What Your Blood Can Tell us About Age and Disease
6th Annual Participant Appreciation Day
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Brain and body functions are tightly linked

- infections
- immune responses
- gut-brain axis
- exercise

- mood
- stress
- pituitary hormone regulation of organ function
Blood connects all organs

Blood tests record organ function and pathology

What is in a drop of blood?

Blood

- Plasma: 55%
- Blood cells: 45%

Blood tests record organ function and pathology

Standard clinical chemistry and medicine
“Molecularization” of plasma

Molecularization of plasma, 1000s of molecules can be measured now

Proteins
Lipids
Metabolites
Genetics

Deep insight into biology and disease

Unbiased profiling of blood composition to discover physiological and pathological states

Genes
Age
Environment
Lifestyle
Human aging captured by the blood proteome

Measure ~ 3,000 different types of proteins

In collaboration with Nir Barzilai and Sofiya Milman at Einstein College; Adam Butterworth for the INTERVAL study and Somalogic Inc.

Vast changes in concentrations of plasma proteins

4,331 healthy people
Plasma proteins change in 3 waves during aging

Link age-specific protein concentrations to biological age and function

Machine Learning (statistical pattern recognition)

Key proteins provide biological information about age and function (based on contribution to the score)

Estimated age = 28

Adapted from Jarod Rutledge

Lehallier et al. Nat Med 2019
Find plasma proteins uniquely expressed in distinct cell types to estimate tissue age and physiology.

Map 4979 plasma proteins to putative organ sources. 15% of proteins in plasma are designated "organ specific."

Identify organ-enriched genes. plasma protein-based clocks to measure organ age.

Plasma protein-based clocks to measure organ age:

Organ specific Aging Model: e.g. brain age gap.

Biological age, physiological state.
Plasma protein-based estimation of heart age and prediction of heart failure

Organic protein-based estimation of heart age and prediction of heart failure

Organs have different ages within the same person and some individuals are extreme organ agers

- Conventional: all plasma proteins
- Organismal: all plasma proteins that are not organ-specific
Individuals with extreme organ age gaps separate into organ specific and multi-organ agers

Brain Age Prediction

Cognitive Decline

Tissue age and AD
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