 hour sessions will be devoted to a particular topic. After an introduction by faculty, course participants will examine the subject further through the discussion of assigned papers from the literature or other texts. Some sessions will also be devoted solely to presentations of topics by the students. All students will submit and essay on a topic covered by the course or a related topic in natural history.

DGP 494-0 Colloquium on Integrity in Biomedical Research (0 Unit)
Required by National Institutes of Health (NIH) but does not count as one of the required IGP courses.

DGP 495-0 Science and Society (0 Unit)
Exploration of the foundations of modern science and discussion of how these ideas impact social issues in the biomedical sciences (creationism, abortion, euthanasia, eugenics, cryogenics, replacement therapies, animal rights).