NATURAL PRODUCTS SCIENCE (NPS)

NPS 5000. Pharmacognosy. (3 Credits)
Pharmacognosy is the study of natural product compounds that have been used for their medicinal, ecological, chemical and other uses. Concepts in this course will include but are not limited to understanding the source of natural products from the different kingdoms including plants, fungi, bacteria and marine organisms. This course will discuss the scientific disciplines that Pharmacognosy unifies such as Social Sciences as Ethnobotany; Chemistry and Pharmacology such as drug discovery, medicinal properties of natural products; Clinical Pharmacy, Medicine and Toxicology such as bioactivity; and Molecular Biology and Genetics such as the genetic manipulation of organisms and Microorganisms.

NPS 5010. Plant Biochemistry. (3 Credits)
Understanding the fundamentals of molecular mechanisms, genetics and physiology among the plant world. Concepts will include but are not limited to understanding plant biological functions (photosynthesis, energy production), and applications of specialized (secondary) plant metabolites. Exploration of plant derived vitamins, minerals, hormones and their influences in food and animal health.

NPS 5500. Natural Products Seminar I. (1 Credit)
The main objective of this seminar series is to illustrate the past, present, and future of Natural Products Sciences and Research (NPSR). This task will be accomplished by combining weekly readings of milestone scientific papers, as well as inviting known scientists in this area of research for seminars and discussion on the recent development of natural products and drug discovery. This seminar series is designed to educate and disseminate the knowledge of NPSR. This series will include, but is not limited to the following areas of interest: Chemistry of Bioactive Natural Products, Medicinal Chemistry, and/or Pharmaceutical Chemistry and Pharmacognosy.

NPS 6110. Medical Cannabis I - History of Medical Cannabis in the World. (3 Credits)
This course is dedicated to understanding how the Cannabis species influenced world history. This course will prepare students for future courses that will expand on the pharmacology and pharmacotherapy of the plant and its products. Topics will cover anthropology, ethnopharmacology, and pharmacology/toxicology. Students will compare and contrast how different peoples have used cannabis throughout history, including medicinal, recreational, and spiritual uses. Finally, we will cover the impacts that medical cannabis has had on public health. Upon successful completion of this course, students will be able to contextualize the use of cannabis across diverse contexts, and differentiate between the therapeutic and adverse effects of the plant and plant products.
Prerequisites: (NPS 500* or 5000*) and (NPS 501 or 5010).
* May be taken concurrently.

NPS 6120. Medical Cannabis II - Cannabis Science. (3 Credits)
The course is dedicated to understanding the mechanisms by which medical cannabis generates its therapeutic and adverse pharmacologic effects. This course builds upon the historical background introduced in the first course, and prepares students to understand the therapeutic effects of cannabis products in future courses. Topics will cover neurochemistry, neuropharmacology, phytochemistry, and drug delivery. Students will understand how the constituents of the cannabis plant operate on a molecular level. Upon successful completion of this course, students will be able to communicate the mechanisms by which cannabis products produce their therapeutic and adverse effects.
Prerequisites: (NPS 600 or 6110).

NPS 6130. Medical Cannabis III - Clinical Efficacy of Cannabis. (3 Credits)
This course is dedicated to understanding the clinical evidence behind the therapeutic and adverse effects of medical cannabis products. This course builds upon the pharmacologic basis introduced in the second course, and prepares students to critically evaluate the literature in the fourth course. Topics will cover pharmacotherapy and clinical pharmacology of medical cannabis products in: stress and anxiety; neurologic disorders and epilepsy; pain and inflammation; cancer and chemotherapy; nausea and vomiting. Upon successful completion of this course, students will be able to communicate the clinical evidence surrounding the medical use of cannabis products.
Prerequisites: (NPS 602 or 6120).

NPS 6140. Medical Cannabis IV - Cannabis in the Interprofessional Setting. (3 Credits)
This course is dedicated to critically evaluating the literature surrounding the use of medical cannabis in various settings. This course applies the history, science, and clinical efficacy background gained in the previous courses toward case studies dealing with medical cannabis products. We will discuss issues relevant to pharmacy, medicine/PA, dentistry, and nursing fields. Guest speakers from the respective fields will be invited to provide their expertise to the discussion. This course will include an active learning component that will encourage students to work together to solve problems. Upon successful completion of this course, students will be able to work with stakeholders from various disciplines to evaluate cases concerning medical cannabis products.
Prerequisites: (NPS 604 or 6130).

NPS 6210. Nutraceuticals I. (3 Credits)
This course provides and introduction into nutraceuticals, their classification and scope. Students will be introduced to the various classifications of nutraceuticals and compare them to drug and biologic classifications. We will then delve into the phytochemical (i.e. bioactive component) of nutraceuticals and their role in health while highlighting the most popular therapeutic areas where nutraceuticals provide the most health benefits. Students will be introduced to multiple examples of nutraceuticals being sold on the market and the pharmacological mechanism of action of the bioactive component that results in health benefits. Although nutraceuticals provide numerous health benefits, safety and toxicity are important considerations which will be discussed in this course.
Prerequisites: (NPS 500 or 5000) and (NPS 501 or 5010).

NPS 6220. Nutraceuticals II. (3 Credits)
This course will focus on discovery and development strategies and consideration for nutraceuticals development. The course will provide students an overview of the processes involved in progressing a nutraceutical from an idea to market. Students will consider what they learned in pharmacognosy, plant biochemistry and nutraceuticals I courses, apply that knowledge in discovery strategies while building upon that knowledge to include development and manufacturing strategies that will allow for successful market sustainability and safety of nutraceuticals. In this course, students will learn about good manufacturing practices (GMP), Good laboratory practices (GLP), SOPs /Good Documentation practices, Quality Assurance and Quality Control (QC) to ensure consistency and safety of nutraceuticals. We will also highlight the role of regulatory agencies around the world with an emphasis on US regulatory agency in nutraceutical development and commercialization.
Prerequisites: (NPS 620 or 6210).

NPS 6230. Nutraceuticals III. (3 Credits)
Building upon Nutraceuticals II, which introduced discovery and development processes, we will introduce the science of distribution of the active components, which informs the efficacy and safety of the nutraceuticals. Students will also learn of various formularies, their components and their utility.
Prerequisites: (NPS 622 or 6220).

NPS 6240. Nutraceuticals IV. (3 Credits)
This course will cover the business aspect of the nutraceutical industry, regulation and intellectual property. This course is designed to assist and guide students to navigate the business world of nutraceuticals that includes, the current regulatory framework, global market and demand trends, intellectual property considerations and sourcing of nutraceuticals. Thus, we will highlight and analyze the global leaders in the industry to demonstrate these core learning concepts. A large component of this course will involve students completing a business plan considering regulations, market trends / marketing, intellectual property, etc., that is a continuation of their capstone project.
Prerequisites: (NPS 624 or 6230).

NPS 6500. Natural Products Seminar II. (1 Credit)
The main objective of this seminar series is to illustrate the past, present, and future of Natural Products Sciences and Research (NPSR). This task will be accomplished by combining weekly readings of milestone scientific papers, as well as inviting known scientists in this area of research for seminars and discussion on the recent development of natural products and drug discovery. This seminar series is designed to educate and disseminate the knowledge of NPSR. This series will include, but is not limited to the following areas of interest: Chemistry of Bioactive Natural Products, Medicinal Chemistry, and/or Pharmaceutical Chemistry and Pharmacognosy.

NPS 7010. Toxic Natural Products. (3 Credits)
Natural products have great medicinal, spiritual, and cultural value; however, the natural defense systems of many plants, animals, and fungi have strong central and peripheral toxic effects that can cause great harm to those that threaten them. The misconception that “natural equals safe” has been responsible for countless instances of illness and death for centuries and continues to this day. In this course, we will examine the mechanisms that different organisms use to protect themselves from harm. We will discuss the ways in which organisms cause damage to various organ systems, highlight some key examples of organisms that contaminate products, and determine strategies for overcoming those toxicities.
Prerequisites: (NPS 606, 626, 6140 or 6240).

NPS 7020. A Historical Perspective on Natural Products in the Marketplace. (3 Credits)
The progression of natural products from traditional medicine sources to drug identification to commercialization is presented. Both successful and unsuccessful examples are presented, along with principles of product development.
Prerequisites: (NPS 606, 6140, 626 or 6240).

NPS 7030. Natural Products from Microorganisms: Bacteria, Fungi, Algae. (3 Credits)
The microbiome has been a rich source of biotherapeutic products, and presents a significant opportunity for entrepreneurs to exploit. Discovery, identification, and production techniques are discussed.
Prerequisites: (NPS 606, 6140, 626 or 6240).

NPS 7040. Research Design, Methods, and Ethics. (3 Credits)
The course will introduce graduate students to the processes involved in research design. This class will introduce the approach to generating a research question, conducting scientific inquiry (i.e. Literature Review), choosing a research design methodology that adequately addresses the research question, data collection and management methods, sound approaches to optimize the reproducibility of research and reporting relevant to basic pharmaceutical sciences, social/behavioral, and health services research. We will also discuss the purpose of review bodies such as IRB and IACUC. Lastly, we will discuss guiding principles of conducting ethical research. At the end of the course, each student should develop a research proposal that must be approved by a faculty mentor and evaluated by the course coordinators.
Prerequisites: (NPS 606, 626, 6140 or 6240).

NPS 7500. Natural Products Seminar III. (1 Credit)
The main objective of this seminar series is to illustrate the past, present, and future of Natural Products Sciences and Research (NPSR). This task will be accomplished by combining weekly readings of milestone scientific papers, as well as inviting known scientists in this area of research for seminars and discussion on the recent development of natural products and drug discovery. This seminar series is designed to educate and disseminate the knowledge of NPSR. This series will include, but is not limited to the following areas of interest: Chemistry of Bioactive Natural Products, Medicinal Chemistry, and/or Pharmaceutical Chemistry and Pharmacognosy.
Prerequisites: NPS 5500* and 6500*.
* May be taken concurrently.