

Brain Cross Training

Exercise for Brain Training

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Foreword

My training is in cognitive neuroscience. I earned my doctorate from Carnegie Mellon and the University of Pittsburgh's flagship [Center for the Neural Basis of Cognition](#) program. I have since worked as a Lecturer/Assistant Professor at the University of Cambridge's [Experimental Psychology Department](#) – the top ranking Psychology Department in the top ranking University in the UK - where the basis of IQ Mindware's training program was devised.

In this series of eBooks I present you with the most effective, evidence-based cognitive interventions within a brain 'cross training' paradigm that combines computerized brain training with other strategies to improve brain health, resilience, performance and creativity.

Enjoy your training!

Mark



Mark Ashton Smith, Ph.D.

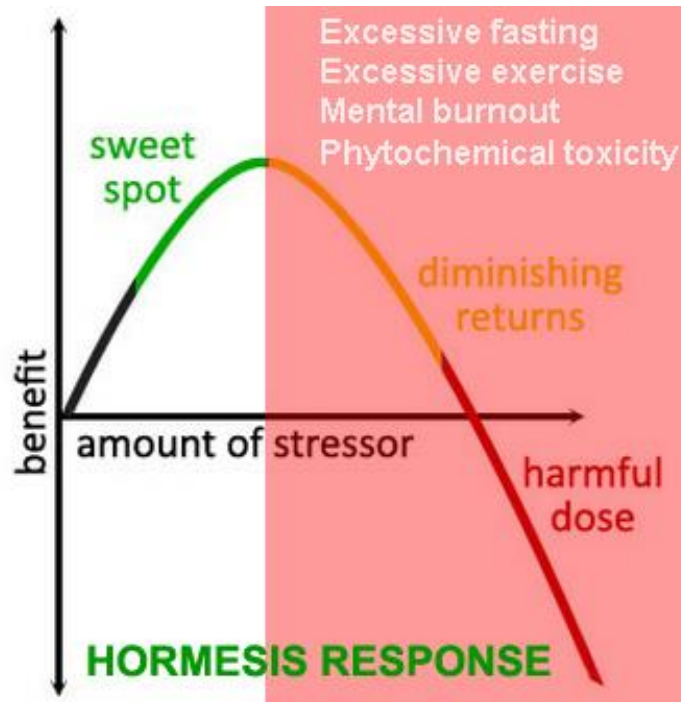
[Personal Website](#)

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Hormesis and Vitagenes

In the previous eBook we learned that stress – in the right doses and applied at the right times – is highly beneficial for the brain and body. We can harness it in brain cross-training programs using the **hormesis response**.



Without stress, the vitagenes and adaptive cellular stress responses don't kick into action to build resilience, health and better brain functioning.

In this eBook we will be looking at exercise as a brain training strategy. Adopting an exercise plan that puts you in the **hormesis sweet spot** improves **neuroplasticity** for adaptive learning and **cell protection** for healthy brain cells.

Combining exercise with effective computerized cognitive training (e.g. IQ Mindware apps) can result in **hormetic synergies** for enhanced brain benefits.

General Health Benefits from Exercise

Numerous studies have demonstrated that via adaptive cellular stress response mechanisms exercise can result in:

- Reduced fat mass
- Increased **insulin sensitivity** and improves glucose metabolism
- Decreases **blood pressure**
- Increased **heart rate variability** (HRV) – a good index of overall mental and physical health
- Less **oxidative damage** during cell metabolism (due to free radicals) to tissues and DNA
- Less **inflammation**
- Better **autophagy** – the detoxification process whereby your cells eliminate waste material and repair themselves)
- Protection against multiple **age-related diseases** including cancers, cardiovascular disease, diabetes, a (amount of blood glucose is too high) and sarcopenia (degenerative loss of skeletal muscle mass)

Exercise for Brain Health & Performance

It has been known for a long time that exercise can promote brain health and performance.

Human and other animal studies demonstrate that exercise targets many aspects of brain function and has broad effects on overall brain health [including] learning and memory, protection from neurodegeneration and alleviation of depression. Exercise increases synaptic [neuro] plasticity. [Cotman, TRENDS in Neurosciences Vol.30 No.9](#)

Human and other animal studies demonstrate that exercise targets many aspects of brain function and has broad beneficial effects on overall brain health and performance including:

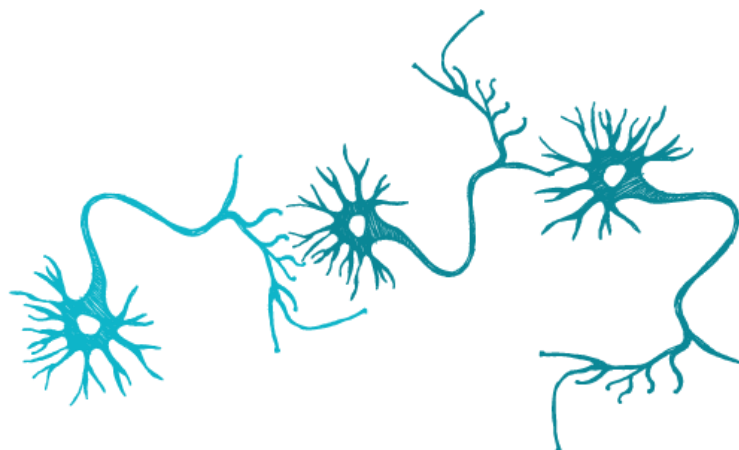
- Improved **learning** and **memory**
- **Protection** from **neurodegeneration**
- Increased **BDNF** and **neuroplasticity**
- **Improved mood** and **reduction of depression**

A key biological mechanism that explains the beneficial effects of exercise are [adaptive cellular stress responses](#) – discussed in the previous eBook. This set of responses to ‘good’ stressors trigger vitagenes responsible for widespread repair and regeneration processes in both the brain and body. Exercise stimulates this stress response at the cellular level throughout the brain and body – and engaging the **hormesis response** can **promote a host of health benefits outlined above, as well as optimal brain function and resistance to age-related brain diseases.**

We will now look at specific brain health benefits one by one. Much of this research can be found in [this Cell Metabolism review paper](#) and this [Nature Reviews Neuroscience paper](#).

Improved Neuroplasticity

Neuroplasticity is defined as the changes that occur in neural pathways and synapses (the communication points between brain cells) as **adaptive responses to environmental challenges**, including those that are voluntary (e.g., problem solving, learning skills, competing in sport) and those that are unwelcomed (e.g., a traumatic injury or disease). **Neuroplasticity is essential for learning and memory**, and as the brain ages it tends to become less neuroplastic.



Neurogenesis: The Growth of New Brain Cells

Neurogenesis is the creation of new brain cells (neurons) from neural stem cells. The new neurons can form synapses with existing neurons, thereby becoming part of a functional neural circuit.

- [Voluntary exercise such as running stimulates neurogenesis in the hippocampus of adult rodents.](#) The hippocampus is critical for learning and memory.



Improved Gene Regulation

Exercise switches on a number of **repair genes**.

- [Both exercise and fasting can induce the expression of neurotrophic factors including the BDNF gene](#). This protein promotes the **survival of nerve cells** (neurons) by playing a role in the growth, and maintenance of these cells. It also plays an important role in **neuroplasticity** which is important for learning and memory as described above.

Keeping the Aging Brain Young

Numerous studies show that exercise helps maintain **brain volume** and **buffer against loss of memory** and other cognitive functions that is associated with **loss of neuroplasticity** with aging ([ref](#)).

- [Aerobic exercise has been shown to aid in maintaining cognitive health by adding to volume of grey and white matter in the brain](#).
- [Elderly subjects who exercised for 4 months showed better blood flow and functional connectivity in brain areas need for memory and higher cognitive functioning](#).
- [Aerobic training for a year improved the aging brain's functional efficiency in higher-level brain networks and associated cognitive control](#).



Bertrand Russell who wrote his autobiography aged 96.

Brain Cross-Training: Exercise and CCT

The science tells us that different brain training strategies based on the principle of hormesis can work **synergistically**. The upregulation of the vitagenes for better brain health, resilience and performance can be enhanced if we choose a carefully customized program of multiple brain training strategies.

Combining exercise and computerized brain training (CCT) can result in enhanced cognitive performance outcomes ([ref](#)).

Summary

The evidence for the brain benefits of exercise, and incorporating exercise into standard computerized cognitive training (CCT), is conclusive. Exercise improves learning and memory, protects against neurodegeneration, increases neuroplasticity and the capacity to learn, improves mood and reduces anxiety and depression. These effects work synergistically with computerized cognitive training (CCT) such as the IQ Mindware apps.

In the next eBook, I will be looking at specific workouts that could be used for your personalized brain cross-training program.

IQ Mindware Apps

If you are interested in finding out more about the IQ Mindware app **i3** for brain performance and resilience, you can do so at [this website](#).

Combining exercise with IQ Mindware app training can result in **hormetic synergies** for enhanced brain benefits.