PHARMACEUTICAL SCIENCES
JAMES L. WINKLE COLLEGE OF PHARMACY

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

FOR APPLICATION YEAR: 2026

PROJECT TITLE: Astrocyte Network Disruption in Opioid Relapse

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Project Description

Opioid use disorder is a chronic brain condition marked by a persistent vulnerability to relapse, a period characterized by increased risk of fatal overdose. Remarkable recent discoveries highlight the fundamental role of brain astrocytes in regulation of neural activity and behavior relevant to opioid use disorder, underscoring their therapeutic potential. Astrocytes in the nucleus accumbens (NAc), a critical hub of the brain’s reward circuitry, undergo pronounced and localized structural changes in response to chronic opioid exposure. These changes actively regulate relapse behaviors and facilitate extinction learning. While astrocytes are well known for their role in synaptic buffering and gliotransmission at the level of individual synapses, astrocyte-astrocyte communication via gap junctions forms functional networks capable of coordinating broader regulatory responses to aberrant neural activity. Despite this potential, the translational relevance of astroglial network plasticity remains relatively unexplored in addiction neuroscience, a gap our work aims to address using cutting-edge imaging and computational tools. We will determine whether human astrocyte structural complexity is diminished by heroin use across the NAc, whether astrocyte networks are disrupted in human drug users and whether astrocyte subtypes that we’ve shown limit relapse are also found in humans heroin users. Altogether, our research underscores the critical, active role of astrocytes in both promoting and suppressing relapse behaviors, opening new therapeutic avenues targeting glial circuits in opioid use disorder.