# A New Frontier:
## Rejuvenation Biotech & The Technologies That Will Redefine Medicine

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# Bio

Derrick Holman, M.D.

Honors research in aging and rejuvenation at the University of Oklahoma • M.D. - University of Oklahoma College of Medicine • B.S. in Microbiology at the University of Oklahoma (Honors) • Undergraduate training at Advanced Center for Genome Technology (Lab of Bruce Roe, Ph.D. – Human Genome Project) • Member of numerous longevity investor groups including Lifespan.io's Longevity Investor Network and The Longevity Syndicate • Broad biotech experience in both academic and commercial settings ranging from NIH grant-based projects to full scale commercial roll out of genomic medicine products • Relationships throughout global rejuvenation community • Managing Director at Biologic Ventures, a venture capital fund investing in rejuvenation biotech companies.

NIH

The University of Oklahoma College of Medicine

Human Genome Project

Keck Medicine of USC

MOLECULAR TESTING LABS

Scripps

Lifespan.io
CROWDSOURCING THE CURE FOR AGING

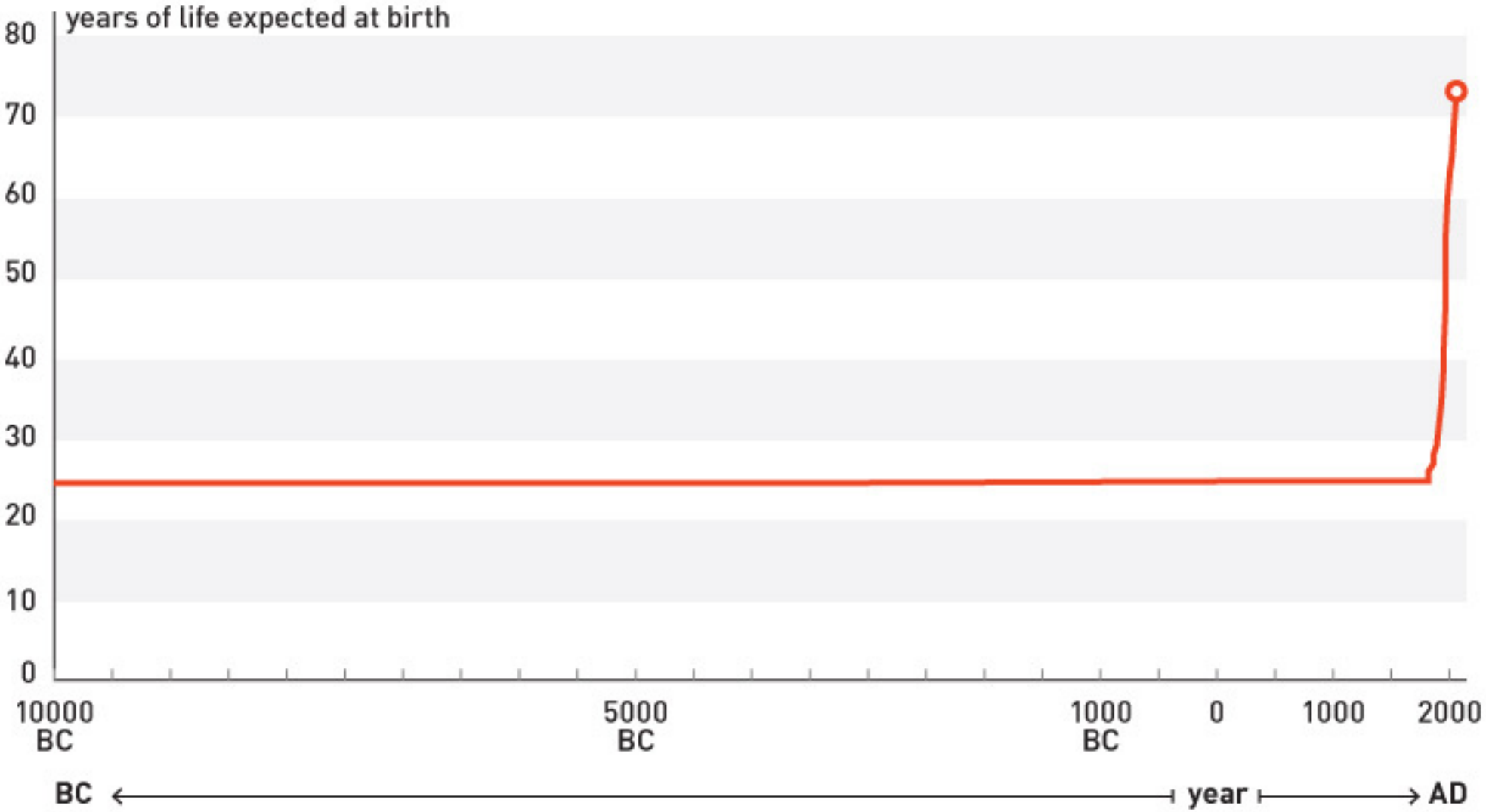
KAISER PERMANENTE

LONGEVITY INVESTOR NETWORK
By Lifespan.io

hoag

# History of Human Life Expectancy

# GLOBAL LIFE EXPECTANCY (10,000 BC–TODAY)




Source: Cato Institute, Our World in Data. Life expectancy is believed to have been 20-30 years prior to 1820. Age 25 is selected as an average.


Why We Age

# Why We Age

- Survival of the Species
  - Early humans would have exhausted natural resources without aging – not sustainable for hunter-gatherer lifestyle
- Shorter Lifespans Preserved Ecosystems
  - (We would have eaten ourselves to death)

# What Determines Lifespan?

- Why do different species have different lifespans?
- Evolutionary Biology – The ecosystem the species evolved in/ food chain
  - Food supply, rate of predation, environmental conditions
  - Tightly controlled within species
    - Generational flexibility based on food supply
      - Caloric restriction slows aging, Increased caloric intake speeds aging
    - Are there species out there that live longer due to their ecosystem?

# Long Lived Species

Bowhead Whale > 200, potentially 270 years

# Long Lived Species

Greenland Shark
- 400 to 500 years

# Long Lived Species

Common Lobster – 140 to 150 years

# Long Lived Species

Giant Tortoise –
190 years or more

# Long Lived Species

Immortal Jellyfish - Turritopsis dohrnii - Immortal

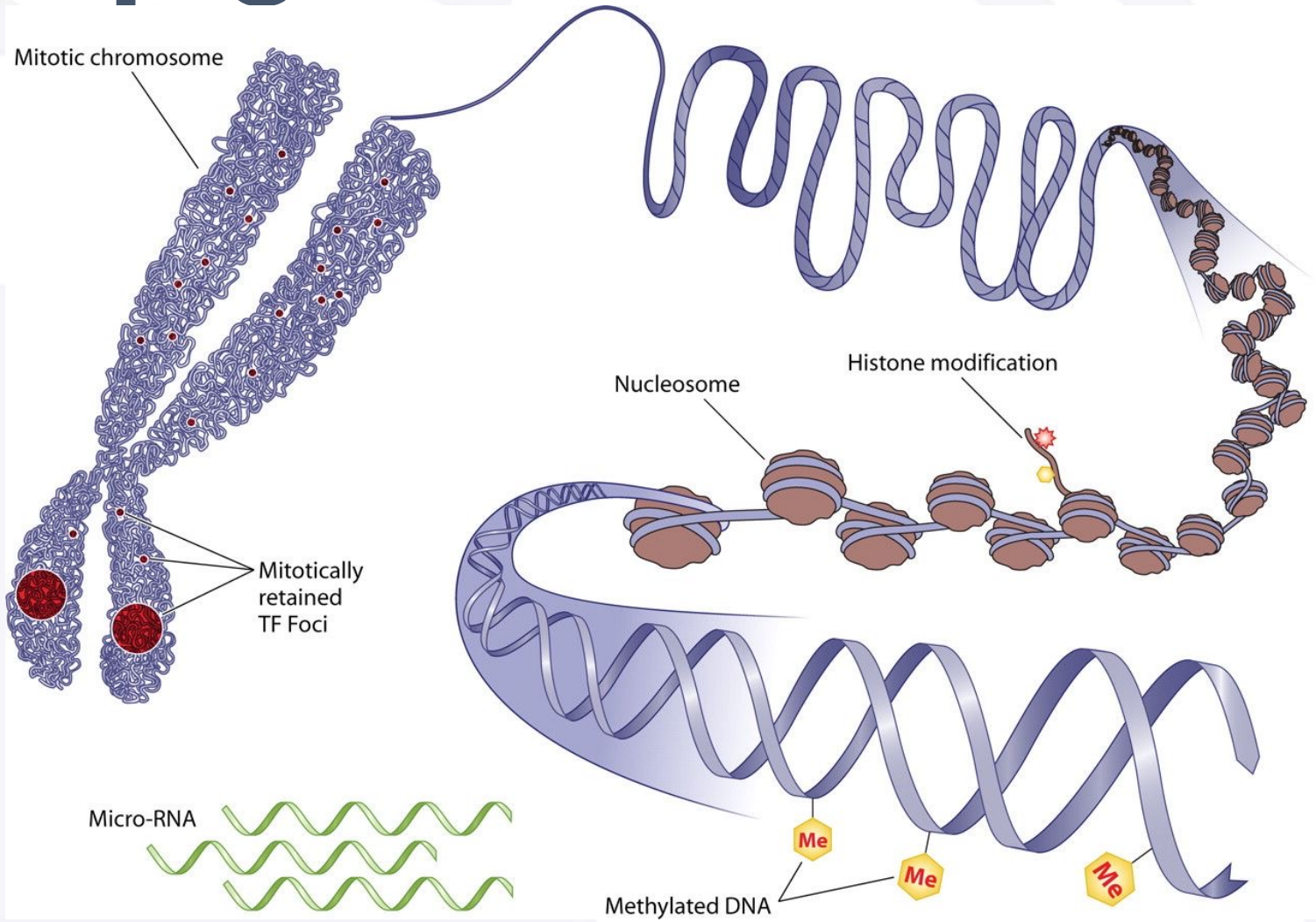
# Long Lived Species

Planaria – Immortal

# What Causes Aging?

- The Epigenome Drives Our Development
  - Embryo → Fetus → Newborn → Toddler → Pre-teen → Teen → Adult → Middle-Aged Adult → Elderly Adult
  - Epigenome controls of which genes get expressed and therefore which proteins are produced (turned on)
- Ticking clock on top of our DNA driving us through life stages
- Old Gene Expression to Young Gene Expression

# The Epigenome



# Can We Change This Process?

# Mammalian Rejuvenation

# Rat Rejuvenation

These rats are the same age. The only difference is one has been treated with the therapeutic and one has not.


More than 30 biomarkers have been reversed to a youthful state.

Both rats are 31.8 months old.

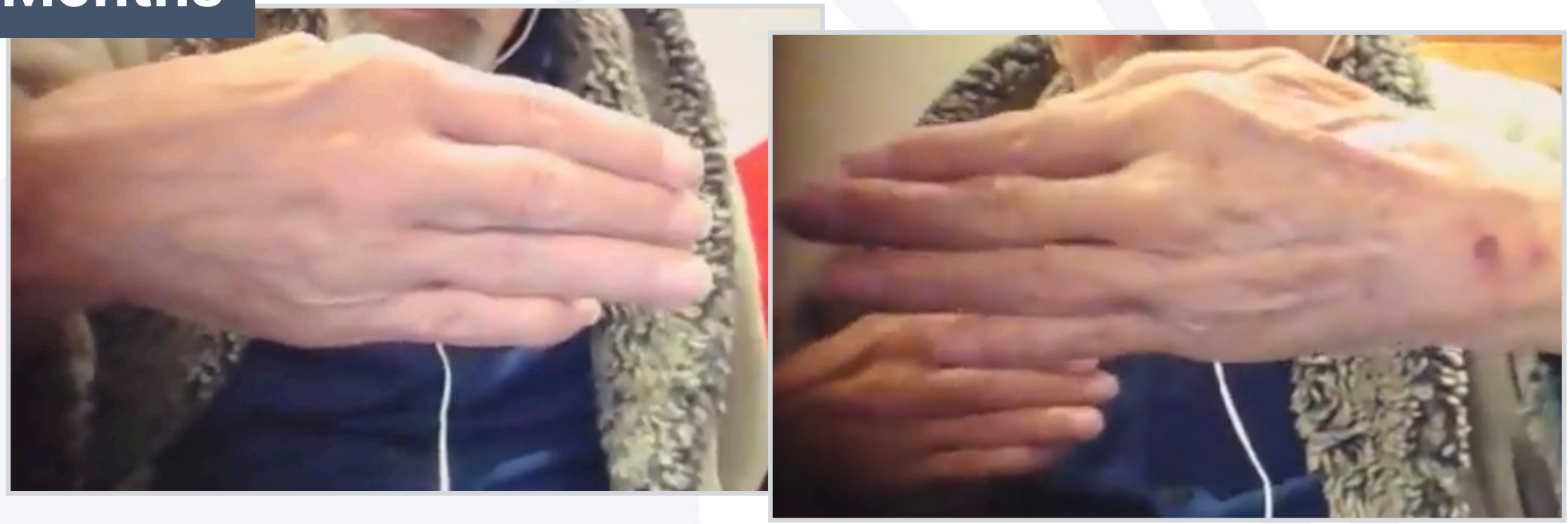
# Human Rejuvenation

## 72 Hours

The skin is noticeably younger just 72 hours after topical application.

# Human Rejuvenation

**3 Months**



# Disease States Reversed

## Aging is the Root Cause

Heart Disease, Type II Diabetes, Chronic Obstructive Pulmonary Disease (COPD), Arthritis, Cancer, Alzheimer's, Stroke

Atherosclerosis, Inflammatory Bowel Disease (IBD), Myocardial Infarction (Heart Attack), Osteoporosis, Parkinson's Disease, Dementia, Fatty Liver Disease, Chronic Kidney Disease, Cardiovascular Disease, Cerebellar Infarction, Osteoarthritis, Tumorigenesis and Malignant Cancer Development, Neurodegenerating Disease, Heart Failure, Loss of Bone Marrow, Cataracts, Multiple Sclerosis, Sjogren, Rheumatoid Arthritis, Degraded Immune Function, Idiopathic Pulmonary Fibrosis, Age-Related Macular Degeneration, Huntington's Disease, Decline in Testosterone, Estrogen, Growth Hormone, IGF-I, and Energy Production, Obesity, Ocular Neovascularization, Diabetic Retinopathy, Glaucoma, Memory Loss, Hearing Loss, Cognitive Impairment, Hypertension, Senescence, Sarcopenia (Frailty), Hair Loss and Infertility.

Regenerative capabilities as well – crushed nerves, damaged tissues, similar therapies can be given in acute settings

# Biotech That Can Pivot

Biotech That Can Pivot - Address multiple diseases states simultaneously, giving them multiple indications and a greater probability of approval if the first indication lacks efficacy (therapeutics can “pivot” to additional core diseases).

# Technologies That Reset This Clock

- Yamanaka Factor Reprogramming (mRNA, Viral Vectors)
- Young Plasma
- Chemically Induced Reprogramming
- Bioelectric Field Modulation
- Many Others/ New Approaches Everyday

# Human Clinical Trials

- These technologies are going to be applied to humans within the next year - starting topically and then moving on to systemic.
  - Multiple companies are in this timeline and using this strategy.

# Thank You

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