Boosting Resilience through Exercise

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Definitions of Resilience

- "The capability of a strained body to recover its size and shape after deformation caused especially by compressive stress" (Merriam Webster)
- An ability to recover from or adjust easily to misfortune or change

Resilient Ageing

- PHYSICAL FITNESS
- COGNITIVE FITNESS
- PSYCHOLOGICAL WELL-BEING
- GOOD NUTRITION
- SOCIAL INTEGRATION
- PURPOSE IN LIFE
- EMPATHY/ALTRUISM

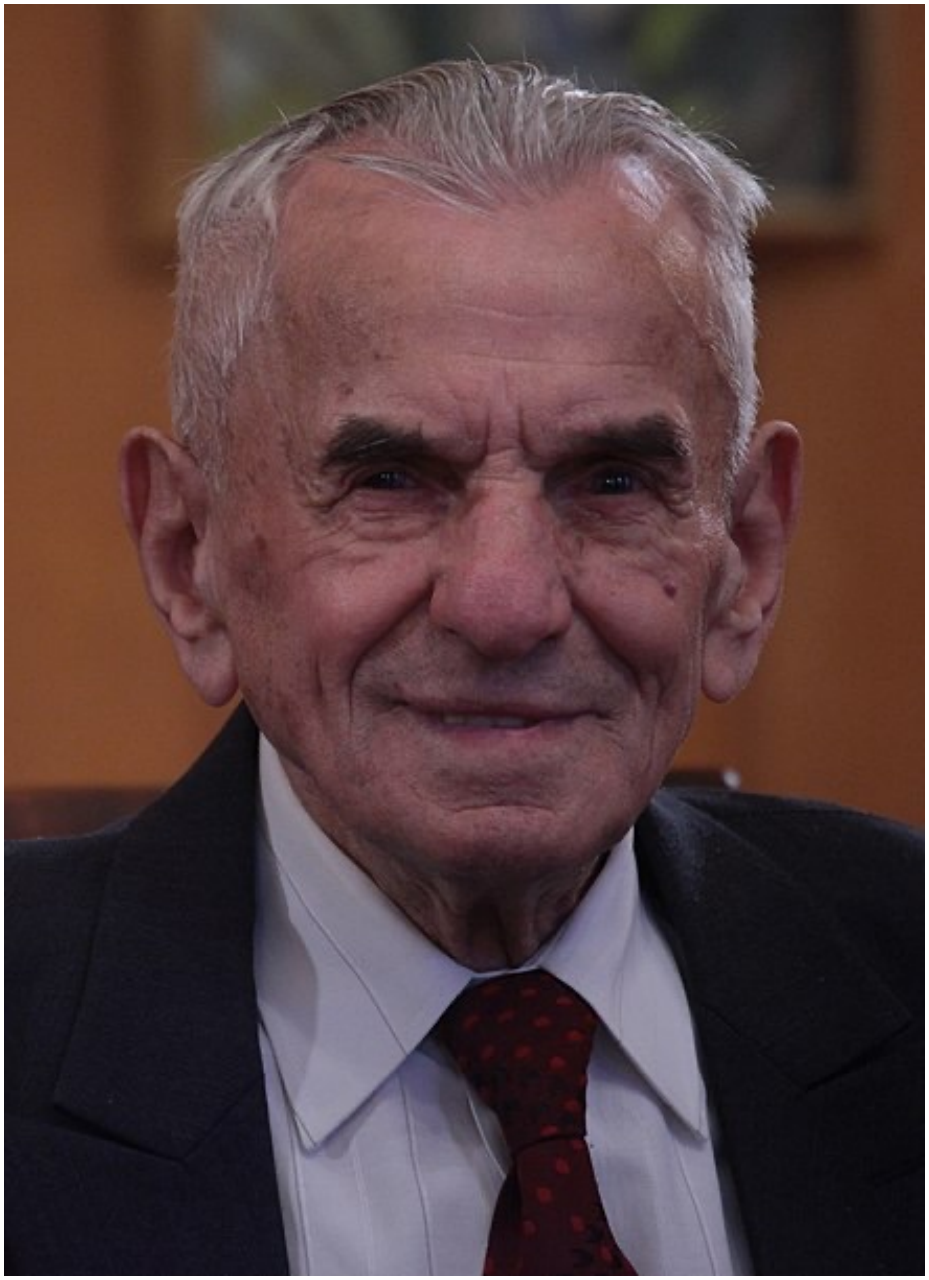
Physical fitness confers resilience: Regular exercise and/or physical activity induces positive physiologic and psychological benefits, protects against the potential consequences of stressful events, and prevents many chronic diseases

- Stanley Kowalski was born on April 14, 1910 in Rogówek, Poland.
- His mother lived to be 99; other long-lived relatives.
- He ran a farm and worked as a railroad lineman.
- Always rode to work on a bicycle regardless of the weather.
- He didn't begin running for recreation until age 92. He claims to run 10K each day in any weather.
- At 104 ran the 100m in 32.79 seconds to become the oldest man to have run the race, besting a 103-year-old Japanese man Miyazaki Hidekichi.
- He became the oldest living man in Poland after the death of 108 year old Józef Żurek on March 19, 2018, and died on April 5, 2022, 9 days short of his 112th birthday.

- By virtue of his age being beyond 105 years old, he necessitated the creation of a new age division for World Masters Athletics, the M105 division of which he was one of only 2 members to have ever competed: sprint, shot put, discus

- He credited his longevity to never going to the doctor and doing whatever he wanted.

- He also said he didn't eat much and not during the evening.



More Common: Ageing with Accumulated Deficits

High Frailty Index Score

'Unsuccessful aging'

- Age 87
- Widower, lost wife to Alzheimer's Disease

- Polio, post-polio syndrome
- TIAs, 2 Strokes
- Clinical Depression
- Chronic Atrial Fibrillation
- Aortic Valve Replacement
- Cardiac Arrest, Pacemaker
- Prostate disease surgery
- Bladder cancer
- Arthritis
- Hernias, inguinal and femoral
- Bowel obstruction, surgical repair
- Rotator cuff disease

medicina

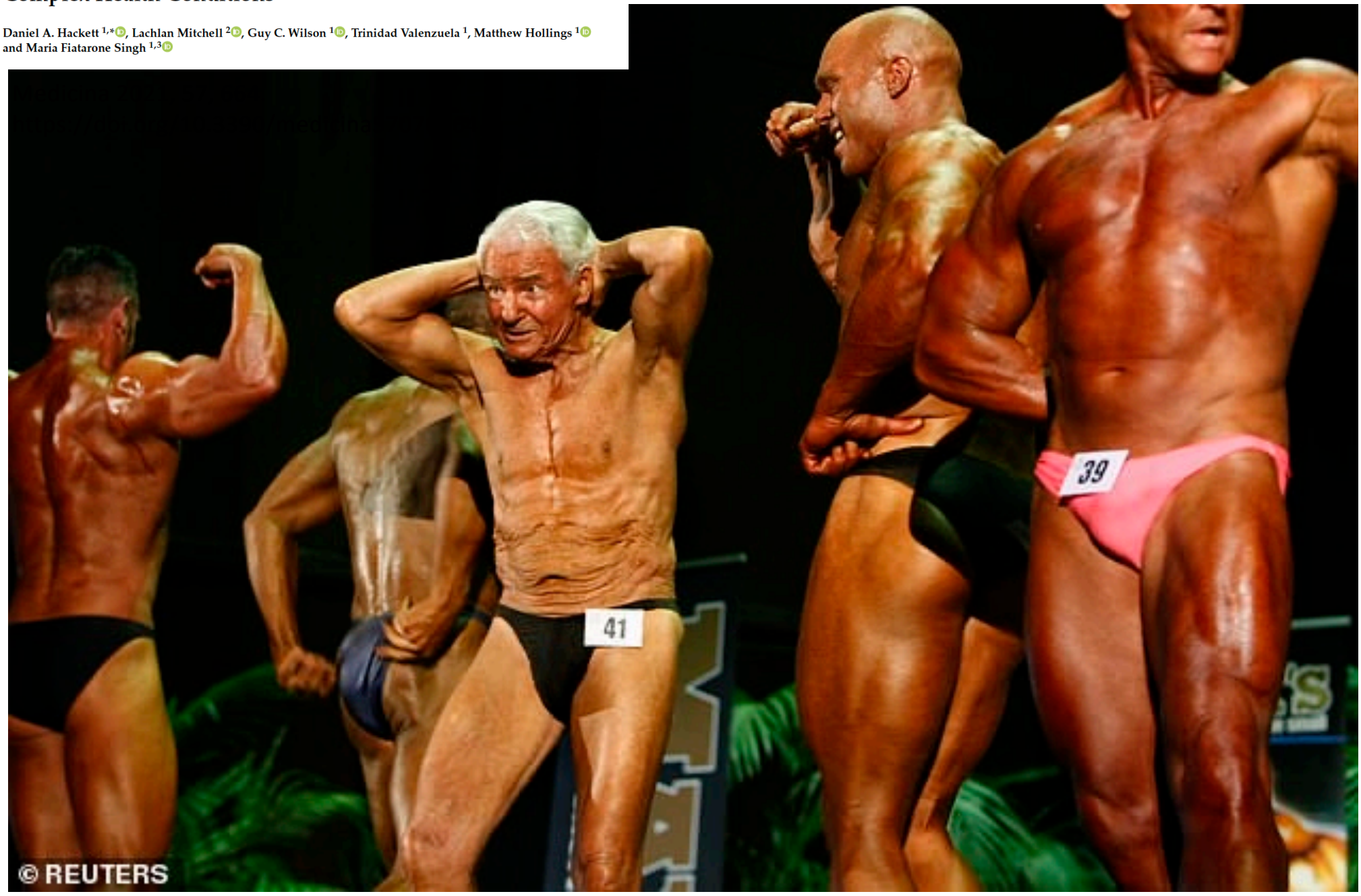
MDPI

R.I.P. *Ray Moon*
Legend

Case Report

A Case Study of an 87-Year-Old Male Bodybuilder with Complex Health Conditions

Daniel A. Hackett [1,*], Lachlan Mitchell [2], Guy C. Wilson [1], Trinidad Valenzuela [1], Matthew Hollings [1] and Maria Fiatarone Singh [1,3]



Body Composition Ray Moon

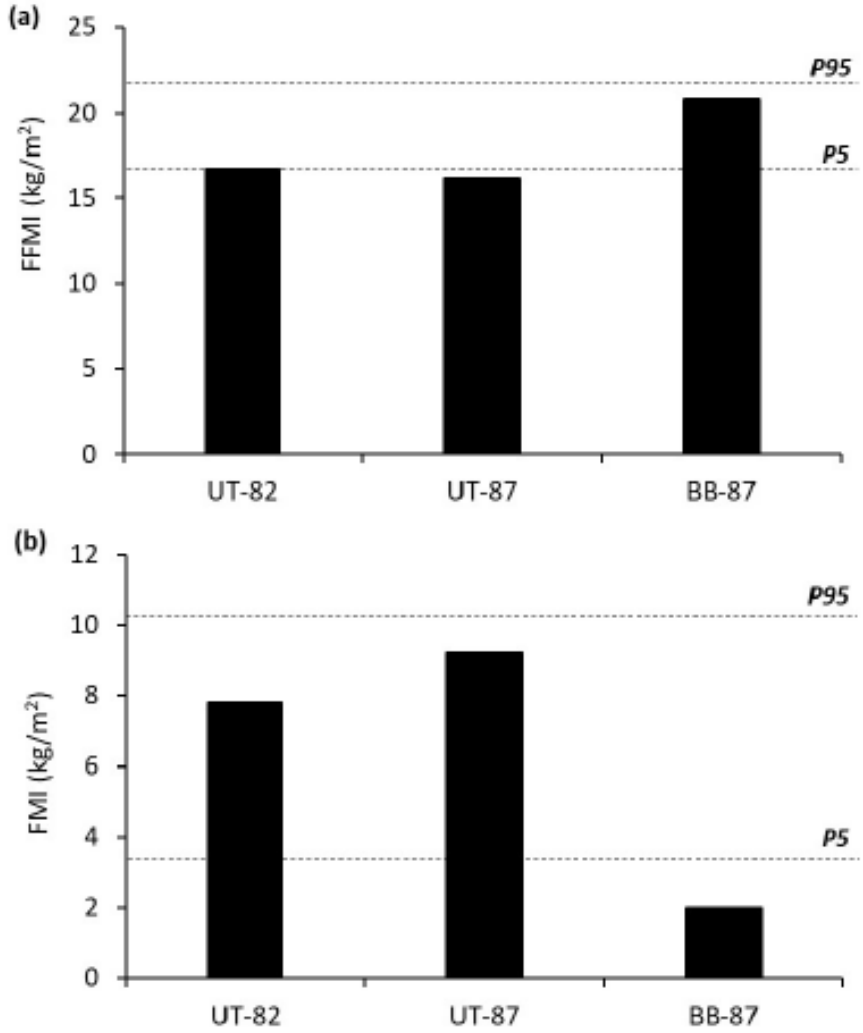
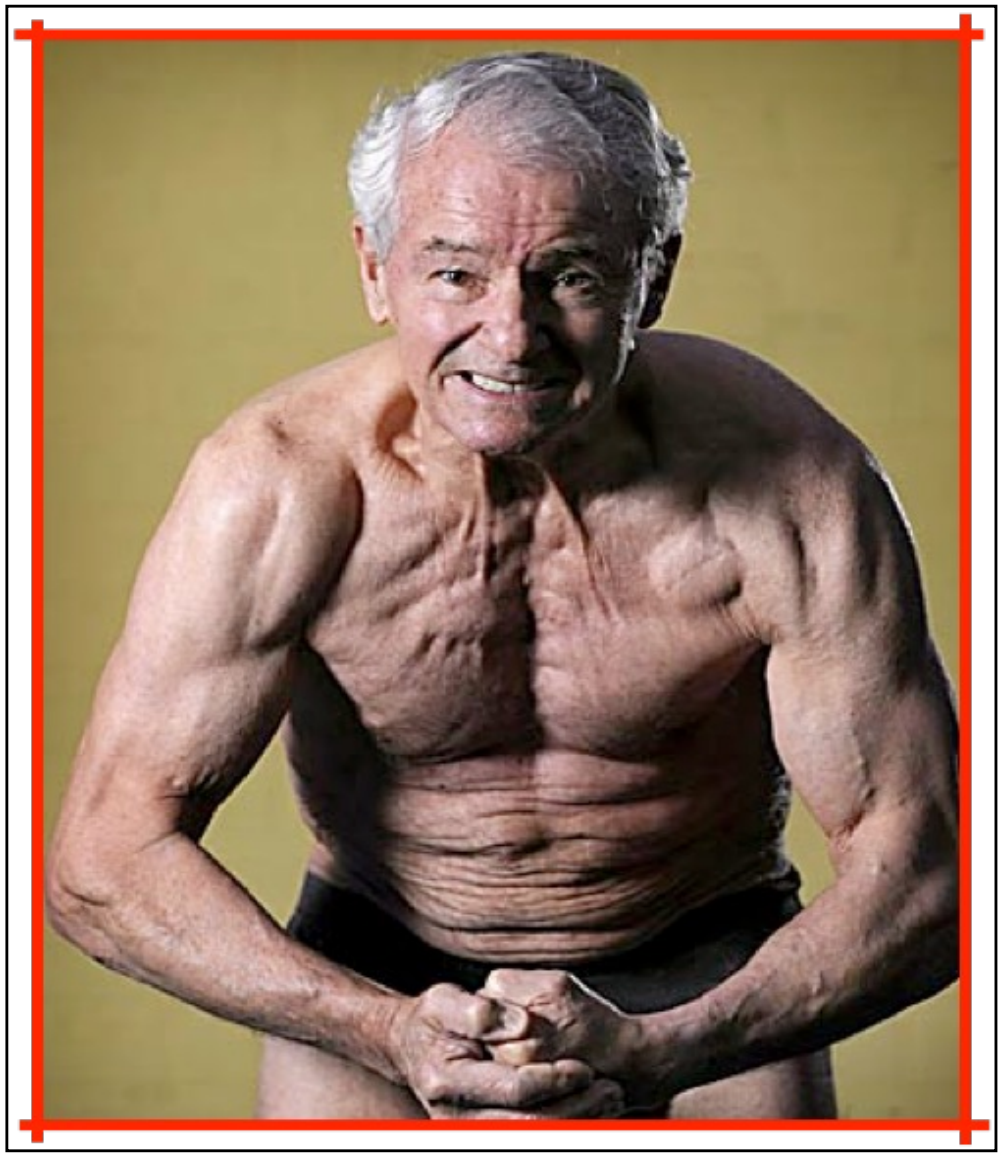


Figure 1. Comparison between the 87-year-old bodybuilder and untrained older males of a similar age for (a) fat-free mass and (b) fat mass indices. UT-82y = untrained male aged 82 years; UT-87y = untrained male aged 87 years; BB-87y = bodybuilder aged 87 years; FFMI = fat-free mass index; FMI = fat mass index; *P95* = 95th percentile; *P5* = 5th percentile.

Ray Moon: Resilient to the end



R.I.P died at age 90, robust, still bodybuilding

Despite facing much personal adversity, *Accumulated Deficits* and 'Unsuccessful Ageing" (according to Harvard Profs!)

What about frailty?

- Shrinkage (weight/LBM loss)
- Slowness
- Strength loss
- Sedentariness
- Sleepiness (fatigue)

Fried LP, Tangen CM, Walston J, Newman, AB, Hirsch, C, Gottdiener, J, Seeman, T, Tracy, R, Kop, WJ, Burke, G, McBurnie, MA (Mar 2001). "Frailty in older adults: evidence for a phenotype". The Journals of Gerontology. Series A, Biological Sciences and Medical Sciences. ***56*** *(3): M146–56.*

We have no drugs for ageing, frailty, mobility impairment and many of its co-morbidities and risk factors…

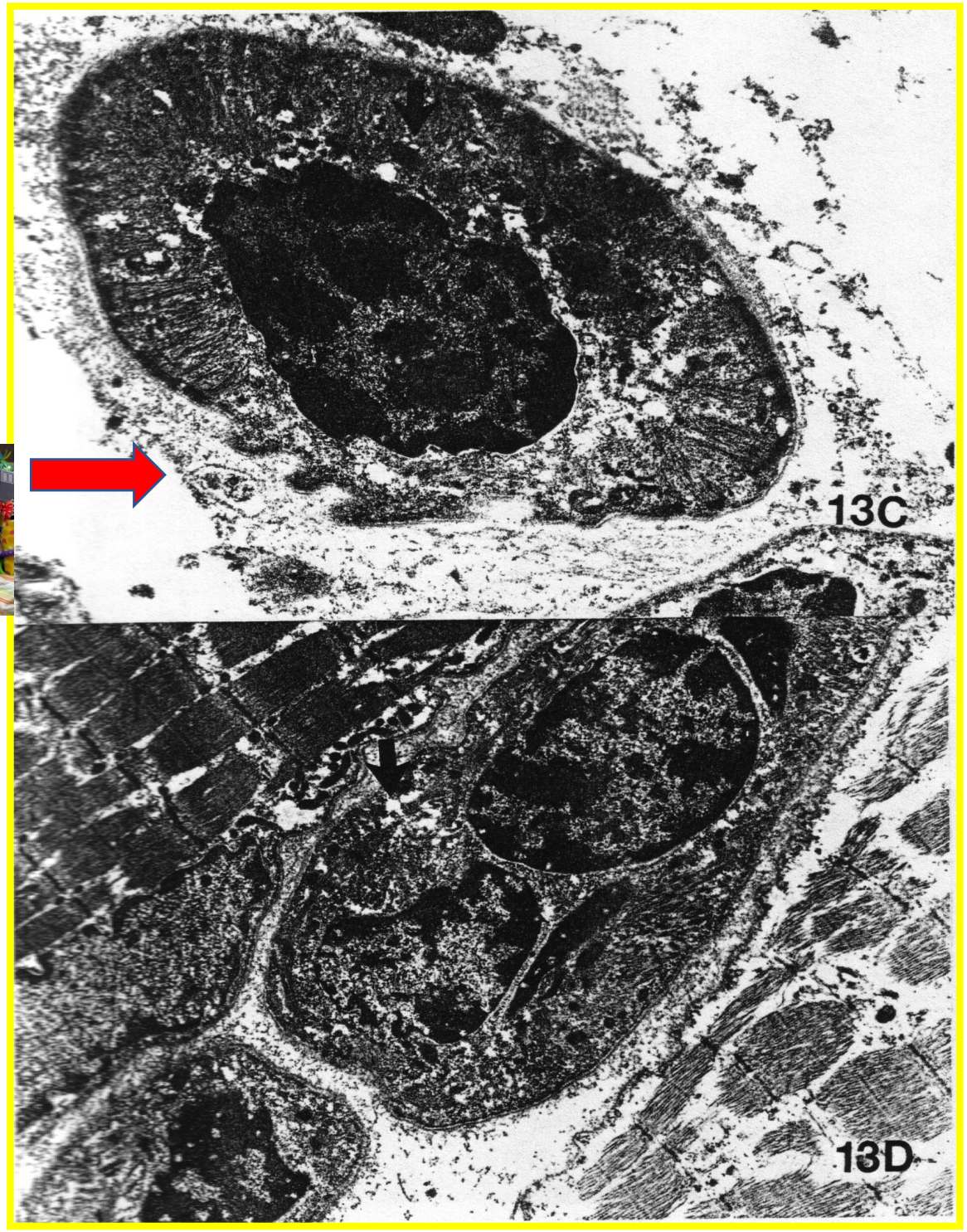
- Poor balance
- Slow gait speed
- Sedentariness
- Sarcopenia
- Wasting/anorexia
- Fatigue
- Poor endurance
- Isolation/loneliness
- Inflammation
- Adipose accumulation
- Injurious Falls
- Low self-efficacy
- Poor sleep quality/quantity
- Poor quality of life/loneliness
- Cognitive impairment
- Functional dependency

Back to the beginning…

- Boston FICSIT Study
- 100 frail nursing home Residents aged 80-103
- Randomised to Weight lifting, Nutritional supplement, both, or double Placebo
- 10 weeks intervention/control
- Sarcopenia (muscle wasting) and related outcomes

Fiatarone, MA *N Engl J Med* 1994; 330:1769-1775

Baby muscle cell



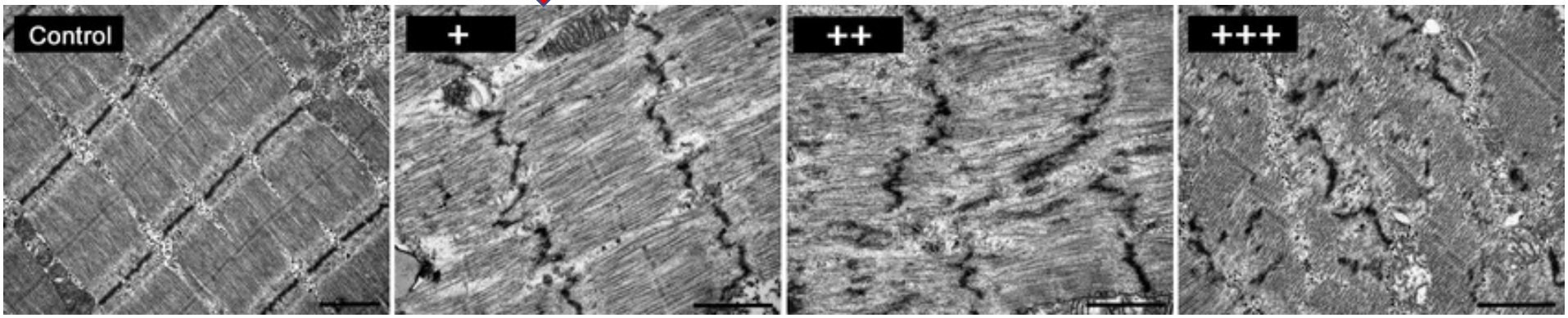
Satellite cell activation, myoblasts and myotube appearance, increased fiber size after 10 weeks of weight-lifting in **FICSIT** Study

Fiatarone Singh, NEJM 1994; AJP 1999

That which does not kill me…

Eccentric muscle *damage* leads to muscle hypertrophy and strength gain

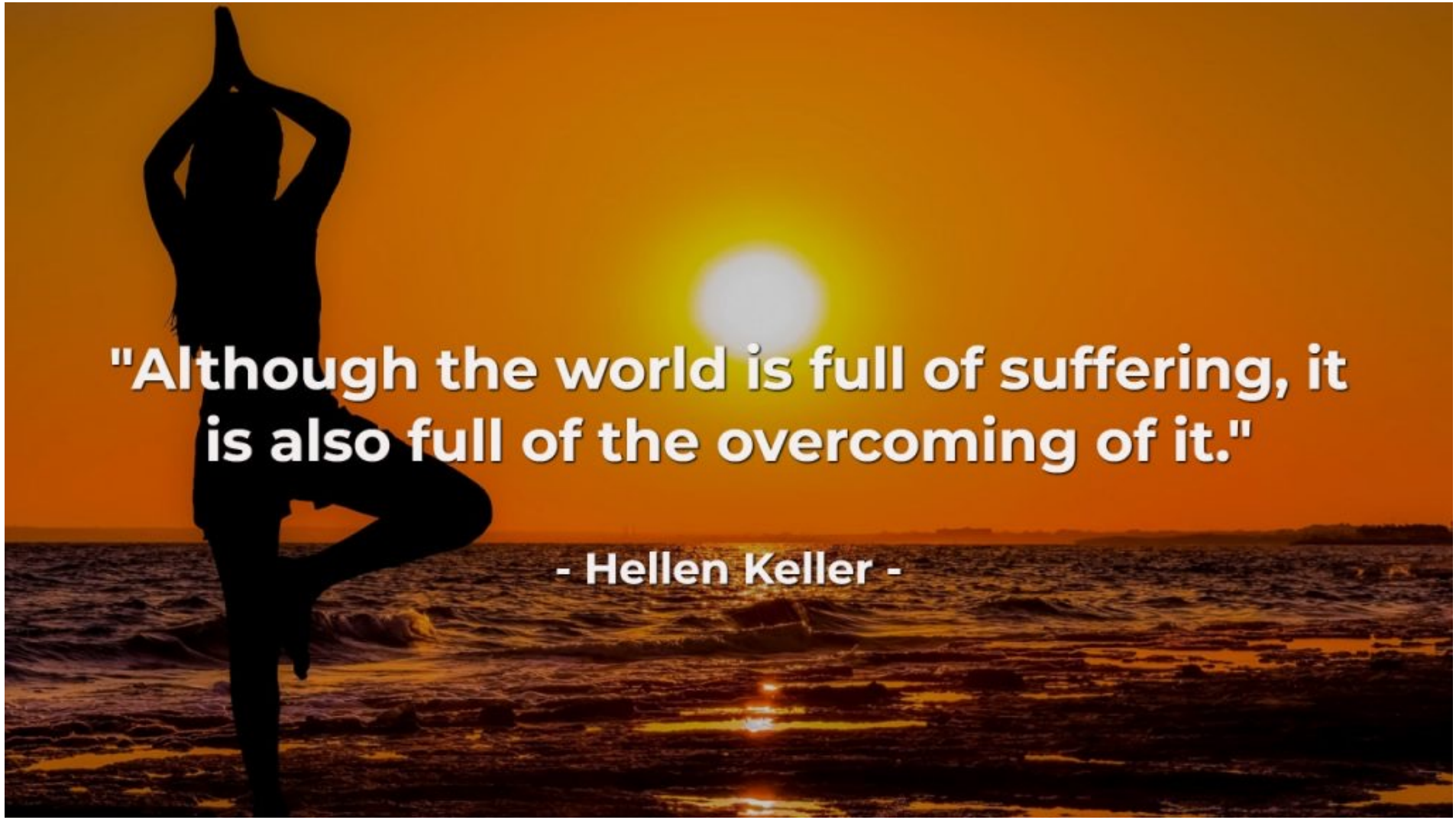
Measured exposure to stress, rather than *avoiding* it led to adaptation and regeneration



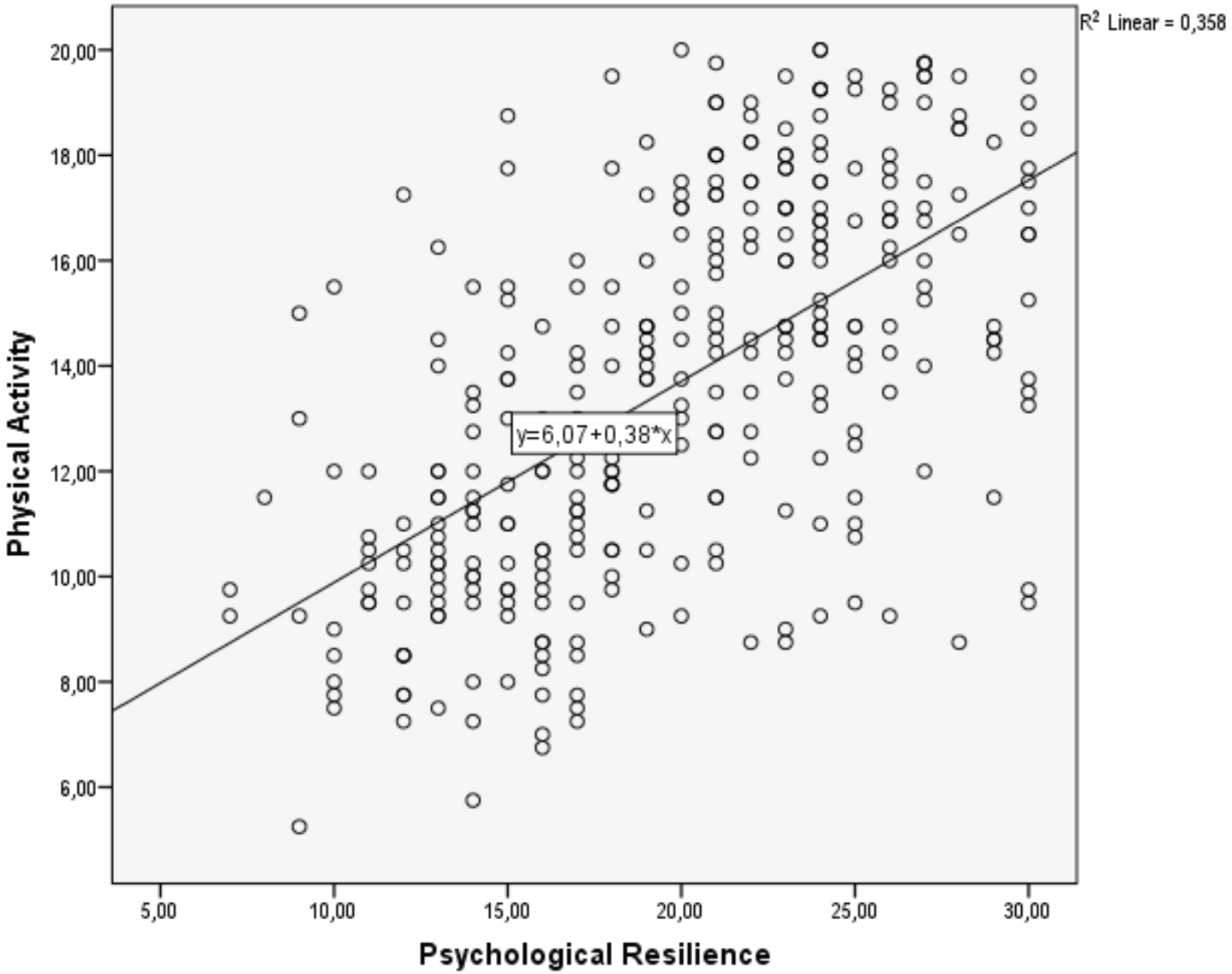
Moving to the brink of disaster

Move to the limits of sway to prevent falls

Exercise and psychological resilience



Physical activity levels associated with psychological resilience



How does exercise increase psychological resilience?

Exercise for psychological resilience benefits:

- Depression
- Anxiety
- Stress
- Insomnia
- PTSD
- Chronic Pain
- ADHD
- Substance use disorders


RESILIENCE
FITNESS
MAZE
BAR

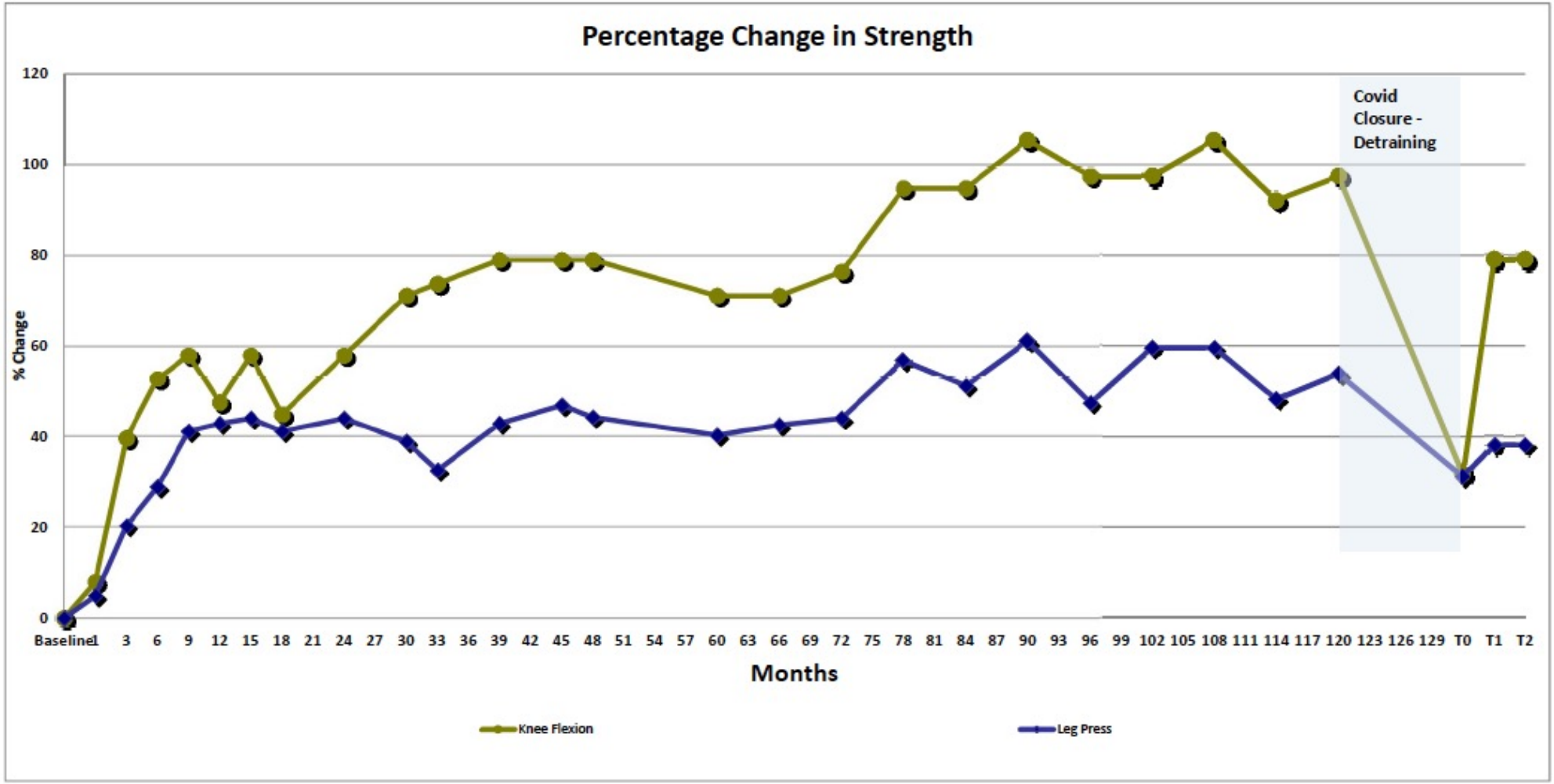
Thriving in unexpected situations

Sylvia

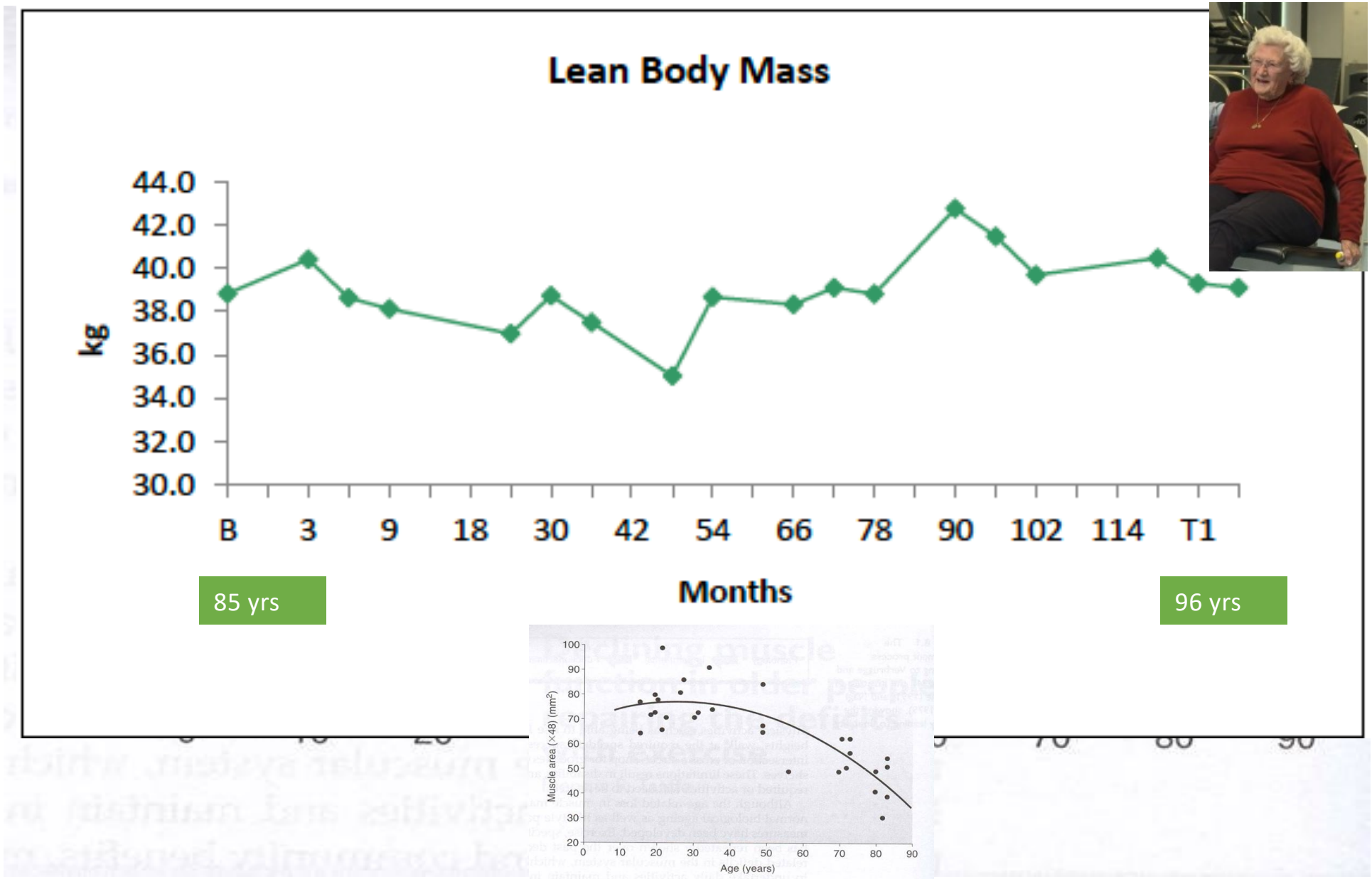
Training at Centre for Strong Medicine for approx. 11 years

Body weight stable 72.9kg

COVID detraining period 7 months in 2020; Now re-training



Changes in Muscle Mass with Ageing



Recovering muscle strength after renal failure during dialysis

The **PEAK** Study

St. George Hospital

Cheema, Fiatarone Singh

Strength and Power Training in Acute Hospital Setting

JAMA Internal Medicine | Original Investigation

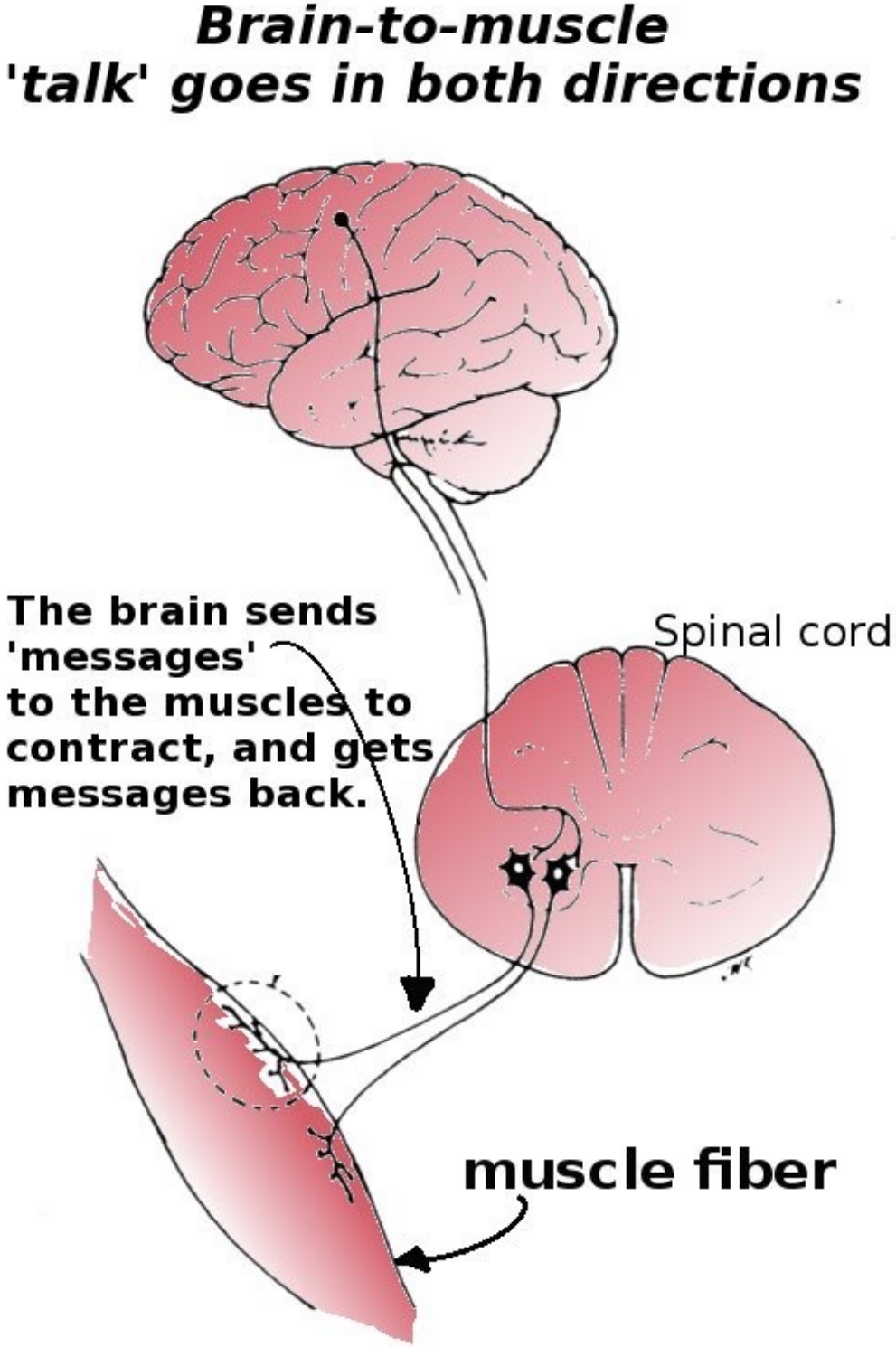
Effect of Exercise Intervention on Functional Decline in Very Elderly Patients During Acute Hospitalization
A Randomized Clinical Trial

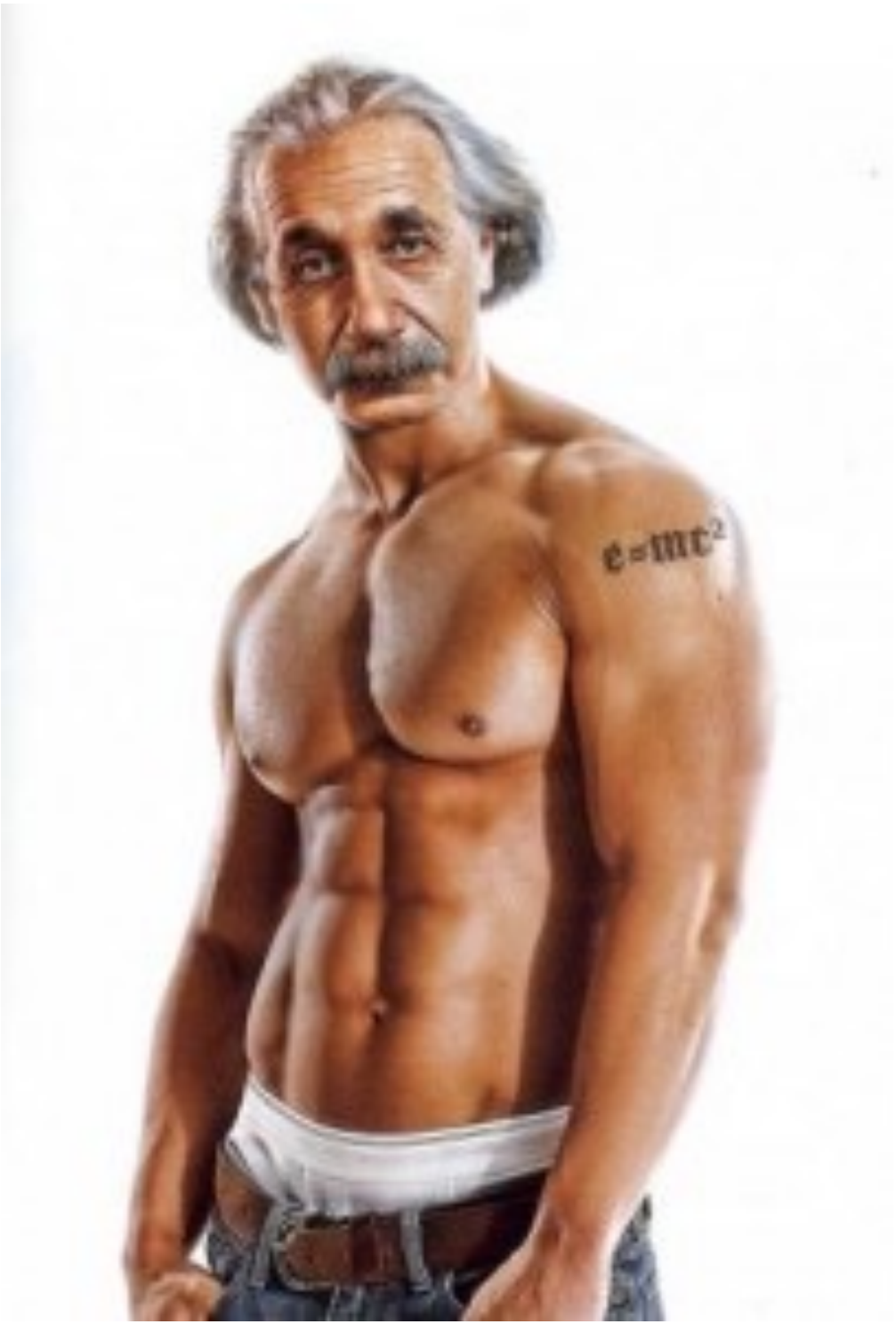
Nicolás Martínez-Velilla, PhD, MD; Alvaro Casas-Herrero, PhD, MD; Fabricio Zambom-Ferraresi, PhD; Mikel López Sáez de Asteasu, MSc; Alejandro Lucia, PhD, MD; Arkaitz Galbete, PhD; Agurne García-Baztán, MD; Javier Alonso-Renedo, MD; Belen González-Glaria, PhD, MD; María Gonzalo-Lázaro, MD; Itziar Apezteguía Irálzoz, PhD, MD; Marta Gutiérrez-Valencia, PharmD; Leocadio Rodríguez-Mañas, PhD, MD; Mikel Izquierdo, PhD

JAMA Intern Med. doi:10.1001/jamainternmed.2018.4869
Published online November 12, 2018.

How does exercise foster resilience?

Modality of Exercise and Intensity *Matter*


Brain-to-muscle
'talk' goes in both directions
The brain sends 'messages' to the muscles to contract, and gets messages back.
Spinal cord
muscle fiber


E=mc²

Pathways to Cognitive Resilience and Disease Prevention

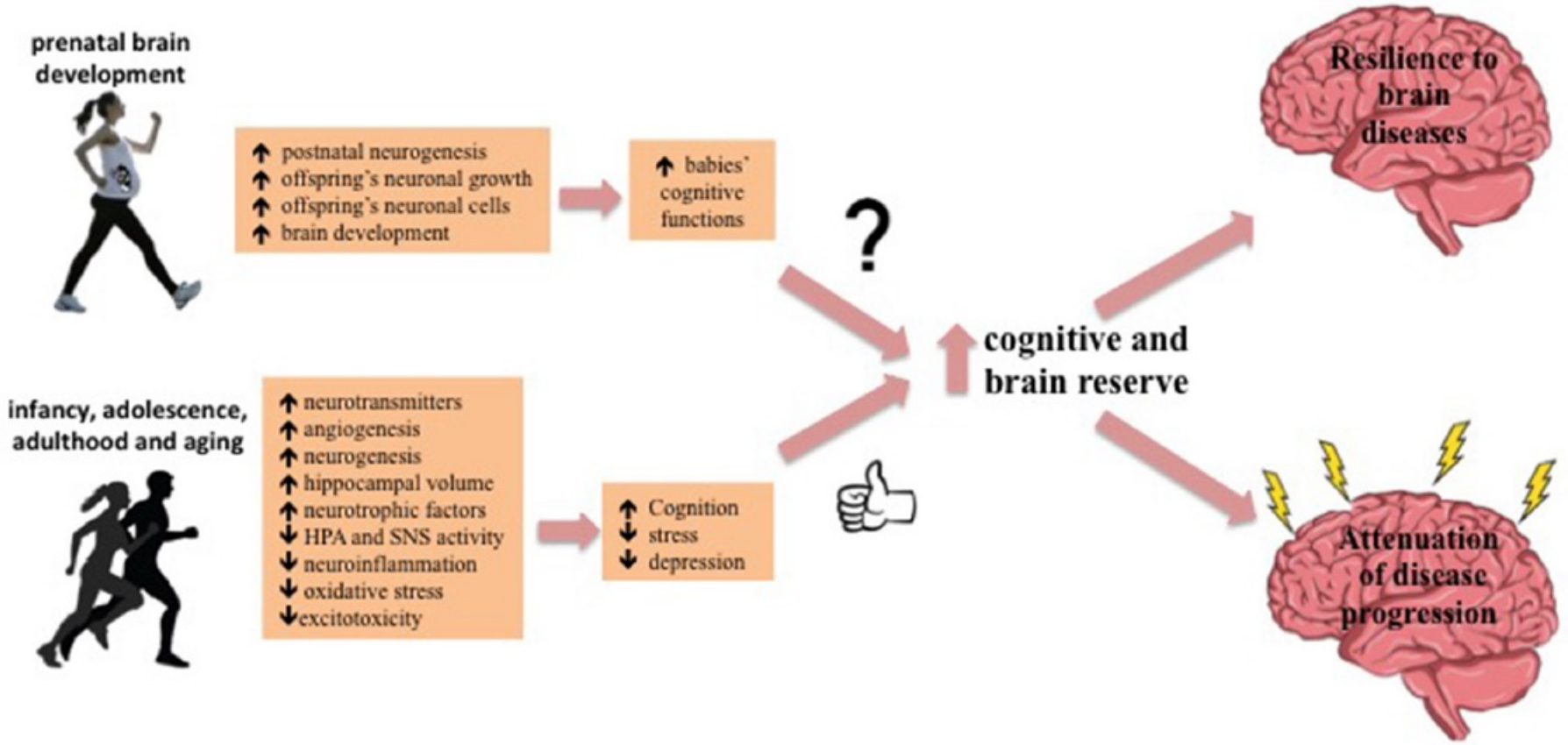


FIGURE 2 | Model of how exercise can confers brain resilience. Exercise positively influences brain and cognitive reserve by multiple pathways, protecting against the consequences of stressful events, improving health, and reduce the risk of chronic disease.

Interface Focus

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Biological mechanisms underlying the role of physical fitness in health and resilience

Marni N. Silverman and Patricia A. Deuster

Physical fitness, achieved through regular exercise and/or spontaneous physical activity, can protect against the development of chronic stress and inflammatory-related disease by:

- lowering physiological and neuroendocrine stress responses to stimuli
- promoting an anti-inflammatory state
- enhancing neuroplasticity and growth factor expression.

Applying lessons from adoption of physical activity to other areas of life

Resilience

‘The mission of medicine is the assertion and the assurance of the human potential’

Dr. Walter Bortz II
93 yr old geriatrician, author, runner

Promoting resilience and reducing the incidence and long-term morbidity and mortality of frailty requires a *paradigm shift* to treat the modifiable frailty components and risk factors, themselves, in particular *inactivity, sarcopenia, depression, isolation, loneliness, and malnutrition* as primary, rather than focus only on potentially less remediable features of chronic disease pathology and progression.

Dedicated to -

Helene Freundlich

January 27, 1892- May 20, 1995

Holocaust Survivor

Weight-lifter

Our First Volunteer at age 96

Our Oldest Volunteer at age 103

Fiatarone, MA *JAMA*. 1990;263(22):3029-3034
Fiatarone, MA *N Engl J Med* 1994; 330:1769-1775