2020 IMPACT CIRCLE

Bioenergetic power as biomarker

Investigators: Akos Gerencser & David Furman

Unmet Need: Blood-based biomarkers of mitochondrial function carry the promise of assessing disease susceptibility, monitoring intervention and prognosing disease. However, until well-defined and standardizable technology is translated from basic research to the clinic, the broader applicability of bioenergetic fitness as a blood-based biomarker will remain remote.

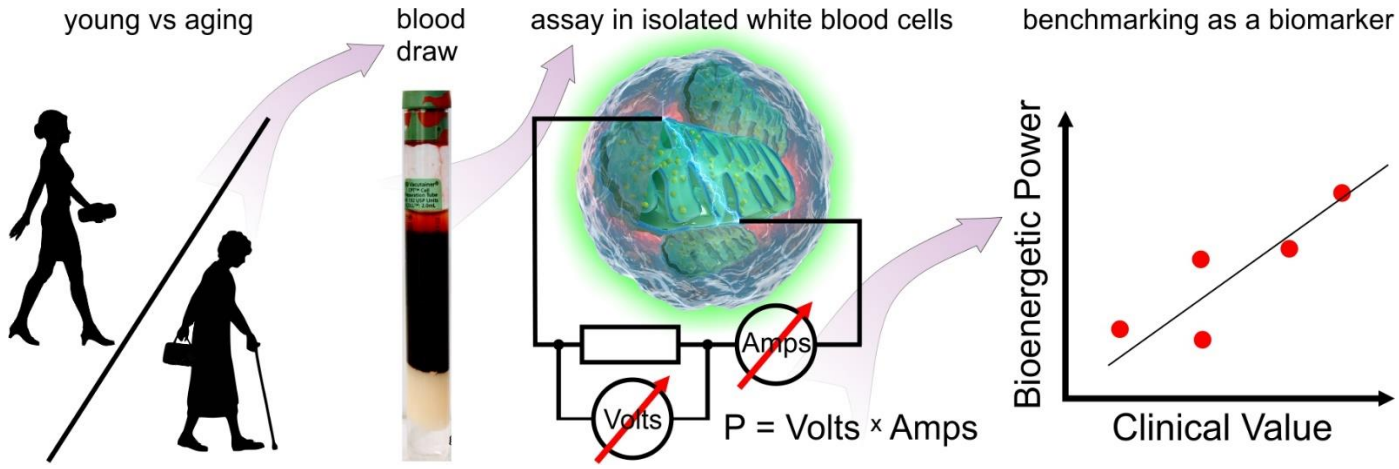
Background: It is broadly assumed that mitochondrial function in blood cells reflects systemic mitochondrial properties due to the interaction of blood with all organs. Cell respirometry is a research laboratory assay using isolated cells and it measures how fast cells can consume O_2. This shows predictive value for patient muscle strength, fatigability, and cognition scores when performed in white blood cells or platelets. Alternatively, as the assay was performed in a mixture of immune cells, it may inform on properties of the immune system, and indirectly on systemic health. Previously proposed blood-based cell respiratory biomarkers have multiple shortcomings in how data is interpreted or how assays are carried out. To address these, we defined a novel metric of mitochondrial function. This metric is peak bioenergetic power, which estimates mitochondrial fitness in cells in physiological-like conditions that maximize output of cellular energy production. We have developed an assay to determine the new metric in cells by the combination of cell respiration data and the electric potential across the mitochondrial inner membrane.

Novel Hypothesis: The peak bioenergetic power is a better metric of bioenergetic fitness than cell respiration parameters or bioenergetic health indices previously proposed as blood-based biomarkers, because they are more robust and have greater predictive power.

Proposal: We will develop the peak bioenergetic power assay – a basic research tool we use now – for use in human blood samples and specific cell types within. We will demonstrate feasibility and utility of this novel technology as a blood-based biomarker.

Impact: We expect to demonstrate superior benchmarks and clinically-relevant predictive power of the new assay as compared to previously proposed blood-based cell respiratory biomarkers. Impact Circle funds will be leveraged by this proof-of-concept study by enabling us to apply for NIH funds or seek investors.

Specialized Equipment Needs: none


young vs aging
blood draw
assay in isolated white blood cells
benchmarking as a biomarker
Amps
Volts
P = Volts x Amps
Bioenergetic Power
Clinical Value