JD/MS in Biochemistry Dual Degree Proposal

This document contains a proposal for a dual degree between the Department of Biochemistry (MS degree) and the School of Law (JD degree).

Justification

Intellectual property is an area of tremendous growth and importance for both law and the sciences. For example, a survey of 272 senior executives in the pharmaceutical, biotechnology, and medical product industries found: "the development and protection of intellectual property is seen as the most critical area, as nearly all the senior executives surveyed identified an urgent need to address issues such as protecting proprietary research, valuing intellectual property, and extending patent protection."[1] Within intellectual property, biotechnology is one of the most important fields. The Biotechnology Industry Organization, the leading biotech trade group, has argued that

> "Intellectual property protection is the key factor for economic growth and advancement in the high technology sector. Patents add value to laboratory discoveries and in doing so provide incentives for private sector investment into biotechnology development. The Biotechnology Industry Organization advocates a strong and effective intellectual property system. For over 200 years the carefully crafted intellectual property laws have been the driving force for innovation and progress in the United States. The U.S. patent system fosters the development of new products and discoveries, new uses for old products and employment opportunities for millions of Americans. Nowhere is this more apparent than in the biotechnology arena. The biotechnology industry did not exist prior to the landmark Supreme Court decision of Diamond v. Chakrabarty in 1980, where the court held that anything made by the hand of man was eligible for patenting. Since this decision, the biotechnology industry has flourished and continues to grow. Strong intellectual property protection is essential to the success, and in some instances to the survival, of the over 1200 biotechnology companies in this country. For these companies, the patent system serves to encourage development of new medicines and diagnostics for treatment and monitoring intractable diseases, and agricultural products to meet global needs."[2]

Because of the importance of these issues, the School of Law has recently expanded its offerings in intellectual property, including establishing the Center for Law, Technology & the Arts (LTA). One of the principal goals of the Center for LTA is to establish an interdisciplinary relationship with the College of Arts and Sciences. The prospect of a dual MS degree is consistent with this goal, particularly in the fields of

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[1] Drug *Development: Intellectual Property and Patent Protection are New Concerns*, Biotech Wk., May 16, 2001, at 10, 10.

[2] *See* http://www.bio.org/ip/background.asp.

biology and biochemistry. It is difficult to overstate the importance of intellectual property to biotechnological innovation and to the biotech industry.

With this understanding in mind, the Center for LTA offers numerous courses related to intellectual property and law and technology, including a course devoted solely to the study of biotechnology law and policy. Students pursuing a graduate degree in biology or biochemistry will enrich the Center for LTA experience immensely and, in turn, these students will benefit by having the opportunity to apply their advanced knowledge to some of the most important legal issues facing the intellectual property and biotech communities today.

Students interested in careers in this area need a combination of legal skills and scientific skills. Drafting patent applications for biotechnology innovations, for example, often requires more sophisticated understanding of biology and biochemistry than would be possible for someone with only an undergraduate background in the sciences.

We anticipate that this joint degree program could draw students to both the School of Law and the Department of Biochemistry, especially because to the best of our knowledge, no such programs are currently offered at any of the schools of higher learning in Ohio, and only a handful nationwide.

JD Curriculum and Structure

The School of Law requires 88 credit hours of course work, including 41 hours of required courses and an upper class writing requirement, for the JD degree. All but four of these required courses are completed during the first year of the law program, which currently includes LAWS 104 Civil Procedure (4 cr.); LAWS 103 Constitutional Law (4 cr.); LAWS 123 Contracts (4 cr.); LAWS 131 Criminal Law (4 cr.); LAWS 144 Property (4 cr.); LAWS 8101 Core Lawyering Skills I and II (5 cr.); LAWS 132 Torts (4 cr.); and an elective from an approved list of perspective courses (3 cr.). In addition to the 32 credits of first year courses, JD students must complete Core Lawyering Skills III and IV (4 cr.) an upper class writing requirement (through participation in the Case Western Reserve University Law Review, Health Matrix or Journal of International Law, completion of a supervised research project, or completion of an approved writing requirement course) (at least 2 cr.). They must also complete LAWS 375 Professional Responsibility (3 cr.), typically during their second year of law studies. JD students are allowed, but not required, to take up to 9 credit hours of graduate level electives outside the law school for credit toward the law degree.

Biochemistry Curriculum and Structure

The Master's degree program in Biochemistry requires: 17 credits of BIOC lecture courses + 1 credit of exam. These are: BIOC 407 (4); 408 (4); 434 (3); 412 (3); approved electives (3); 600 (exam)(1). In addition, the MS program requires 18 credits of approved electives in Biomedical Science - related courses, including BIOC 601, Biochemical Research. In the dual degree program, 9 credits of approved LAWS

electives dealing with Law and Science or Medicine (see Appendix A) would be included within the 18 credits of electives. These courses would be approved by the Biochemistry advisor assigned to each student. For examples of appropriate Biochemistry courses see Appendix B.

Dual Degree Curriculum:

Students would have to begin in the School of Law. For the Biochemistry MS degree, students would have two options:

1) Research oriented MS

Year 1: First year law school curriculum. (32 hours)

	Semester 1		Semester 2	
Year 2.	BIOC 407	(4)	BIOC 408	(4)
	BIOC 434	(3)	BIOC 412	(3)
	BIOC 601	(2)	BIOC 601	(2)
	LAWS el.	(3)	LAWS el.	(3)
Year 3	BIOC 601	(2)	BIOC 601	(3)
	LAWS	(12)	LAWS	(12)
Year 4	BIOC elective	(3)	BIOC 600	(1)
	LAWS el.	(3)	LAWS	(9)
	LAWS	(2)		

Alternatively, up to 6 credits of BIOC 601 could be taken during each of the summers after the second or third years (up to a maximum of 12 credits), freeing up time during the regular semesters.

2) Course work oriented

Year 1: Law School 1L curriculum (32 hours)

	Semester 1		Semester 2	
Year 2.	BIOC 407	(4)	BIOC 408	(4)
	BIOC 434	(3)	BIOC 412	(3)
	Appr. BIOC el.	(3)	Appr. BIOC el.	(3)
			LAWS	(2)
Year 3	LAWS el.	(3)	LAWS el.	(3)
	LAWS	(9)	LAWS	(9)

Year 4	BIOC elec.	(3)	BIOC elec.	(3)
	LAWS	(6)	LAWS	(9)
	LAWS el.	(3)	BIOC 600	(1)

Years 3 & 4 include completing the upper class legal writing requirement and LAWS 375 Professional Responsibility in the School of Law.

Successful completion of the program would require 103 credits:

Total Hours in the School of Law:	76
Total Hours in the Department of Biochemistry:	27
Total Hours in the Dual Degree Program:	103

As a result of participating in the dual degree program, students would complete 12 fewer hours of law school course work than they would if they were in the JD program alone. However, since law students are allowed to take up to 9 credits of graduate course work outside the law school, this represents only a 3-credit decrease in the amount of law course work. The Department of Biochemistry proposes accepting 9 hours of law school classwork in courses dealing with science issues, in place of 9 credits of other elective work.

Dual Degree Student Advising

Dual degree students are advised concerning matters related to the JD degree by the Associate Dean for Academic Affairs at the School of Law. In addition, dual degree students are granted priority registration for upper class courses, ensuring that they will be able to accommodate their scheduling needs in obtaining needed classes. Dual degree students are advised concerning matters related to the MS in Biochemistry by a JD/MS Advisor as designated by the Graduate Education Committee of the Department of Biochemistry.

By regulations of the School of graduate Studies, Master's students should maintain a GPA of 2.75 or greater; this will be applied to the combined GPA for Biochemistry or approved Biochemistry elective courses. The School of Law requires a GPA of at least 2.0; this will apply to all courses (in the aggregate) taken towards the JD degree. On a biannual basis, immediately after the end of the fall and spring semesters, or more frequently if necessary, the Associate Dean for Academic Affairs at the School of Law and the JD/MS Advisor of the Department of Biochemistry will meet to discuss the progress of all students in the program. Students performing unsatisfactorily in the JD or the MS components of the program or both, will be given warning that they will have one semester to show substantial improvement. If not they will be dismissed from the component(s) in which they are performing poorly.

Admissions

Target enrollment in the program is eight or more students, achieved by admission of at least two students annually. Students wishing to enroll in the dual degree program initially apply to and are admitted into each program separately. Once the

program is up and running, students will be able to submit a joint application to the School of Law, which will forward materials of students who are admissible to that program, to the Department of Biochemistry for their consideration. Students admitted to the program will consult with the Associate Dean for Academic Affairs at the School of Law and the JD/MS Advisor of the Department of Biochemistry to determine their appropriate program of study.

Tuition Revenue Mechanics: A written agreement about the management of tuition revenues will exist between the School of Law and the Department of Biochemistry. The text of this agreement is shown below:

Agreement between the Department of Biochemistry in the School of Medicine and the School of Law.

Students who are enrolled in the JD/MS dual degree program receive a Degree of Juris Doctor and a Master's Degree in Biochemistry upon completion of the program. The students in this program will register and pay tuition through the School of Law at that school's current rate. The tuition revenue for these dual degree students will be shared by both schools, as follows:

The number of credit hours being taken at each school will be divided by the total number of credit hours taken to derive the percent of tuition to which each school is entitled. This computation will be done on a per student per semester basis. These percentages will be applied to the net tuition* collected from each dual degree student for the corresponding semester. The School of Law will then transfer the appropriate tuition revenue to the Department of Biochemistry through a journal entry.

EXAMPLE

	Law School	Biochemistry Department	Total
John Doe - Credit Hours	5	7.5	12.5
- % of Revenue	40%	60%	100%
- Distribution of Tuition	$4,410	$6,616	$11,026

Note: Tuition used in the example is the going rate for a law student in Fall 2004 semester.
($14,100 gross tuition - $2,820 (20% of $14,100) - $254 university skim = $11,026 tuition to be distributed)

*Net tuition = gross tuition less scholarship rate (20% of gross) less university "skim".

Approval Signatures:

Dean, School of Law *Gerald Korngold*	X
Chair, Department of Biochemistry	

Michael A. Weiss	X
Dean, Graduate Studies *Lenore A. Kola*	X

Student Activities: Both the Dean for Academic Affairs of the School of Law and the JD/MS advisor of the Department of Biochemistry will regularly contact students in the program by e-mail with information about activities and to verify proper progress.

Students are encouraged to participate in regular School of Law and Department of Biochemistry activities as well as those targeted to them. Under direction of the Associate Dean for Academic Affairs of the School of Law, all JD students enrolled in dual degree programs (except for the JD/MBA program which will be treated separately) will meet bi-annually in a colloquium retreat (approximately one-half day in length). The purposes of the retreat are (1) to ensure the programs are meeting the expectations of the students and the faculty in charge, (2) to capture the benefits of the interdisciplinary experience, (3) to socialize the dual degree students as a group, instead of small groups of isolated students, and (4) to explore the intellectual and professional challenges of doing interdisciplinary work.

In addition, prior to registration, the Associate Dean of the School of Law meets with each dual degree student to review their schedule and to explore any other issues on which they need guidance and advice. All new students will be partnered with an experienced student to address questions the students may have about the program and life as a graduate student at Case. These students will initially be drawn from the ranks of School of Law and Biochemistry students, but when the program is up and running, from advanced JD/MS Biochemistry students. A get-acquainted dinner will be organized during registration week in the fall to facilitate this process.

To fulfill the J.D. degree portion of the dual degree program, students will focus their capstone writing requirement on the subject of their work in the Department of Biochemistry. The JD/MS Advisor from that department will serve as a co-supervisor of this research.

For the Department of Biochemistry, bimonthly luncheon discussions and seminars will be scheduled and moderated by the JD/MS Advisor to discuss papers from the current literature that focus on recent breakthroughs in biotechnology as well as other topics, as requested by the students. Other appropriate activities include attending the weekly Departmental Seminar and Student Seminars, as well as annual named lectureships, participating in annual retreats, and one or more journal clubs. Additional events include general Department of Biochemistry picnics and the Annual Holiday Party in December.

Advantages of the Joint Degree Program

There are several advantages to the students in the JD/MS program. The key advantage will be the integration of the two disciplines during the time of the students receive their training, thus allowing the students to develop a unique focus on their studies in each of

the two disciplines. In addition, our Master's of Science in Biochemistry is a two year program but the students in the joint degree program will be able to complete the program requirements in just 12 months beyond the time required for obtaining the JD degree.

Appendix A

School of Law courses and electives for JD/MS program.
Please note that this list is not all-inclusive.

L0430 Biotechnology Law & Policy (Spring) (2-credits) (Pre-req: Patent Law)
Profs: Jones, Kovach & Szczepaniak

This course is designed to expose the law student and graduate student in science or business to the legal, business, and policy issues relevant to the biotechnology industry. We will cover issues related to patents, corporate organization and financing (particularly venture capital as it relates to the Start-Up Biotech Company), licensing and other transactions, regulatory issues relevant to the Food and Drug Administration, university technology transfer, and academic conflicts of interest.

L3900 Intellectual Property Survey (Spring First-Year Elective) (3-credits)
Prof: Nard

This course is designed to provide students with an overview of several areas of law traditionally associated with intellectual property or IP, including copyright law, which pertains to the protection of literary, musical, and artistic creations and has issues replete with First Amendment implications; patent law and trade secret law, which focus on the protection of technological works ranging from chemical formulae, to software, to biotechnology; and trademark law, which relates to the goodwill associated with corporate identity and product recognition. We will also devote time to the study of the philosophy and economics of intellectual property keeping in mind, throughout the course, the need to strike an optimal balance between incentives to create and commercialize intellectual creations on the one hand and public access to these creations on the other hand.

L0320 Intellectual Property Theory (Spring) (3-credits) (Pre-req: IP Survey OR Patent Law OR Copyright Law) (Seminar)
Prof: Nard

This course is the study of the philosophy of intellectual property. We will explore and ask several questions such as: Should one=s intellectual product be entitled to protection? What are the reasons for granting or denying protection? What form, if any, should this protection take? What are the costs and benefits to society of protecting one=s intellectual product?

L0850 Intellectual Property Transactions (Fall) (Co-reqs: BA)
Profs: Shirali

This course will study how a hypothetical Internet company implements its business strategy, protects its intellectual property assets, and enters into a variety of agreements, including with strategic business partners, content providers, vendors, and

licensees. As part of the course, we, as a class, will do such things as select a company name and protect it, draft and negotiate agreements, and hold a mock negotiation at the end of the semester.

L5610 International Intellectual Property (Spring) (3-credits)
Prof: Gerhart

This course considers the evolving system by which international intellectual property laws are structured, with an emphasis on the role of intellectual property in development and the effect of international intellectual property on developing countries. Of special interest is the process that drives and shapes international intellectual property law, the dynamics of that process, and the interplay between national interests, international institutions, and concepts of global efficiency and justice. Particular topics include theories of development and the relationship between technology and development, the effects of the TRIPS treaty of the WTO on development and the freedom of developing countries to shape their intellectual property systems under TRIPS, controversies about patent protection and public health, especially the AIDS crisis, the protection of agriculture and genetic resources, the protection of traditional knowledge and culture, plugging developing countries into the digital world and reducing the digital divide, and theories about what induces nations to comply with their international obligations.

The course omits a number of intellectual property topics that might be found in an international intellectual property course, including comparative aspects of intellectual property laws in developed countries, current controversies between national IP systems about, for example, the patenting of software or life forms or the protection of data bases, the intellectual property systems of the European Union and Japan, and processes for securing intellectual property rights in other countries.

L2290 Patent Law (Fall) (3-credits)
Prof: Nard

This course, designed for students schooled in all disciplines, including the humanities, will endeavor to introduce the student to the law and policy of the United States patent system. We begin with a discussion of the origins and theoretical underpinnings of the patent system followed by a look at the composition of an issued patent and the procedural mechanism for obtaining patent rights. We proceed with a detailed examination of the substantive requirements of patentability, including the disclosure requirements, novelty, nonobviousness, utility, and subject matter. Thereafter, we explore the issues associated with enforcing a patent, including the scope of a patent owner's rights, and the common defenses to a patent infringement suit. We close with a discussion of remedies available to the patent owner; and, if time permits, we will briefly cover the basics of trade secret law.

L0330 Intellectual Property & Indigenous Peoples (Fall) (3-credits) (IP Survey or Patent Law or Copyright Law) (Seminar)
Prof: Arewa

This course will explore the current mechanisms for protecting intellectual property and an examination of how such mechanisms apply with respect to traditional and indigenous knowledge, including knowledge associated with cultural expression, indigenous flora and fauna, genetic resources, and medicines. We will also discuss explicit and implicit conceptions of authorship and ownership that are embodied in intellectual property rules as well as issues associated with "biopiracy" and the need for a formalized compensatory mechanism related to the foreign commercial exploitation of indigenous peoples' knowledge.

L2000 Patent Litigation (Spring) (3-credits) (Pre-req: Patent Law)
Prof: O'Malley

This course will begin with an overview of a patent litigation case and then proceed to discuss issues relating to pre-litigation strategy, the various types of infringement, invalidity defenses, and patent claim construction in the context of a mock *Markman* hearing. Thereafter, the course will explore the drafting of a complaint and the answer thereto, including counterclaims; drafting discovery documents; preparing witnesses; and taking and defending a deposition, which will take place in the context of a mock deposition. The course will also discuss pre-trial motions and the issues that pertain to a trial, including the roles of judge and jury, jury instructions, direct and cross-examination, jury selection, and post-trial motions.

L2630 Patent Prosecution (Spring) (2-credits) (Pre-req: Patent Law)
Prof: D'Aurelio

The course is intended to give students a basic introduction to patent prosecution. This is accomplished by covering 3 main topics. First, students will learn how an invention is defined. This is accomplished by reviewing relevant case law and having students perform one or more tasks such as performing an on-line patentability search for a hypothetical invention, drafting an invention disclosure, and/or drafting a patentability opinion based upon a hypothetical invention and related prior art. The second topic will involve drafting a patent application on a simple hypothetical invention. Before the drafting takes place, the class will cover relevant case law. Also, nonlegal, practical aspects such as organization, various grammatical concerns, and other concepts related to patent drafting will be covered. Ultimately, students will take the information provided in the class and draft an actual patent application based upon a simple hypothetical invention. Finally, the third topic will involve responding to an Office Action rejecting the patent application as is typically encountered during the practice before the US Patent and Trademark Office. The class will cover case law that relates to various issues encountered in the rejection of patent claims during the prosecution process. Students

will then be given a set of claims relating to the invention for which they drafted a patent application and an Office Action rejecting those claims. Based upon the case law covered in class, students will generate a response to the Office Action to overcome the rejection and achieve allowable claims.

L2590 Representing the Start-Up Technology Company (Fall) (3-credits)
Prof: Arewa

This course provides students with an understanding of issues associated with the formation, structuring, and financing of start-up technology companies. We will explore (1) *formation* issues relating to choice of state, entity name, marketing strategies, service providers and business goals and strategies; (2) *structuring* issues relating to tax, intellectual property, capitalization, human resources, and labor relations; and (3) *financing* issues relating to venture capital, angel networks, and securities law considerations.

Intellectual Property Entrepreneurship Clinic (Spring) (3-credits)
Professor Shirali

This clinic is to be taken in conjunction with the course on "Engineering Entrepreneurship" offered at the Weatherhead School of Management. "Engineering Entrepreneurship" is a two-semester course that focuses on entrepreneurship in a technology-based setting, whereby several teams of engineering students study the entrepreneurial process, how to write and present a business plan, innovation processes within an organization, strategic alliances, and idea generation and the creative process. In the IP Entrepreneurship Clinic, it is the role of the law student, acting in teams of two, to serve as legal counsel to each of the aforementioned engineering teams. Each legal team is expected to advise their respective team members on a variety of legal issues pertaining to, among other things, intellectual property protection, corporate structure and financing, and various transactional concerns that arise in an entrepreneurial/technology-based setting.

Appendix B

Department of Biochemistry courses and electives for JD/MS program.
Please note: that this list is not all-inclusive.

BIOC 407: Introductory Biochemistry (4 credits): Overview of the macromolecules and small molecules key to all living systems. Topics include: protein structure and function; enzyme mechanisms, kinetics and regulation; membrane structure and function; bioenergetics; hormone action; intermediary metabolism, including pathways and regulation of carbohydrate, lipid, amino acid, and nucleotide biosynthesis and breakdown.

BIOC 408: Molecular Biology: Genes and Genetic Engineering (4 credits): An examination of the flow of genetic information from DNA to RNA to protein. Topics include: nucleic acid structure; mechanisms and control of DNA, RNA, and protein biosynthesis; recombinant DNA; and mRNA processing and modification. Where possible, eukaryotic and prokaryotic systems are compared. Special topics include yeast as a model organism, molecular biology of cancer, and molecular biology of development. Current literature is discussed briefly as an introduction to techniques of genetic engineering.

BIOC 420. Molecular Genetics of Cancer (3 credits)**:** Using a combination of lectures and student presentations, this course provides an in-depth analysis of cancer as a genetic disease in the Mendelian sense of inheritance and in the sense of causation by somatic mutation. The objectives of the course are to examine both the proto-oncogenes and tumor suppressor genes that are the targets of oncogenic mutations and the mechanisms of mutational change. Discussions emphasize experimental approaches used to identify and study oncogenes and tumor suppressor genes. This course also covers viral mechanisms of oncogenesis which involve interactions between viral proteins and the products of cellular proto-oncogenes or tumor suppressor genes.

BIOC 434: Proteins and Enzymes (3 credits): A detailed consideration of the structure and function of proteins and enzymes. Topics include: enzyme structure, kinetics, and mechanisms; structural biology of proteins and protein-DNA complexes; and techniques for structural analysis.

BIOC 412: Introduction to Physical Biochemistry (3 credits): Interactions between biomolecules are discussed in a system-based approach that stresses quantitative and structural characterization. Topics discussed include site-directed mutagenesis of enzymes, DNA-protein and protein-protein interactions (protein-ligand interactions, with emphasis on protein – nucleic acid interactions).

BIOC 430: Advanced Methods in Structural Biology I (3 credits): An in-depth introduction to biophysical techniques used to quantify macromolecular structures. A major part of the course will deal with the use of nuclear magnetic resonance to derive a 3-D structures of macromolecules in solution. Other topics include electron spin

resonance, absorption, fluorescence and circular dichroism spectroscopies, Raman and infrared spectroscopies and methods used in modeling.

BIOC 431: Advanced Methods in Structural Biology II (3 credits): This course provides an introduction to biophysical techniques for graduate students who are interested in structural biology and biophysical chemistry. Offered with BIOC 430, "Advanced Structural Biology I" in alternate years. Advanced Methods I (430) focuses on NMR and optical spectroscopies. Advanced Methods II deals with protein hydrodynamics and thermodynamics, crystallography, and mass spectrometry.

BIOC 452. Nutritional Biochemistry and Metabolism (3): Mechanisms of regulation of pathways of intermediary metabolism; amplification of biochemical signals; substrate cycling and use of radioactive and stable isotopes to measure metabolic rates.

BIOC 620: Transcription and Gene Regulation (3 credits): Topics will include Structure of bacterial and eukaryotic RNA polymerases; regulation of transcription initiation; gene-specific eukaryotic transcription factors; promoter clearance; the role of the RNA polymerase II CTD; transcription elongation: pausing and arrest; transcription control in HIV; coupling of transcription and RNA processing.

BIOL 401: Biotechnology Laboratory: Genes and Genetic Engineering (3 credits): Laboratory training in recombinant DNA techniques. Basic microbiology, growth, and manipulation of bacteriophage, bacteria, and yeast. Students isolate and characterize DNA, construct recombinant DNA molecules, and reintroduce them into eukaryotic cells (yeast, plant, animal) to assess their viability and function.

BIOL 402: Principles of Neural Science (3 credits): Lecture/discussion course covering concepts in cell and molecular neuroscience, principles of systems neuroscience as demonstrated in the somatosensory system, and fundamentals of the development of the nervous system. This course will prepare students for upper level Neuroscience courses and is also suitable for students in other programs who desire an understanding of neurosciences.

BIOL 416: Fundamental Immunology (3 credits): Introductory immunology providing an overview of the immune system, including activation, effector mechanisms, and regulation. Topics include antigen-antibody reactions, immunologically important cell surface receptors, antigen processing and presentation, cell-cell interactions, cell-mediated immunity, cytokines, and basic molecular biology of B and T lymphocytes. Lectures emphasize experimental findings leading to the concepts of modern immunology. A term paper is required.

BIOL 443. Advanced Microbiology (3 credits)**:** The physiology, genetics, biochemistry, and diversity of microorganisms. The subject will be approached both as a basic biological science that studies the molecular and biochemical processes of cells and viruses, and as an applied science that examines the involvement of microorganisms in human disease as well as in the workings of ecosystems, plant symbioses, and industrial

processes. The course is divided into four major areas: bacteria, viruses, medical microbiology, and environmental and applied microbiology.

BIOL 473. Introduction to Neurobiology (3 credits)**:** How nervous systems control behavior. Biophysical, biochemical, and molecular biological properties of nerve cells, their organization into circuitry, and their function within networks. Emphasis on quantitative methods for modeling neurons and networks, and on critical analysis of the contemporary technical literature in the neurosciences.

EPBI 408. Public Policy and Aging (3 credits): Overview of aging and the aged. Concepts in the study of public policy. Policies on aging and conditions that they address. The politics of policies on aging. Emergent trends and issues.

EPBI 431. Statistical Methods I (3 credits): Application of statistical techniques with particular emphasis on problems in the biomedical sciences. Basic probability theory, random variables, and distribution functions. Point and interval estimation, regression, and correlation. Problems whose solution involves using packaged statistical programs.

EPBI 432. Statistical Methods II (3 credits): Methods of analysis of variance, regression and analysis of quantitative data. Emphasis on computer solution of problems drawn from the biomedical sciences. Design of experiments, power of tests, and adequacy of models.

NTRN 410. History of Food and Nutrition (3 credits)**:** Investigations of the development of nutrition as a science and interactions with medicine, agriculture, public health and dietetics. Food and technological effects on health.

NTRN 433. Advanced Human Nutrition I (4 credits)**:** Emphasis on reading original research literature in energy, protein and minerals with development of critical evaluation and thinking skills. Prereq: NTRN 201 and CHEM 223 and BIOL 348 or equivalent.

NTRN 434. Advanced Human Nutrition II (3 credits)**:** Emphasis on reading original research literature on vitamins with development of critical evaluation and thinking skills. Prereq: NTRN 433 or consent.

PHRM 413. Molecular and Genomic Pharmacology (3 credits)**:** The primary goal of this seminar style course is the development of a critical approach to the evaluation and design of research in the broad context of the interaction of receptors with endogenous ligands and with drugs and the determination of the polygenetic basis of disease states and interindividual variation in responsiveness to drugs. Lectures and/or journal article presentation will illustrate the application of fundamental principles of chemistry, biochemistry, thermodynamics, genomics, and pharmacology to experimental problem solving. Students and faculty participate as discussion leaders.