

Research Summary

We primarily seek to understand the molecular mechanisms of Coronary Artery Disease, the most common cause of age-related cardiovascular disease. We study the signaling mechanisms underlying the reduced tolerance elderly patients' hearts show to stress from restricted blood flow (ischemia) and the restoration of normal blood flow (reperfusion) and also from pressure-induced hypertension. Our work aims to devise novel strategies to boost cardiac tolerance of these events in aged populations and to prevent patients' decline in resilience. Closely tied to this work, we explore the intrinsic relationship between diabetes and cardiovascular diseases. Evidence suggests that adenosine monophosphate-activated protein kinase (AMPK) may protect the heart from ischemic injury and limit the development of cardiac myocyte hypertrophy. This enzyme is activated by hormones, cytokines, and certain drugs used to treat type 2 diabetes. AMPK binds to adenosine monophosphate (AMP), through which it moderates enzymatic activity, balancing cellular production and consumption of adenosine triphosphate (ATP). We want to elucidate the molecular mechanisms responsible for AMPK activation, identify novel downstream AMPK targets, and develop therapeutic techniques that target the enzyme to prevent and treat myocardial ischemia, hypertension, cardiac hypertrophy, and diabetes.

AMPK also shows potential as a drug target for cancer treatment because it may work as an antioxidant, modulating the levels of reactive oxygen species and inflammatory response in tumor cells. Building on our understanding of these processes, we have reported that natural antioxidants extracted from herbal medicines inhibit the proliferation of tumor cells via related processes. We currently aim to determine these substances' signaling targets in tumor cells and to develop cancer therapies based on natural products from herbal medicines.