

## **COSMETIC SCIENCE GRADUATE PROGRAM COURSE DESCRIPTIONS**

### **PCEU 8010 Skincare Science – 3 Credit hours**

Lectures and homework assignments covering basic skin anatomy, epidermis and dermis, dermatological terminology, basic biophysical methods for evaluation of skin, structure of the stratum corneum barrier (SC), and SC barrier homeostasis, skin penetration, skin immune system, skin color, sunscreens, phototoxicity, skin surfactant interactions and skin cleansing, skin and eye irritation, and skin moisturizers and anti-aging products.

### **PCEU 6020 Introduction to surface, colloid and membrane science – 2 Credit hours**

Lectures and homework assignments covering fundamentals underpinning cosmetic formulations including wetting, spreading, contact angle, surface excess and adsorption, interfacial and solution chemistry of surfactants, surface tension, micellization, mixed surfactant systems, silicone surfactants, basic rheology, polymers and polyelectrolytes, silicone polymers, foams, foam stability and rheology, solid-liquid interface and a brief introduction to bilayers and stratum corneum membrane will be the focus of this course.

### **PCEU 6025 Advanced surface, colloid and formulation science – 2 Credit hours**

Lectures and homework assignments covering fundamentals underpinning creation, characterization and stability of complex fluids with multiphase systems will be the focus of this course. Topics covered will include the following: Phase behavior of surfactants and phase diagrams, polymer-surfactant and protein surfactant interactions, Emulsifiers and emulsification including various types of emulsions such as micro-nano- and mini-emulsions, DLVO theory of colloidal stability, Hansen solubility parameter, partitioning and release of actives in multicomponent systems.

### **PCEU8030 Haircare Science – 2 Credit hours**

This course covers the science of hair and hair care products. Topics will include hair growth, morphological and macromolecular structure of hair, physical properties of Hair, reducing agents, reactions and kinetics, permanent waving, straightening, and depilation, hair coloring, and bleaching, shampoos and conditioners, laboratory and consumer testing methods for evaluating hair properties, hair damage and repair, hair fixatives, and dandruff.

### **PCEU8051 Skin, Hair and Oral Care Formulations – 3 Credit hours**

The class is designed to provide a practical overview of the formulation approaches used for cosmetic and selected OTC drug products broadly intended for use in skin care, hair care, and oral care, including stability and performance evaluations. Sufficient background information regarding the anatomy and physiology of the skin and associated appendages, the hair, and the oral cavity as well as solution and colloid (emulsion) chemistry will be provided for appropriate understanding of the contexts of the formulation approaches. In addition, an overview of pertinent FDA regulations regarding cosmetic and OTC products will be included as well as descriptions of the development processes for these products, record keeping, and intellectual property protection.

**PCEU 7004 – 001 and PCEU 7004 – 002 Journal Club – 1 Credit hour**

This course involves the reading and discussion of published or unpublished scientific research papers in an area relevant to the student's graduate studies. Many of the discussions will be student led. The literature review session may be supplemented with scientific presentations by students, faculty or visiting scientists. 7004-001 is for onsite students and 7004-002 is WebEx based for online students.

**PHDD 8060 Statistical principles in clinical research – 3 Credit hours**

This course is designed to teach the statistical principles involved in designing clinical research studies to support new drug development programs. Statistical analysis techniques commonly used will be discussed as well as newer approaches will be considered.

**PCEU 8081 Cosmetic science project I (Capstone) – 2 Credit hours**

This course requires comprehensive evaluation of a contemporary issue in cosmetic science or topical drug development that demonstrates competency in multidisciplinary didactic coursework and scientific, regulatory and business aspects of research and development related to personal care or topical drugs. Students will select topic, perform literature search and analysis and prepare a detailed outline of the problem.

**PCEU8091 Cosmetic science project II (Capstone) – 2 Credit hours**

This course requires comprehensive evaluation of a contemporary issue in cosmetic science or topical drug development that demonstrates competency in multidisciplinary didactic coursework and scientific, regulatory and business aspects of research and development related to personal care or topical drugs. Students during this phase of the course will prepare a detailed review article analyzing the problem and present the results in a seminar. The article will be written in a format suitable for publication and submitted to a journal but final acceptance of the article is not required for the completion of the course.

**DETAILED DESCRIPTION OF VARIOUS ELECTIVES FOR THE COSMETIC SCIENCE PROGRAM**

**PCEU 6000 Survey of Cosmetic Science\* - 1 Credit hour**

This introductory course provides an overview of the personal care and cosmetic industry with emphasis on current and future needs and opportunities in R & D in this field. The course will be a broad survey of various topics such as consumer understanding, science of bio-substrates such skin, scalp, hair, and oral substrates, formulation science, cosmetic microbiology, and identification, and evaluation of efficacy, safety and toxicity of cosmetic actives and products. The course will also provide an overview of IP (intellectual property), regulatory, safety and sustainability aspects in the cosmetic industry. Introduction to key technologies such as personal cleansing, moisturization, sun protection and anti-aging will also be covered. The intent of the course is to provide students a clear idea of the scope, opportunities and challenges in this area. This course is designed to aid students in deciding whether or not to pursue their education in the cosmetic science area.

\*This course is specifically designed for BS-MS students who want to enter the BS-MS track. Those who are new to the cosmetic science field also may benefit from this course.

**PCEU 6020L Introduction to surface, colloid and membrane science Lab\* - 1 Credit hour**

In this laboratory course students will learn experimental techniques to measure such properties surfaces and interfaces as surface tension, wetting, spreading, contact angle, solubilization and emulsification. Students will also learn about methods to measure size, charge and stability of colloidal dispersions. Students will carry out simple rheological measurements of model surfactant and polymer solutions.

\*This laboratory course is an onsite course for the BS-MS students. Will be offered during the spring semester.

**PCEU 8021L Cosmetic Science Laboratory – 2 Credit hours**

This laboratory course will teach formulation science principles and give the students hand on experience in making skin and hair care products and test their stability. This is offered as a one week intensive course during summer so that online students can come to Cincinnati and attend the course.

**PCEU 8040 Color Cosmetics – 2 Credit hours**

Color Cosmetics is a two-credit graduate course that provides a comprehensive look at the broad spectrum of color additives and their use in color cosmetics. Topics on color additives will include inorganic, organic, and effect pigments, their regulation, properties, and color selection. Formulation and processing of the major classes of color cosmetics will also be covered.

**PCEU 8060 Clinical and instrumental testing of skin – 2 Credit hours**

This course covers principle of skin clinical testing, including human subject protection, study design and testing on special populations such as infants. The principles behind the most commonly used instruments for studying skin in-vivo are covered along with their use in clinical protocols. Methods covered include skin water loss measurements, electrical measurements, mechanical measurements, laser Doppler blood flow, ultrasound imaging, surface contour imaging, optical coherence tomography, skin color measurements, confocal microscopy, skin spectroscopy and magnetic resonance imaging. Protocols for testing moisturizers, cleansing products, anti-aging products, antiperspirants, and deodorants are among the ones that will be covered in the course.

**PCEU 8070 Molecular Biology of Skin – 2 Credit hours**

This is an advanced course focusing on the molecular biology of skin. The molecular structure of the epidermis, dermis and dermal – epidermal junction will be covered in detail along with key cell signaling pathways in the skin.

**PCEU 8080 Cosmetic Microbiology – 2 Credit hours**

The goal of this course is to teach cosmetic science and microbiology graduate students up-to-date information on cosmetic microbiology, product preservation, skin flora, and regulations pertaining to cosmetic and OTC drug products. The approach is a practical one based on industry experience with the preservation of skincare products. Topics to be discussed will include historical developments in cosmetic microbiology, a basic review of microbiology, product preservation, preservatives, microbiological issue in the manufacturing plant, problems with *Pseudomonas* spp., modulation of skin microflora with products and probiotics, and Food, Drug & Cosmetic Act and Regulations pertaining to cosmetic and OTC drug products.

**PCEU 8016 Consumer Understanding – 2 Credit hours**

The purpose of this course is to develop a basic appreciation of the importance of and approaches to consumer understanding in the development of new consumer products. We will bring this to life using case study examples and two individual research projects. This introductory course will cover the role of consumer understanding and consumer research in the development of a product, beginning with either a new technology or the identification of a currently unmet consumer need. We will explore the need for and use of consumer understanding to develop the core consumer concept, claims, product performance, design, and qualification for market. We will also discuss and understand the role of market data, public relations issues, and success criteria in a consumer centric products company. Both Qualitative and Quantitative consumer research approaches will be overviewed and each student will design both a qualitative and quantitative research study in an area of their personal interest, with individual feedback and coaching playing a major part in their learning experience. Students will also conduct an in-depth consumer discussion as part of the qualitative research project.

**PCEU 8015 Cosmetic Pharmacology – 2 Credit hours**

This introductory course will cover principles of pharmacology including absorption, distribution, metabolism and elimination of drugs. In addition, this course will provide a fundamental understanding of pharmacodynamics and toxicodynamics, pharmacokinetics, principles of how agonists and antagonists interact with drug receptors to modulate physiologic function and the importance of the dose-response relationship in drug development and therapy. Dermatologic pharmacology pertaining to topical drugs and cosmetics will be reviewed with regard to major drug classes as well as “non-drug” actives and mechanism of action. Novel models used in the evaluation of topical pharmacology and cosmetic products will also be addressed. In addition, the pharmacology of selected therapeutics relevant to OTC drugs such as respiratory, gastrointestinal, and analgesia will be introduced.

**PCEU 8005 Cosmetic Safety – 2 Credit hours**

This course will review the principles and guidelines for pre-clinical and clinical safety evaluation of new cosmetic and topical OTC drug products. The course will include a review of the regulatory requirements for safety testing, the role of the toxicologist, the importance of exposure in safety testing, specific types of safety studies (pre-clinical and clinical), and the use of the data for a risk assessment for marketing clearance of new products. Current hot topics and practical approaches to safety program design and management will be covered. Course work will include workshops to design safety programs, evaluation of the results to confirm safe exposure limits, and post-marketing safety monitoring requirements.

**PCEU 8023 Fragrance Science – 2 Credit hours**

This course will focus on all aspects of fragrance as a science and as a commercial endeavor, including the sense of smell, the history of fragrance, fragrance creation and duplication, natural products and aroma chemicals used in fragrances, fragrance applications in personal care and household products, the physical chemistry of fragrance solutions, safety and regulatory requirements, the emotional and psychological effects of odors, and marketing considerations.

**PCEU 8089 OTC Drug Products – 2 Credit hours**

This course is designed to provide an introduction into the physiology and conditions/diseases of the skin amenable for self-diagnosis and treatment. These include sunscreens, antiperspirants (and deodorants), and anti-acne products. Formulation approaches used for the over-the-counter (OTC) drug products intended for treatment of these conditions and diseases will be covered. This will include historical development, active agents and drugs, excipients, processing, packaging, and compatibility and stability issues. In addition, an overview of pertinent FDA regulations regarding cosmetic and OTC products will be included with emphasis on OTC monographs pertaining to sunscreens, anti-perspirants and anti-acne products.

**PHIL 6050 Ethical Foundation for Researchers – 1 Credit hour**

This course is offered by the Philosophy department as a variable credit course. Cosmetic science students will register for this course as a one credit hour course. Scientific and technological developments bring both great promise and grave peril. Contemporary researchers cannot afford to ignore the moral dimensions of their work. This is a fast-paced introduction to ethical reasoning in the context of university, industry, and clinical research, with special attention to the sciences and social sciences. Students will master the conceptual and theoretical tools for identifying and analyzing areas of moral complexity in research practices. Topics will vary and could include: research objectivity and bias; biotechnology and the meaning of life; research priorities in an era of global scarcity; energy science in the age of climate change; corporate funding and research integrity; ties between academia, industry, and the military; intellectual property; plagiarism and data fabrication; protection of human and nonhuman research subjects. Students will learn to think for themselves about the moral costs and benefits of their own research, rather than simply learning how to comply with laws and regulations. This course satisfies NSF and NIH requirements for training in the Responsible Conduct of Research (RCR).