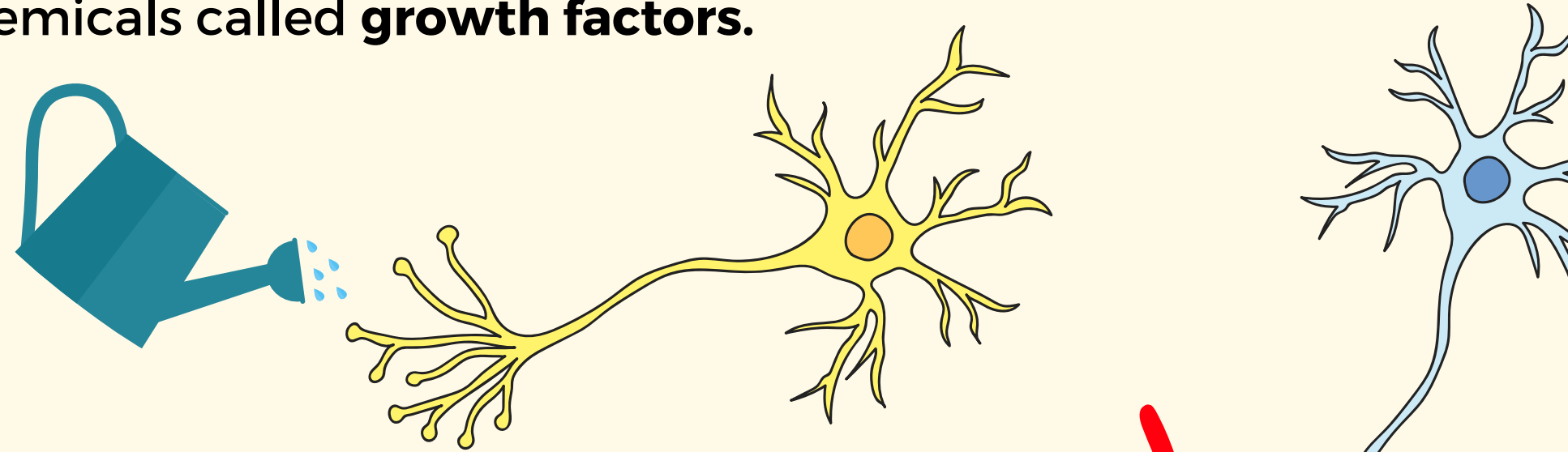


Exercise and learning

How does exercise affect the brain?

Exercise stimulates the brain to secrete chemicals called **growth factors**.

Growth factors are like a **fertilizer for learning!**

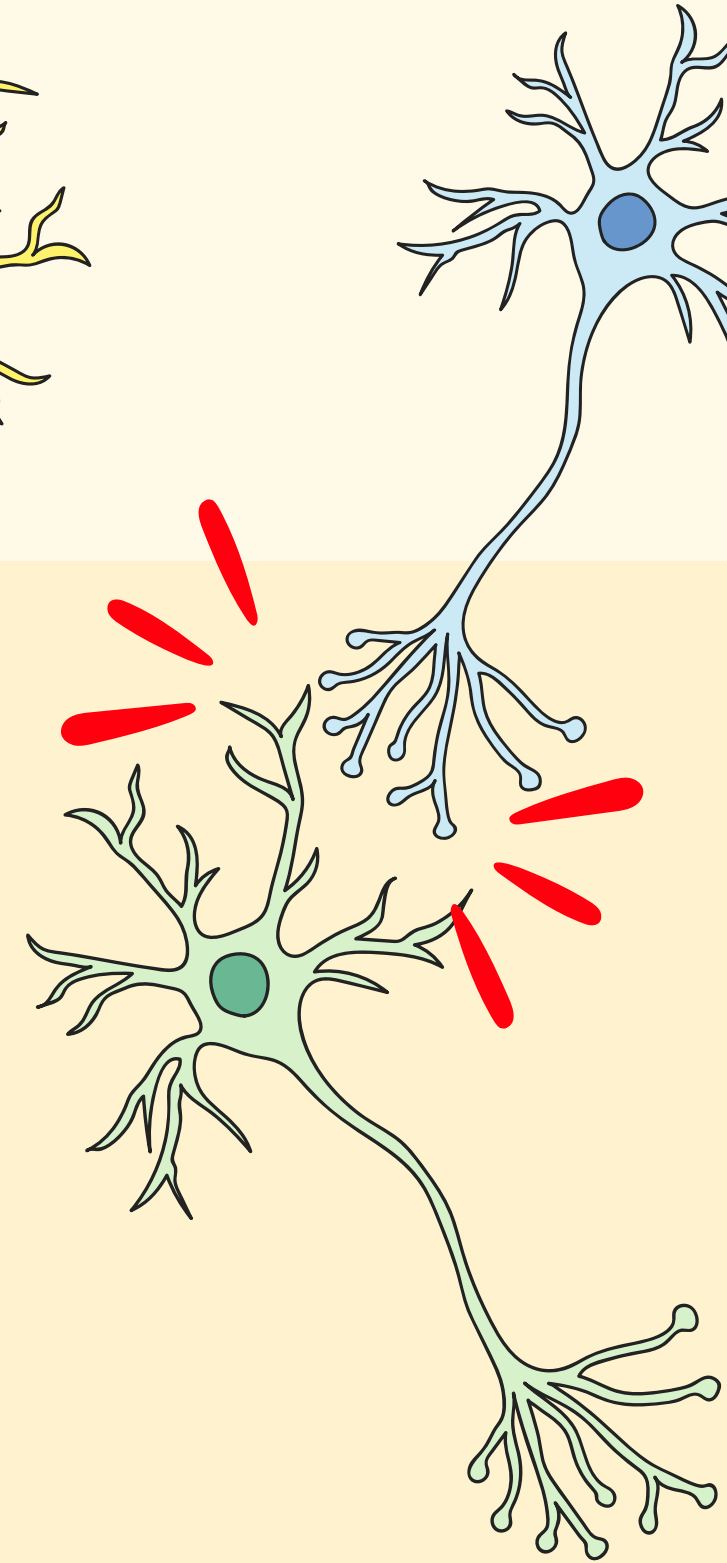


Growth factors support the **growth of neurons** and the **formation of new connections between neurons** - this is what underlies the creation of memories!

This neuronal growth:

1. Helps **cognitive functioning**.
2. Has been associated with the **growth of brain regions** related to memory.

Cognitive functions include **memory, attention, and executive functions!**

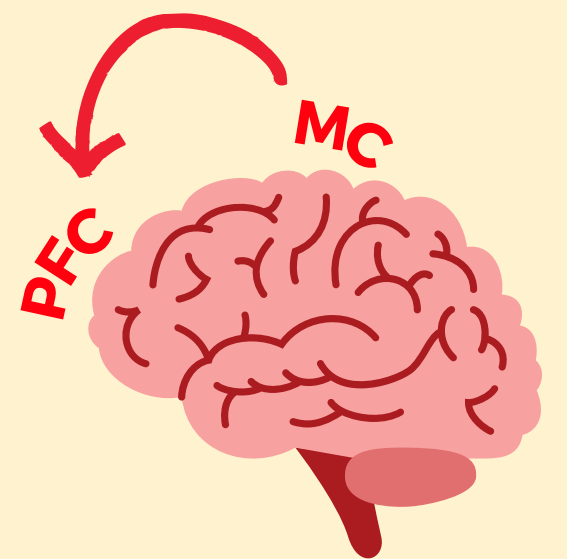


Important Brain Regions

- Hippocampus** → Associated with memory
- Prefrontal Cortex (PFC)** → Associated with executive functioning
- Motor Cortex (MC)** → Directs movement

Exercise also **strengthens the connectivity between** different brain regions such as the hippocampus, motor cortex, and the prefrontal cortex.

This makes it easier for these brain regions to communicate with each other!



Benefits of exercise

Memory

Exercise improves both short-term and long-term memory (Loprinzi et al., 2021).



Attention

Attention is heightened for up to **two hours** after exercise (Basso & Suzuki, 2017).

Executive function

Decision making skills and ability to self-regulate, plan, and juggle various ideas in working memory improve with exercise (Ferrer-Uris et al., 2022).



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Basso, J. C., & Suzuki, W. A. (2017, March 28). The effects of acute exercise on mood, cognition, neurophysiology, and neurochemical pathways: A Review. *Brain plasticity* (Amsterdam, Netherlands). Retrieved February 17, 2023, from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5928534/>

Loprinzi, P. D., Roig, M., Etnier, J. L., Tomporowski, P. D., & Voss, M. (2021, October 20). Acute and chronic exercise effects on human memory: What we know and where to go from here. *MDPI*. Retrieved February 16, 2023, from <https://www.mdpi.com/2077-0383/10/21/4812>

Exercise intensity

Low intensity exercise

- Light walking, exercise at a casual pace
- 4 - 6 times a week
- 15 minutes



Moderate intensity exercise

- Speed walking, yoga
- 2 -3 times a week sufficient for inducing neuronal change
- 11 - 21 minutes in duration

High intensity exercise

- Weight lifting, running, cycling, interval training
- 2 - 3 times a week
- 10 - 30 minutes



Choosing the right intensity

For memory and attention

Memory formation and attention abilities benefit most from **higher intensity** exercise (Ferrer-Uris et al., 2022).

For executive function

Executive function may benefit more from **moderate intensity** exercise (Ferrer-Uris et al., 2022).

Low intensity exercise can also be beneficial for mood, cognitive function, and attention.

Incorporating any movement in your routine will make a positive difference.

Caveat: too much exercise can result in **excess fatigue** and **dehydration** - diminishing cognition-enhancing effects.

It is important to make sure you do not over-exert yourself!

Timing exercise with learning

Are you:

A. **Looking to improve consolidation of information**

or

B. **Low on energy and looking for a boost**

Try working out **after** a study session!

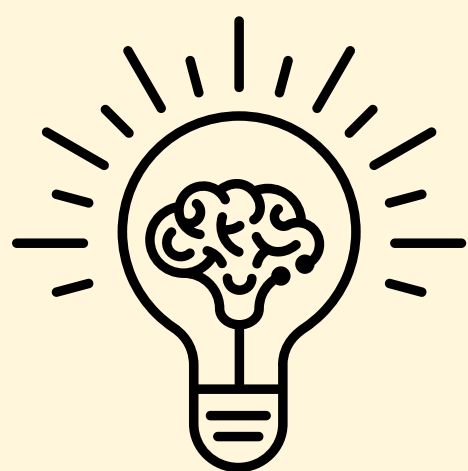
Increased concentration of growth factors will promote long-term information storage as growth factors help cement the neural connections holding information (Ferrer-Uris et al., 2022).

Try working out **before** your study session.

This will provide you with a surge of attention to get you through your studying (Ferrer-Uris et al., 2022).



More benefits of exercise



- Reduction of **anxiety** and **depression symptoms**
- Enhanced **mood** and **happiness**
- Strengthened **immune system**
- Increased **focus** and **motivation**
- Improved **sleep quality**

Check out the Student Wellness Hub's [Exercise for Wellness](#) Workshop!

Check out Teaching and Learning Services' [Sleep and learning](#) resource!



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