**DIVISION OF PHARMACEUTICAL SCIENCE**
**JAMES L WINKLE COLLEGE OF PHARMACY**

**SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students**

**FOR APPLICATION YEAR: 2025**

**PROJECT TITLE: Alginate-Based Films for Enhanced Delivery of Active Ingredients in Cosmetic Applications**

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## Project Description

Hydrogels, particularly alginate-based systems, have demonstrated significant potential in delivering active ingredients due to their biocompatibility, tunability, and ability to mimic biological tissues. Alginate, a naturally derived polymer, forms hydrogels through ionic cross-linking, making it an ideal candidate for controlled release applications. This summer SURF project seeks to investigate alginate-based films as delivery systems and optimize their performance by examining their chemo-physical properties, release rates, and the impact of chemical modifications on film functionality.
The student will gain hands-on experience with various techniques essential for hydrogel research. They will learn to prepare alginate films and modify their composition by incorporating functional groups or blending with other polymers. Advanced analytical tools such as UV-Vis spectroscopy and High-Performance Liquid Chromatography (HPLC) will be used to quantify the release rates of active ingredients, while Fourier-Transform Infrared (FTIR) spectroscopy will help analyze chemical modifications. The student will also use rheometry to measure the films' mechanical properties and Scanning Electron Microscopy (SEM) to evaluate their microstructure.
Through these techniques, the student will investigate factors influencing release rates, including film thickness, cross-linking density, and environmental conditions such as pH. By correlating the structural and mechanical characteristics of alginate films with their functional performance, the project aims to optimize their design for sustained and targeted delivery of active ingredients. This research provides a foundation for advancing hydrogel technology in pharmaceutical, cosmetic, and biomedical applications while equipping the student with valuable interdisciplinary skills in materials science, chemistry, and analytical techniques.