2026 IMPACT CIRCLE

Project Title: A Novel Multiplex Screening Platform to Identify Combination Supplement Strategies for Healthy Aging

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Unmet Need/Primary Question:
Aging is not caused by just one problem. Instead, it reflects the gradual breakdown of many systems in the cell at the same time. Because of this complexity, it is unlikely that one "magic bullet" drug will meaningfully slow or reverse aging. Yet most research still tests one gene or one drug at a time, even though aging emerges from many interacting defects across the cell, including problems with energy production, mitochondrial function, and cellular cleanup. This mismatch between simple research models and the real complexity of aging may help explain why so few aging interventions have translated into practical use. To address this gap, we need a new kind of screening platform that can measure how multiple age-related defects interact and identify combinations of supplements or compounds that work together. By combining this platform with artificial intelligence (AI), we aim to pinpoint the most important weak points in the aging network and guide the rational design of interventions that restore function.

Novel Hypothesis:
Aging is not a single molecular defect, but a network of interconnected problems. We hypothesize that meaningful rejuvenation will require combinations of interventions that work together, rather than one gene or one compound tested in isolation. To make this possible, we propose a new platform designed to uncover combinations that can counter several forms of age-related dysfunction at once. No existing method can systematically tackle this level of complexity in aging biology.

Project Proposal:
With support from Impact Circle in 2021, our lab built a yeast-based platform to systematically identify age-related changes in cellular function at single-cell resolution and with unprecedented spatial detail. Yeast shares many core features of aging with human cells, including problems with metabolism, energy production, and protein quality control, as well as the buildup of damaged proteins seen in age-related disease. This platform allows us to see exactly what breaks down as cells age and then use AI to identify combinations of daily supplements that may help restore those failing systems. We can also compare different versions or precursors of each supplement to find the most effective combinations. The idea is similar to repairing an aging machine or car: first, you identify which parts are failing; then, you understand how those parts work together, so you can determine what each one needs to restore the function of the whole machine. We have already completed initial screens and uncovered hundreds of previously unknown age-associated defects. These results position us to

take the next step—using AI-guided design and experimental testing to develop supplement combinations that target multiple aging-related declines at once. This work represents both a technical advance and a new way of thinking about aging: not as one problem to solve, but as a system-wide decline that may require coordinated, multi-part solutions.

Description of Potential Impact:
I believe the future of aging interventions will lie in combinations of compounds, nutrients, or other treatments that can address many problems inside aging cells at the same time. Our goal is to use our screening platform and AI tools to identify interventions that can help repair multiple parts of the aging cellular machine at once. Based on what we have seen so far, we may be getting close to rationally designing daily supplement combinations that target several age-related declines in how cells make and use energy. This study will help establish a new framework for combination-based approaches to healthy aging.