

# CAN ADVENTURE PREVENT DEMENTIA?

## Untangling the mechanisms of cognitive reserve

### WHY ARE SOME PEOPLE'S BRAINS RIDDLED WITH AMYLOID PLAQUES YET THEY REMAIN COGNITIVELY INTACT?

Thirty years ago, Columbia University neuropsychologist Yaakov Stern observed that people with a higher education or more intellectually challenging occupation were less likely to develop Alzheimer's. He postulated that mental stimulation might impart a buffer against the onset of clinical symptoms and coined the term 'cognitive reserve'. At first ridiculed by his colleagues, the concept of cognitive reserve is now recognised as a critical piece of the dementia prevention puzzle.

### WHAT IS COGNITIVE RESERVE (CR)?

Cognitive reserve is the ability of the brain to continue functioning despite the presence of structural damage (amyloid beta A $\beta$  plaques and tau tangles). CR is like having a second income stream. If you lose one job, you still have funds to keep you going. Similarly, if we lose one circuit in the brain, CR means we have alternative pathways to accomplish the same cognitive task.

**WHAT ARE THE NEURAL UNDERPINNINGS OF COGNITIVE RESERVE?** Loss of cognitive functions in Alzheimer's disease is linked to the degradation of dendritic spines leading to a loss of synapses. Conversely, preservation of synapses strongly correlates with resilience to dementia. How might we preserve our synapses? Researchers led by Jeremy Herskowitz from the University of Alabama at Birmingham have identified several proteins that regulate dendritic spine length & density, and act as mediators of cognitive reserve. These include neuritin (NRN1) & Twinfilin-2. When we engage in activities that stimulate cognitive processes, we increase levels of NRN1, which helps to preserve existing synapses and create new ones.

**Rats who are made to overcome obstacles to obtain food, have larger forebrains and are smarter than rats who are given food without needing to work for it.**



### HOW CAN WE BUILD COGNITIVE RESERVE?

CR is not only built up through lifelong learning, creative pursuits, problem-solving, social activities and seeking out new experiences, but also through aerobic exercise and strength training. Weaker hand grip strength is associated with a weaker memory, poorer cognition and shorter life expectancy.

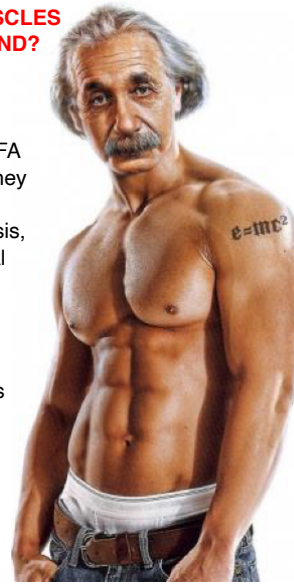


### HOW DO STRONGER MUSCLES CREATE A STRONGER MIND?

Putting our muscles to work through aerobic and resistance training delivers proteins BDNF, IGF-1, VEGFA & irisin to the brain, where they stimulate neurogenesis, synaptogenesis, angiogenesis, neuronal repair, and removal of toxins including A $\beta$ .

In addition, carriers of the APOE4 gene nullify their increased risk of Alzheimer's if they engage in regular moderate to high intensity physical exercise.

We don't get weak as we get old. We get old if we allow ourselves to get weak.

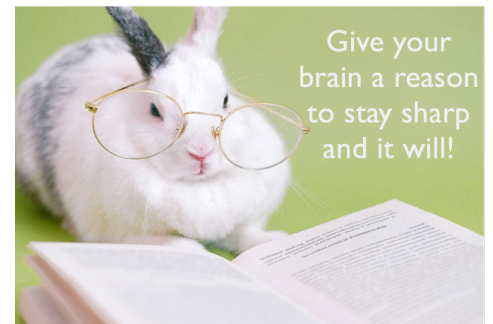
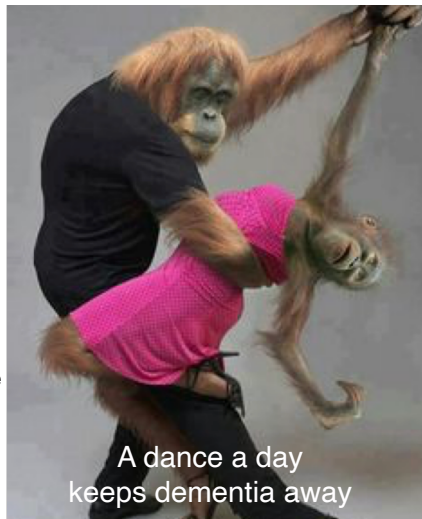


### WHAT IS COGNITIVE DEBT (CD)?

Complementing the Cognitive Reserve Hypothesis is the Cognitive Debt Hypothesis: **persistent negative states of mind induce a chronic stress response that erodes brain function.**

Researchers at University College London found that repetitive negative thinking (RNT) — also known as perseverative cognition — can change the structure & function of our brain and predispose to Alzheimer's.

A study of 350 men & women over the age of 55 revealed that those who habitually criticised themselves, focused on regrets, ruminated about past failures & worried about the future had greater decline in memory & thinking skills than people who were more positive & optimistic. The ruminators also had higher amounts of A $\beta$  & tau. The key word is 'repetitive'. Everyone sometimes feels despondent but if it becomes a person's default mode of thinking, **pessimism impairs cognition.** This is an astonishing finding: our **thoughts have a physical impact on our brain.** Toxic thoughts produce toxic molecules such as Corticotropin Release Factor (CRF), which lead to reduced brain blood flow (cerebral hypoperfusion), increased inflammation & depletion of brain cell energy.



### KEY FINDINGS

- The first step to ageing better is to feel better about ageing.
- Our brain doesn't stop learning because we get old. Our brain gets old if we stop learning.
- The process of learning — whether or not we attain mastery — is what builds CR.
- The younger the age of retirement, the earlier the age of dementia onset.
- Brain changes leading to Alzheimer's start 30 years before any symptoms. Therefore, it's never too early to build CR. Equally important, it's never too late to make positive lifestyle changes that can boost brain function.
- Just because it doesn't come in a pill, doesn't mean it isn't powerful.
- **Education is more powerful than medication.**

