

RCCN Measuring Biologic Age

Does each tissue age independently?

Jan Vijg

Department of Genetics, Albert Einstein College of Medicine,
New York

Center for Single-Cell Omics, School of Public Health,
Shanghai Jiao Tong University School of Medicine, Shanghai

Evolution of human longevity and the genetic complexity governing aging rate*

(primates/hominids/cranial capacity/body weight)

RICHARD G. CUTLER

Institute for Molecular Biology, University of Texas at Dallas, P.O. Box 688, Richardson, Texas 75080

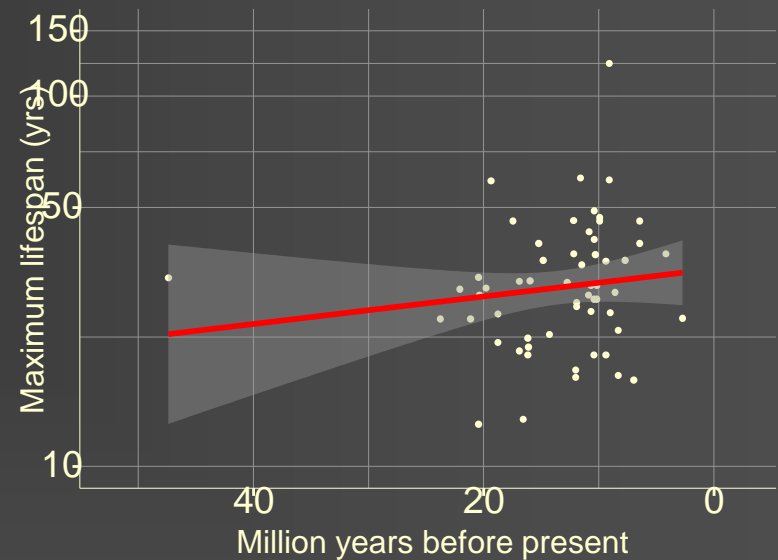
Proc. R. Soc. Lond. B 205, 531-546 (1979)

Printed in Great Britain

The evolution of ageing and longevity

BY T. B. L. KIRKWOOD† AND R. HOLLIDAY, F.R.S.‡

† *National Institute for Biological Standards and Control,
Hampstead, London NW3 6RB, U.K.*



Evolutionary changes in molecular error regulation across tissues can explain rapid evolutionary changes in longevity. This implies that aging across tissues is synchronized through intracellular error regulation

11 April 1975, Volume 188, Number 4184

SCIENCE

Evolution at Two Levels in Humans and Chimpanzees

Their macromolecules are so alike that regulatory mutations may account for their biological differences.

Mary-Claire King and A. C. Wilson

Evolutionary change is mostly based on variation in gene regulatory regions (about 10% of the genome)

Vol 437|1 September 2005|doi:10.1038/nature04072

nature

ARTICLES

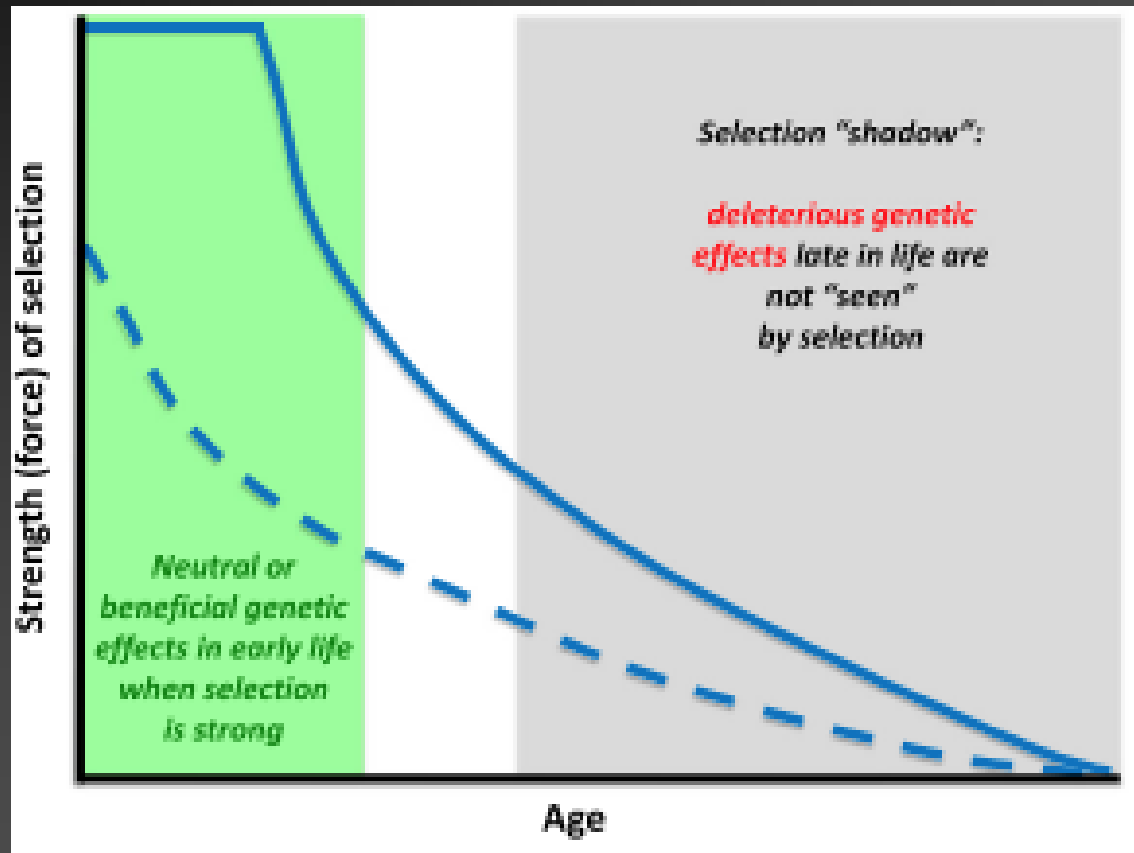
Initial sequence of the chimpanzee genome and comparison with the human genome

The Chimpanzee Sequencing and Analysis Consortium*

Human and Chimp genomes are 96% identical
~ 10 times more variants than between two humans

Rapid life span changes can involve many, many traits

The force of natural selection declines with age



Flatt and Partridge, BMC Biology 2018

Evolution can rapidly alter life span through mutations at many traits

Aging is a generalized phenomenon and reflects a diversity of physiological and anatomical changes across tissues as dictated by many late acting deleterious genes

(Williams, 1957)

PHYSIOLOGICAL ASPECTS OF AGING IN MAN¹

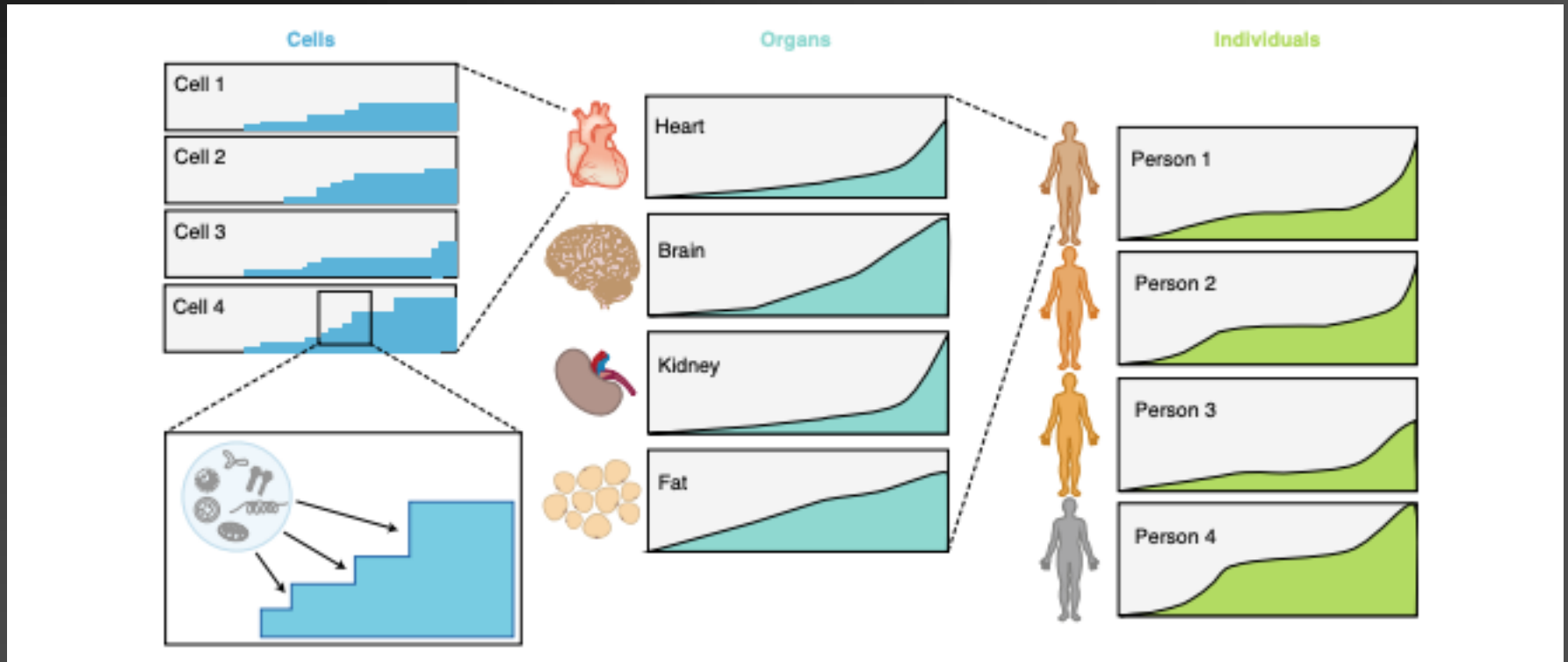
BY NATHAN W. SHOCK

*Gerontology Branch, National Institutes of Health, Bethesda, and
the Baltimore City Hospitals, Baltimore, Maryland*



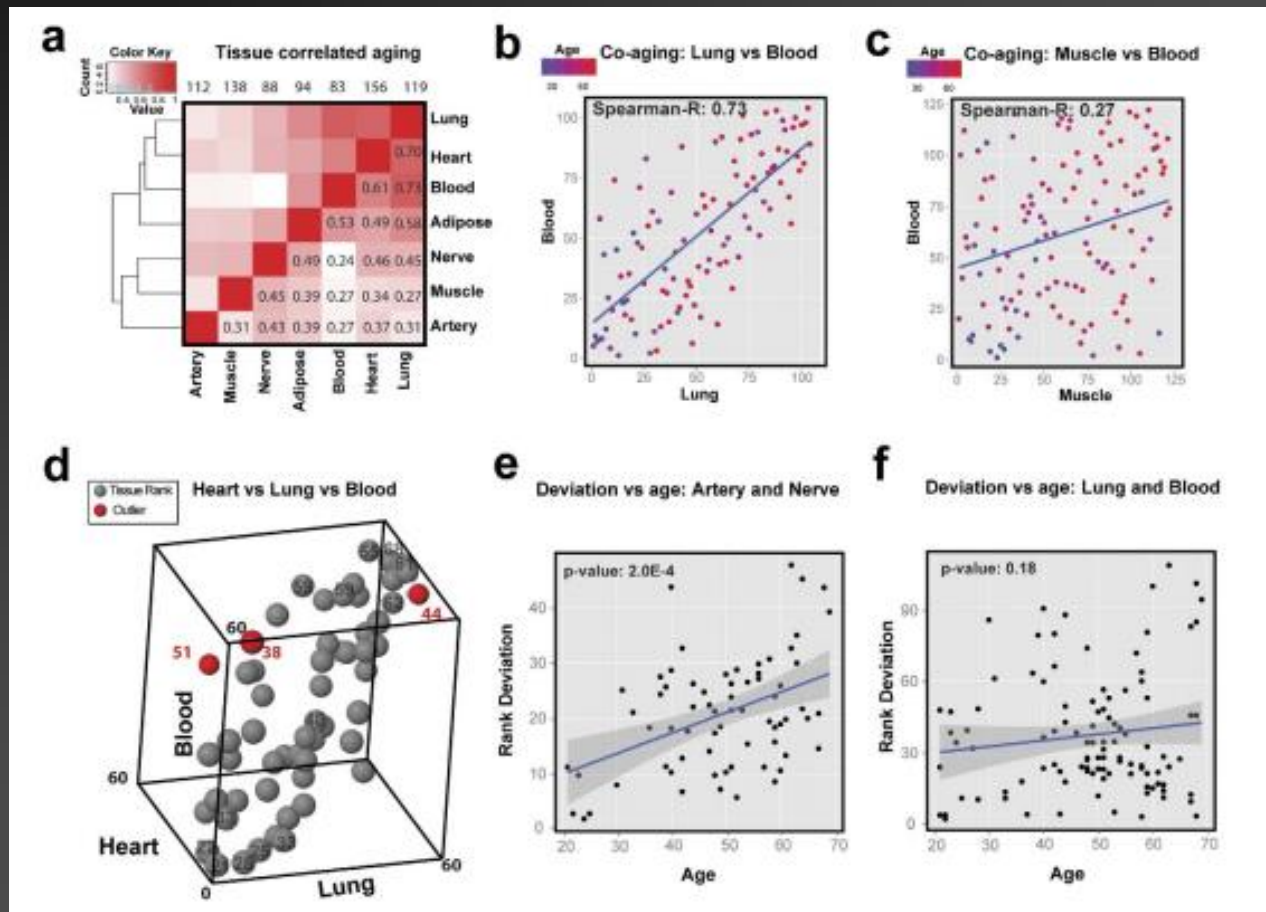
Annual Review of Physiology, 1961

Aging rate varies at multiple levels



Rando and Wyss-Coray, Nature Aging 2021

Co-regulation of age-related gene expression in different human tissues



Conclusions

- Tissues provide function in an integrated, manner optimized for early life
- Late-life diversity in aging rate among tissues arises through stochastic effects of genetic, epigenetic and environmental factors
- Inter-tissue diversity does not preclude accurate estimates of chronological age, possibly by measuring error regulation