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(I) The physics of aging: embracing complexity

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As living organisms age, they stochastically move through high-dimensional “health-space”. Developing simple and predictive models that captures aging dynamics is challenging because the organism is not homogeneous: there are many thousands of distinct physiological attributes that could be measured. We pursue three strategies to simplify aging while embracing its complexity. First we develop simple one-dimensional summary measures of health. These predict mortality surprisingly well, but not health-trajectories. Second we develop minimal models of networked health that still capture the heterogeneity of the data. These “generic network models” allow us to model how the heterogeneity of health affects aging, but also the effects of disease. Finally, we use machine-learning to identify natural coordinates for describing aging, and to identify simple interactions between health attributes.

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