Metabolomics Core

The Buck Metabolomics Core is a state-of-the-art facility dedicated to advancing the field of metabolomics through high-end mass spectrometry, the development of innovative metabolomics platforms, and the integration of computational approaches. Interns will have the opportunity to engage with cutting-edge technologies and methodologies, gaining hands-on experience in both targeted and untargeted analyses while collaborating on multiple research projects focused on the metabolic underpinnings of aging and age-related diseases. This collaborative environment fosters interdisciplinary research and allows interns to contribute to impactful studies alongside leading experts in the field. Additionally, interns will enhance their skills in data analysis and interpretation, positioning them to make meaningful contributions to the future of science and health in a rapidly evolving landscape. Examples of projects the Summer Scholar could join include:

Unraveling the Genetic and Metabolic Foundations of Immunometabolism in Aging Through GWAS and Mendelian Randomization
This proposal aims to integrate Genome-Wide Association Studies (GWAS), Mendelian randomization (MR), and metabolomics to elucidate the role of immunometabolism in aging. By identifying genetic variants linked to immunometabolic markers and aging phenotypes through meta-analysis of existing GWAS data, the study will explore causal relationships between these factors and aging outcomes using MR analyses. Additionally, it will analyze metabolomic data from aging cohorts to characterize signatures of accelerated versus healthy aging and identify metabolites associated with the genetic variants. The integration of these multi-omics approaches will develop comprehensive models to identify key pathways and potential therapeutic targets, ultimately enhancing our understanding of how immunometabolism influences aging and promoting strategies for healthy longevity.

LC-MS Analysis of Ovarian NAD+ Metabolism and Its Influence on Oocyte Quality and Mitochondrial Function in Aging
This study investigates how enzymes in ovarian support cells influence the health and function of oocytes as they relate to aging. A key focus is on NAD+, a molecule essential for cell metabolism, energy production, and DNA repair, which decreases with age and has been linked to reduced oocyte quality. In the ovarian environment, specific enzymes that break down NAD+ may indirectly affect oocytes, even though these enzymes are not present in the oocytes themselves. Using advanced liquid chromatography-mass spectrometry (LC-MS), this research will apply both untargeted and targeted metabolomics to analyze key metabolites in the ovary and understand mitochondrial function within oocytes. By examining different age groups and enzyme-deficient models, the study aims to reveal mechanisms that contribute to reproductive aging and potentially identify targets for therapies to support ovarian health and fertility as women age.

Investigating the Metabolomic Links Between Skeletal Bone Health, Frailty, and Aging
This study will focus on investigating the relationship between skeletal bone health, frailty, and aging through metabolomic analysis, utilizing ultra-high performance liquid chromatography tandem mass spectrometry (UHPLC-MS/MS) for sensitive detection of metabolites. The project will emphasize key metabolic pathways, including amino acid metabolism, energy metabolism, neurotransmitter pathways, and oxidative stress-related pathways. By employing multivariate statistical analyses, the study will aim to identify metabolic patterns that correlate with aging and frailty in bone health. Additionally, by analyzing both bone and brain samples from the same animal models we will establish baseline metabolomic profiles, and explore metabolites influencing both bone and brain function, such as kynurenine pathway metabolites.

Desired Skills for Interns:

- A solid interest in biology, chemistry, and analytical technologies.

- For data analysis: Proficiency in coding using R.
- For benchwork: Emphasis on reproducibility and accuracy in handling biological samples.
- Enthusiasm for project engagement and a willingness to collaborate as a team player.
- A strong desire to learn and grow in a dynamic research environment.