INTERNAL MEDICINE CARDIOLOGY
COLLEGE OF MEDICINE

SUMMER RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

FOR APPLICATION YEAR: 2026

PROJECT TITLE: Explore New Danger Signaling in HFpEF

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Project Description

Heart failure with preserved ejection fraction (HFpEF) affects millions of people and accounts for more than half of all heart failure cases. Despite its high prevalence, HFpEF remains difficult to diagnose and treat because its underlying causes are not fully understood, and effective therapies are limited. Importantly, many disease-related changes occur early, before obvious damage to the heart develops. A major challenge in HFpEF develops gradually: long before clear symptoms or structural damage appear, molecular and cellular changes are already reshaping the heart. By the time HFpEF is clinically recognized, many of these changes are irreversible.

Our lab aims to understand the early dynamic progression of HFpEF, with an emphasis on how stress and “danger” signals in the heart activate inflammation and fibrosis (scar formation), leading to increased stiffness of the heart muscle. Using mouse models and modern molecular biology approaches, we will investigate how cardiac cell types, including cardiomyocytes, endothelial cells, fibroblast cells, and immune cells, communicate during the earliest stages of disease development.

Undergraduate students in our lab can participate in research projects exploring cell–cell communication, inflammatory signaling pathways, molecular changes, cardiac function, and cardiac morphology over time in HFpEF models. Students will develop key research skills, which may include tissue processing, immunofluorescence staining, fluorescence microscopy techniques, basic molecular biology techniques (such as RNA or protein analysis), flow cytometry analysis, echocardiography, data interpretation, and critical reading of scientific literature. In addition, students will have the opportunity to gain experience in experimental design, data analysis, and

presenting at lab meeting.