Science & Technology for Healthy Longevity: A Workshop for the Global Roadmap for Healthy Aging

Eric Verdin, MD
Buck Institute for Research on Aging
June 14, 2021
- Populations in the developed world are rapidly aging.
- Aging is the biggest risk factor for the chronic diseases of aging.
- The science of aging has made remarkable progress: Aging is malleable and controlled by specific pathways.
- Interventions that target aging will be critical for true preventative medicine.
- Populations in the developed world are rapidly aging
- Aging is the biggest risk factor for the chronic diseases of aging
- The science of aging has made remarkable progress:
  Aging is malleable and controlled by specific pathways
- Interventions that target aging will be critical for true preventative medicine
Population of Japan from 1920 to 2010

- Populations in the developed world are rapidly aging
- Aging is the biggest risk factor for the chronic diseases of aging
- The science of aging has made remarkable progress: Aging is malleable and controlled by specific pathways
- Interventions that target aging will be critical for true preventative medicine
The Geroscience Hypothesis: Aging is the Strongest Risk Factor for Age-Related Diseases
-Populations in the developed world are rapidly aging
-Aging is the biggest risk factor for the chronic diseases of aging
-The science of aging has made remarkable progress: Aging is malleable and controlled by specific pathways
-Interventions that target aging will be critical for true preventative medicine
Genes Control Lifespan

- Control
- Gene Mutation (DAF-2)
- Gene Mutation (DAF-2) + Removal of Gonad

Survivors (Percent)

Time (Days)
Modulation of Lifespan/Healthspan by Calorie Restriction

Conserved Pathways Mediate Calorie Restriction

**C. elegans**
- ↓ TOR
- ↑ SKN-1 in Neurons
- ↑ PHA-4
- ↑ S6 Kinase
- ↑ Autophagy
- ↓ Translation
- ↑ Respiration

**Drosophila**
- ↓ TOR
- ↑ Sirtuin
- ↓ S6 Kinase
- ↓ General Translation
- ↑ Respiration

**Mammals**
- ↓ TOR
- ↑ Sirtuin
- ↓ S6 Kinase
- ↓ General Translation
- ↑ Respiration

**Calorie Restriction**

**Long Life**
- Populations in the developed world are rapidly aging.
- Aging is the biggest risk factor for the chronic diseases of aging.
- The science of aging has made remarkable progress: Aging is malleable and controlled by specific pathways.
- Interventions that target aging will be critical for true preventative medicine.
Medicine in the 20th Century

- Cancer
- Heart Disease and Stroke
- Alzheimer Parkinson
- Arthritis
- Diabetes
- Hearing Loss
- Nutrition
- Vision
Focusing on Aging to Change Medicine

Sick Care

Organ-based

Reactive

Disease Management

Universal
Focusing on Aging to Change Medicine

Sick Care vs. Health Care

- **Organ-based** → **System-based**
- **Reactive** → **Proactive**
- **Disease Management** → **Preventative**
- **Universal** → **Personalized**
Our goal: Extending healthspan and lifespan
What would you do with an extra 20 years of healthy life?
Thank You!

everdin@buckinstitute.org
Vital Signs: heart rate (Afib), heart rate variation (HRV), blood pressure, temperature, respiratory rate, weight, body composition...

Novel Functional Tools: steps/day, movement, gait speed, grip strength, VO$_2$ max, “living space”, fall/balance monitoring, voice recognition, complex gait analysis. Sleep analysis (REM vs. deep vs awake)

New Biomarkers of Aging: Horvath clocks, Proteomics clocks, Transcriptomics Clocks, iAge, Glycan Age, SASPome, facial recognition..
### Buck Institute for Research on Aging

- **First free-standing research institute in the world focused solely on the biology of aging**
- **24 research groups**
  - 230 employees from over 30 countries
- **Nonprofit, opened in 1999**
- **IM Pei-designed 250K square-foot campus**
  - North of San Francisco
- **Annual budget of ~$45M:**
  - 50% NIH
  - 17% corporate
  - 17% philanthropy
  - 17% endowment
Buck’s Focus Areas

AI and computational biology
Mitochondria and bioenergetics
Exercise, nutrition, and metabolism
Senescence and inflammation
Neurodegeneration
Stem cells and regenerative medicine
Basic mechanisms of aging
Female reproductive longevity
Cancer associated with aging
Cellular stress and disease

buckinstitute.org