Physiology of Sport and Exercise

Neuro Control of the Movement

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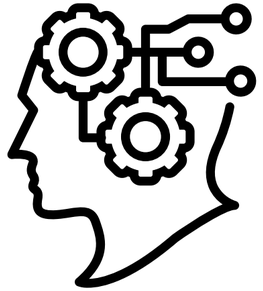
Learning Objectives

The basic structures of the nervous system

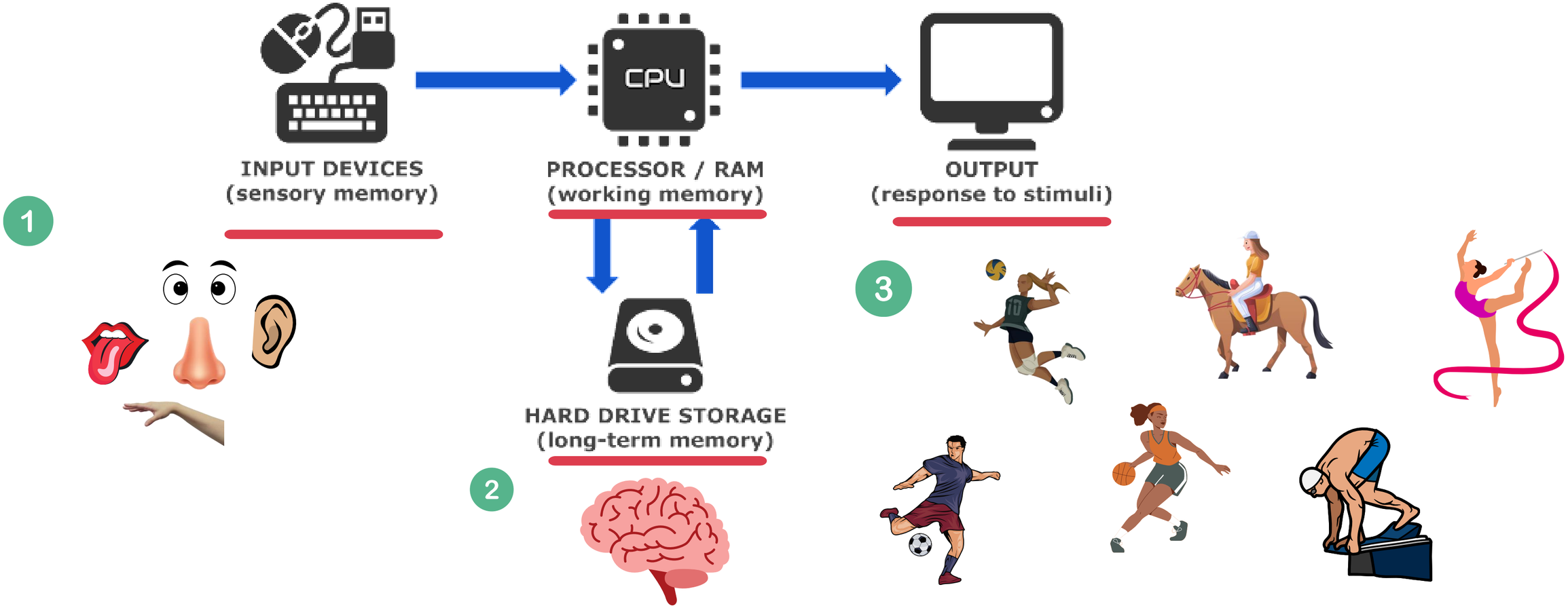
Motor control pathway

Example of study in neuroscience and sport

Information Processing Model

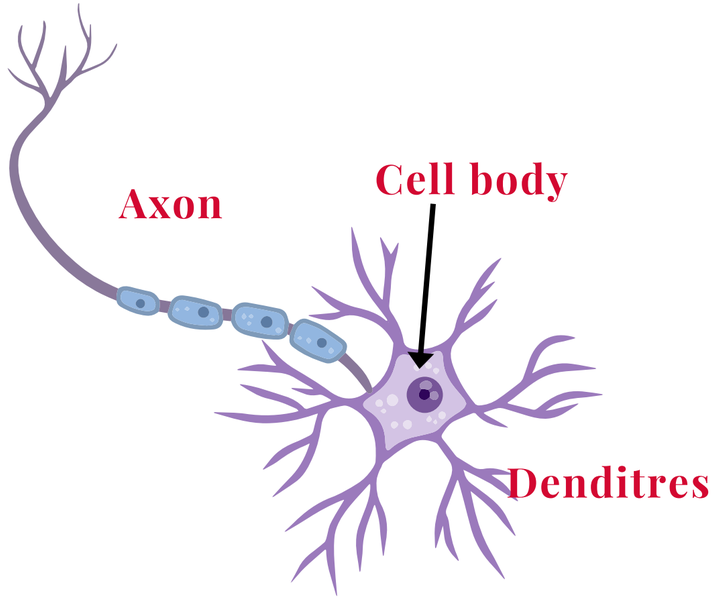


Brain similar to a computer in the information process



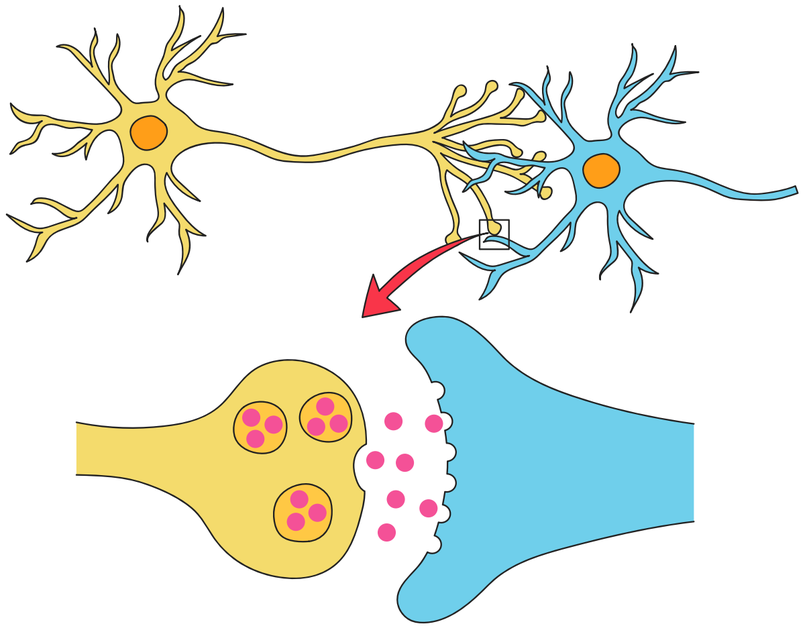
The neuron

Axon terminal



Smaller morphofunctional unit of the NS

Information transport



Synapse

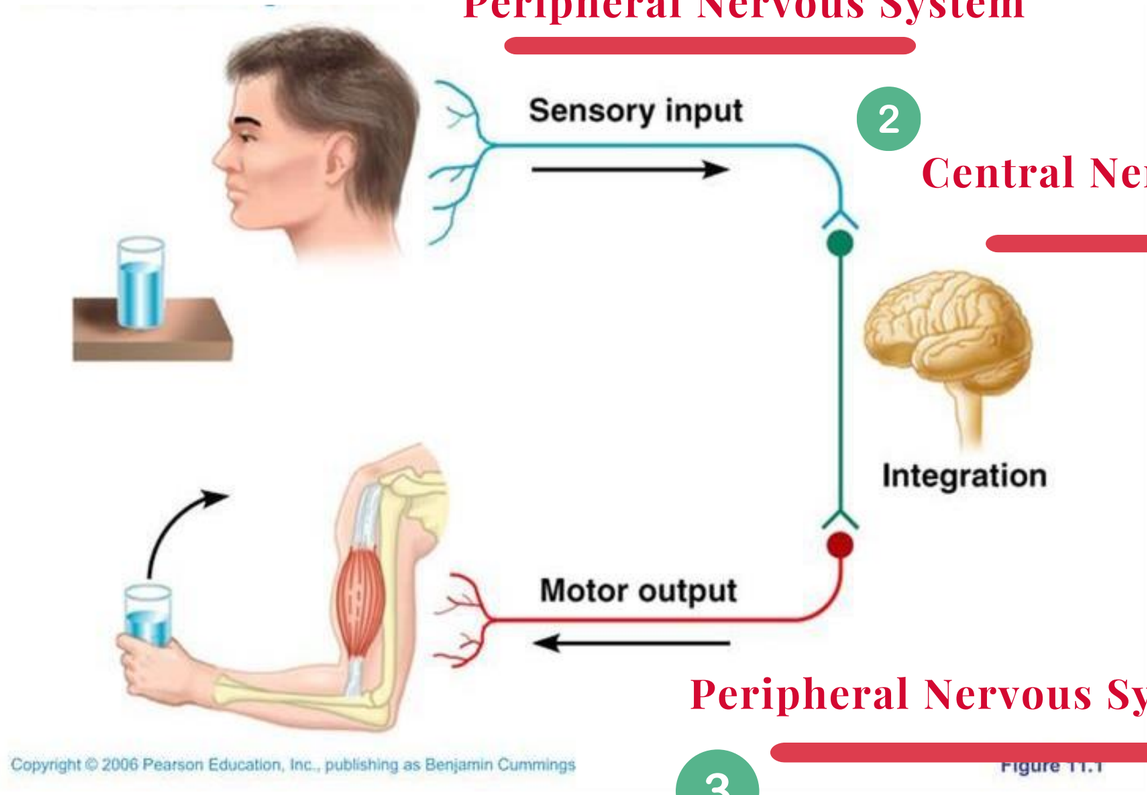
Point of connection and communication between neurons

one hundred million neurons ?

Nervous System

1

Peripheral Nervous System



2

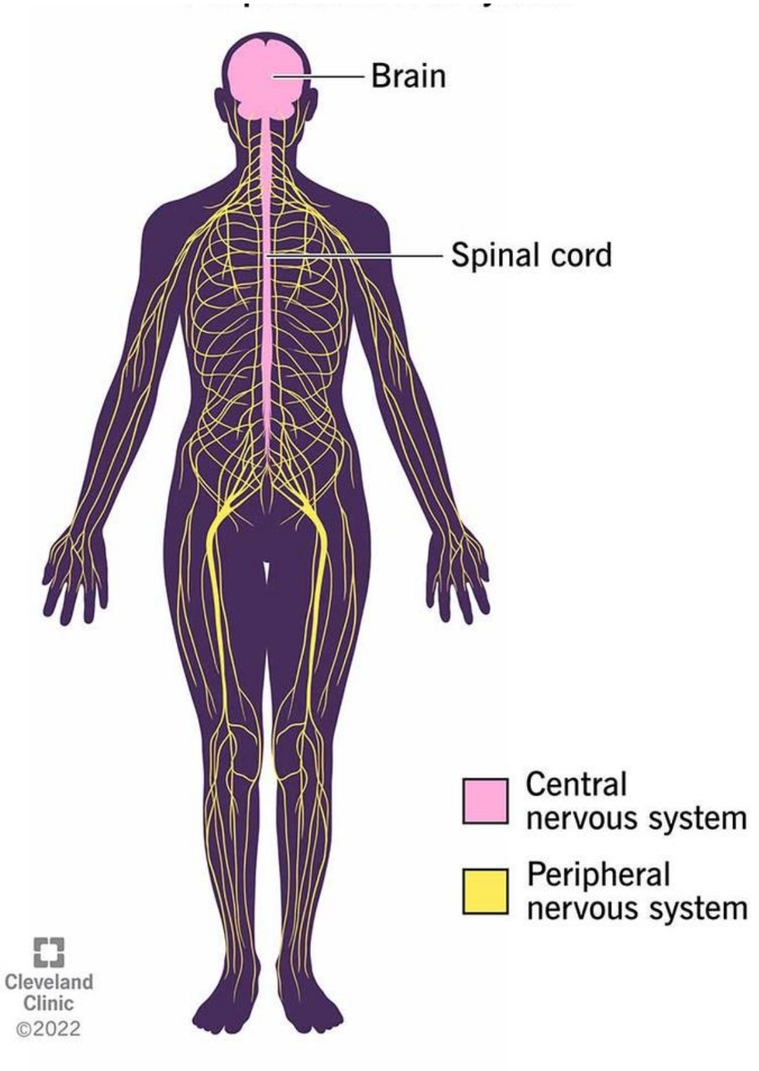
Central Nervous System

Peripheral Nervous System

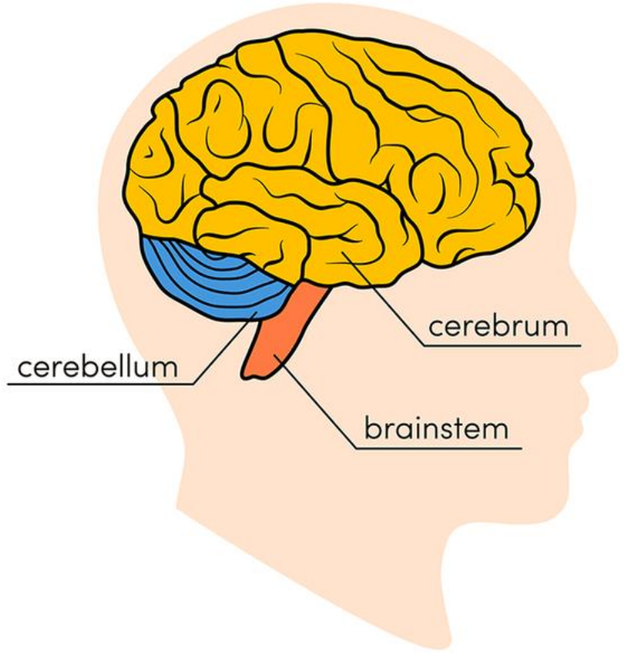
3

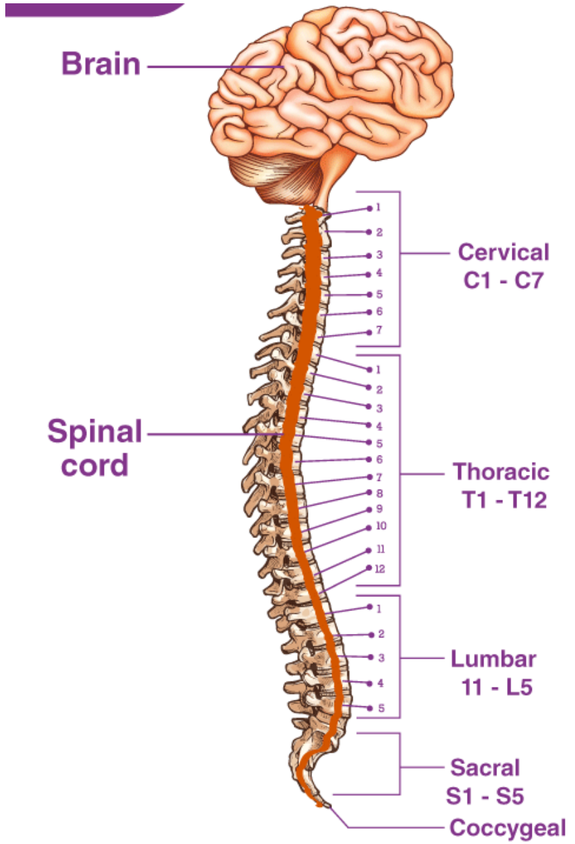
Figure 11.1

Central Nervous System



Central Nervous System

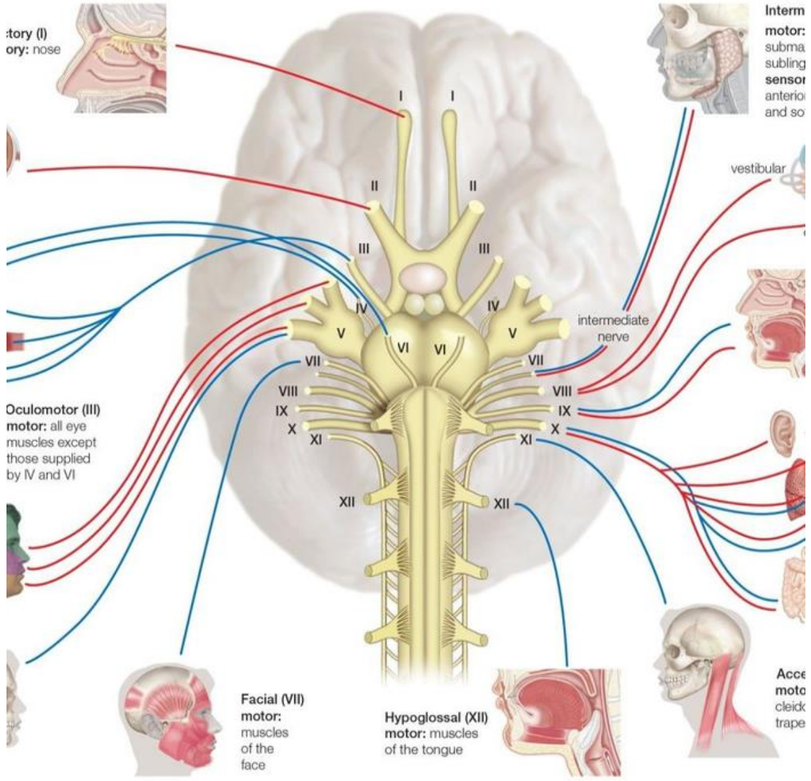




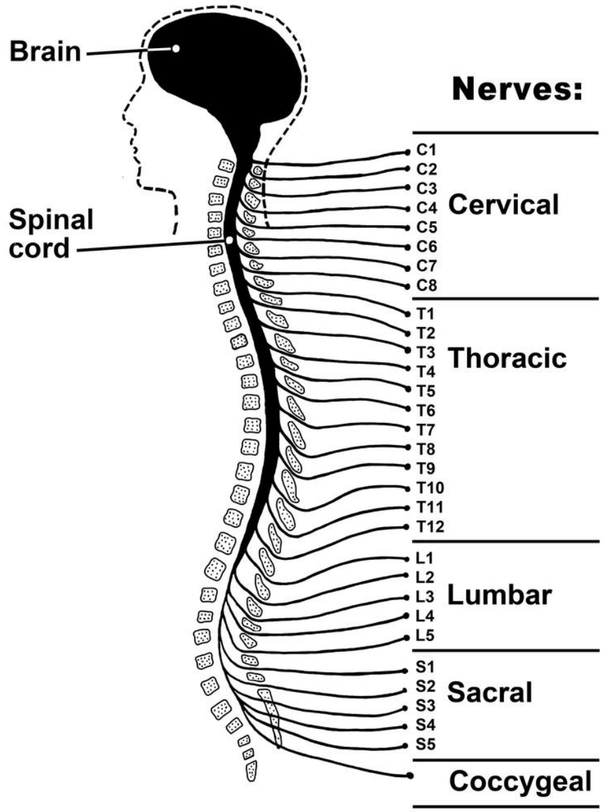
Periferal Nervous System

Nerves and Glanglia

12 pairs of cranial nerves connected with the brain

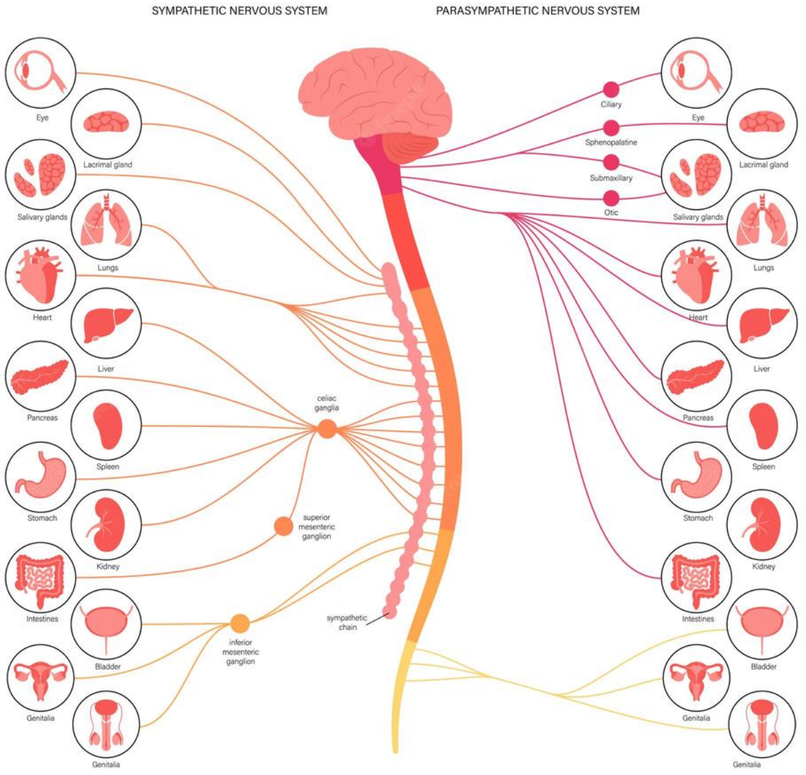


31 pairs of spinal nerves connected with the spinal cord



Periferal Nervous System

Control the physiological functions that are **unconscious** in nature.



Autonomic System

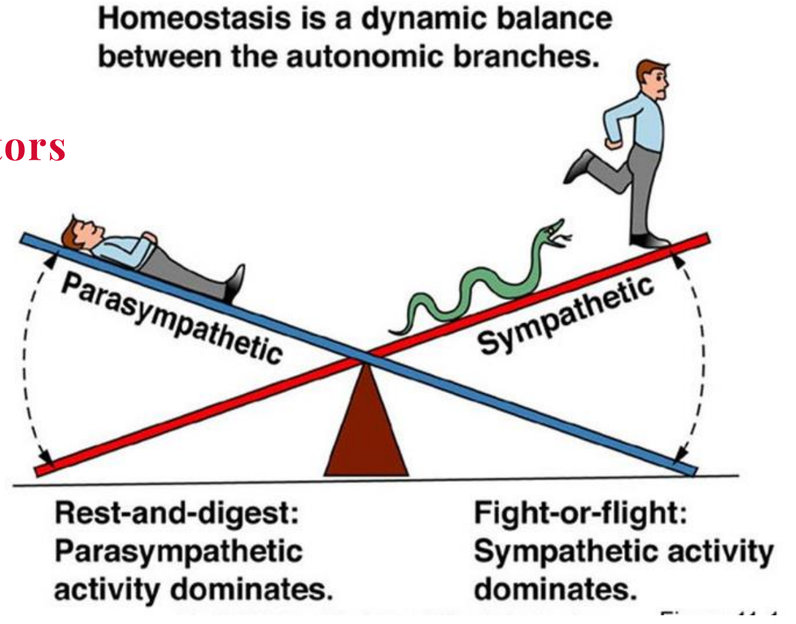
Sympathetic

Stimulate the physiological systems. Activate under the stress. 'Fight-or-flight'

Parasympathetic

Responsible for the body's constant or resting homeostatic state.

1. **Input from internal receptors**
2. **Output to smooth muscles and glands**

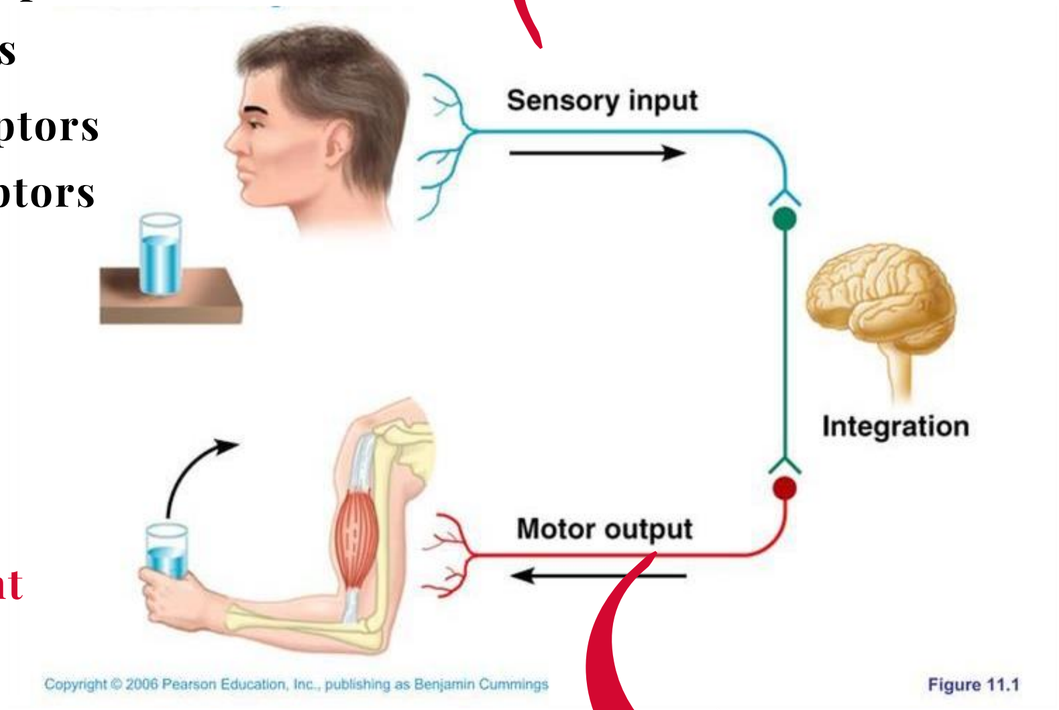


Periferal Nervous System

Somatic System

Afferent Neurons

Mechanoreceptors
Thermoreceptors
Nociceptors
Photoreceptors
Chemoreceptors



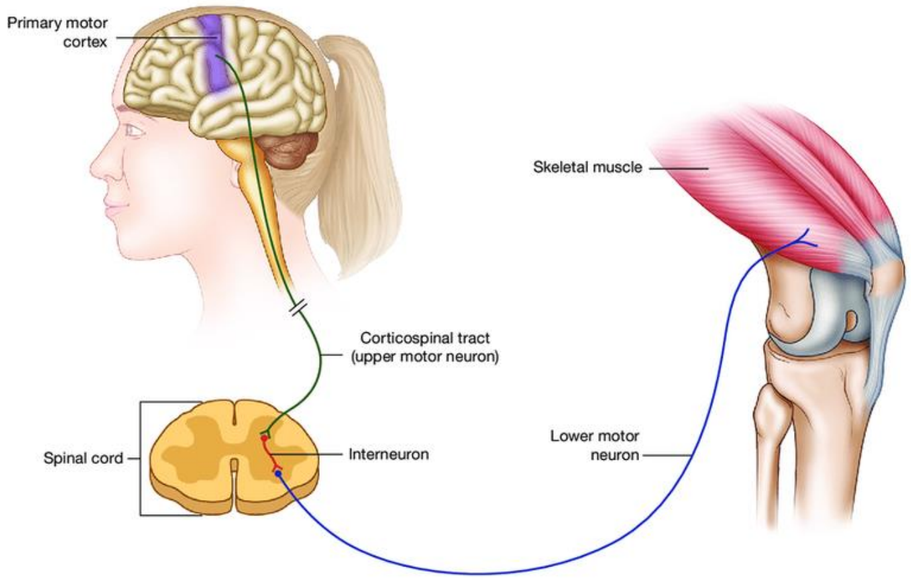
Efferent Neurons

Allows coordinating actions and responses to the external environment. Conscious control of the movement.

Motor Control

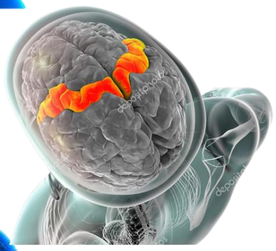
Motor Pathways

Motor Pathways



Premotor cortex: planning the movement (complex)

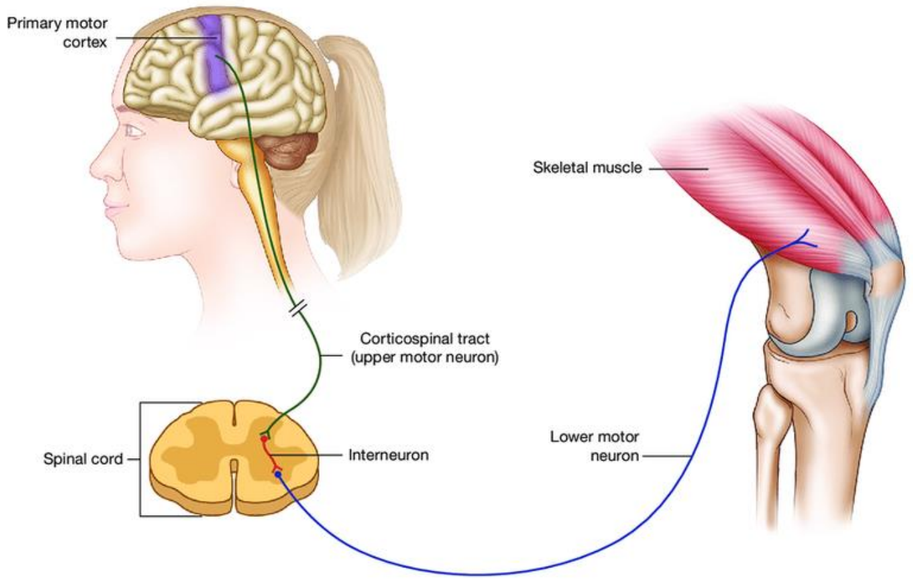
Primary motor cortex: command the execution of the movement



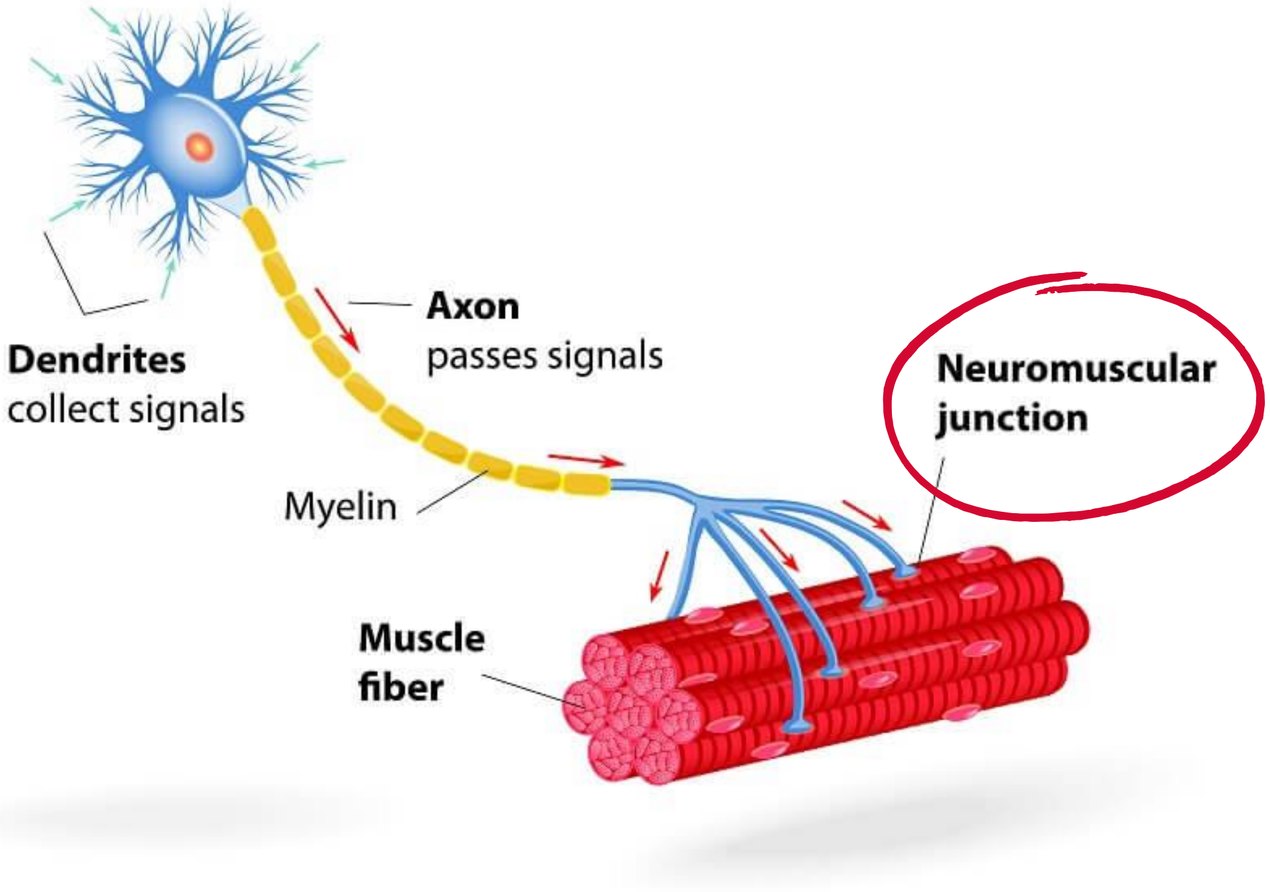
Basal Ganglia: Control and adjust of the movements

Cerebellum: Control and adjust the movements. Movement memory, timing, 'learn with mistakes'

Motor Control



Motor Neuron



Motor Control

Motor Reflex Reaction

Quickly and an unconscious responses provided by our body to protect from dangerous situations

The first response involves the peripheral nerves and the spinal cord. The brain is not aware of the first response. The message will come to the brain for further actions

Simple Reflex

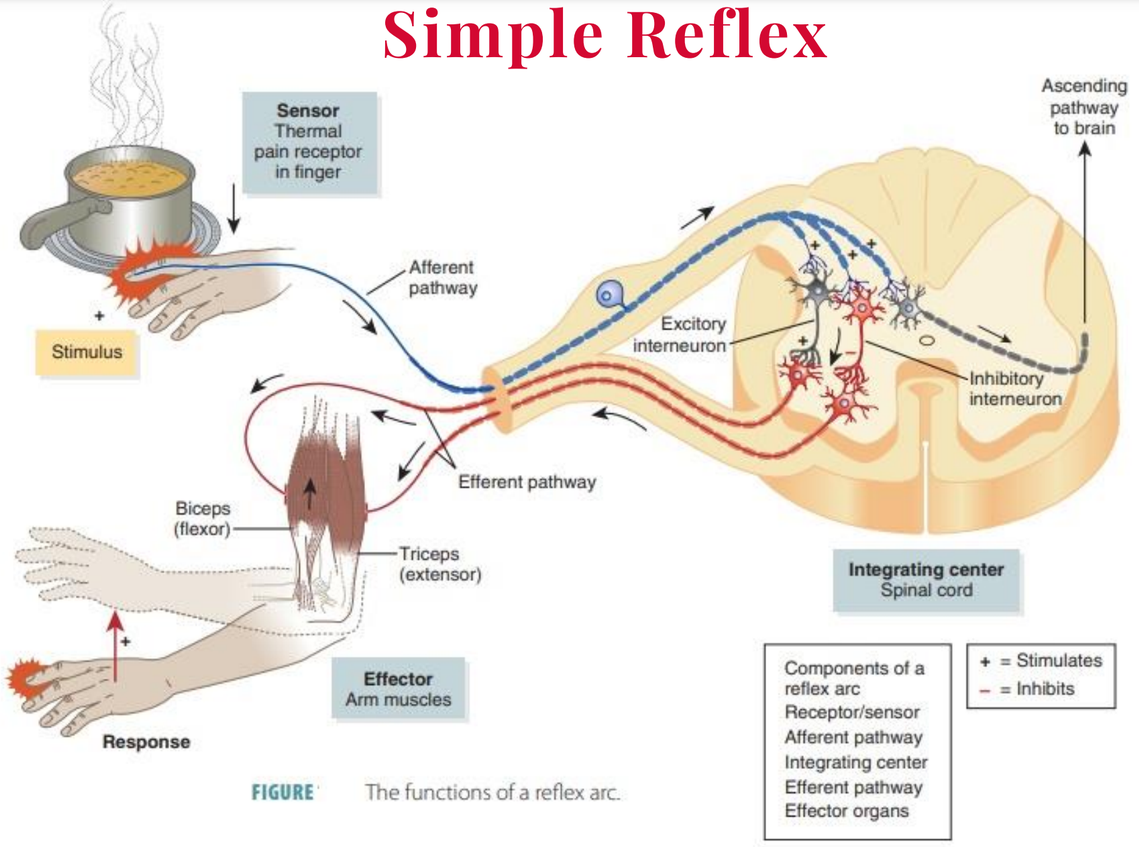
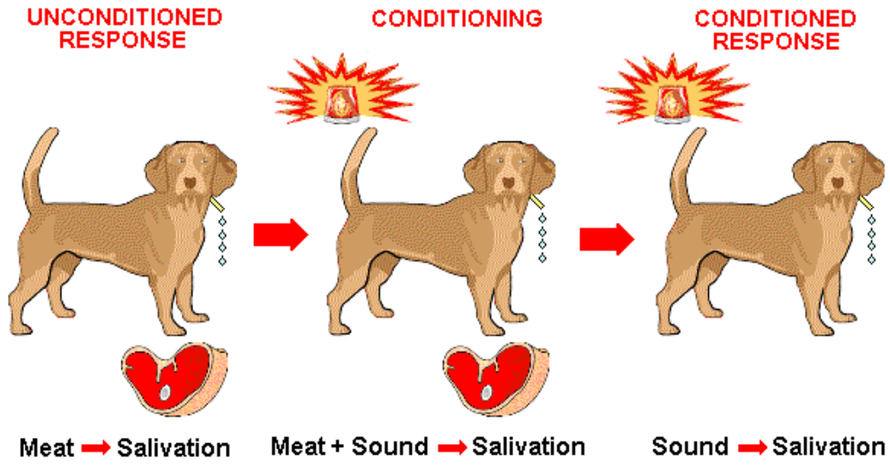


FIGURE The functions of a reflex arc.

Conditioning Reflex



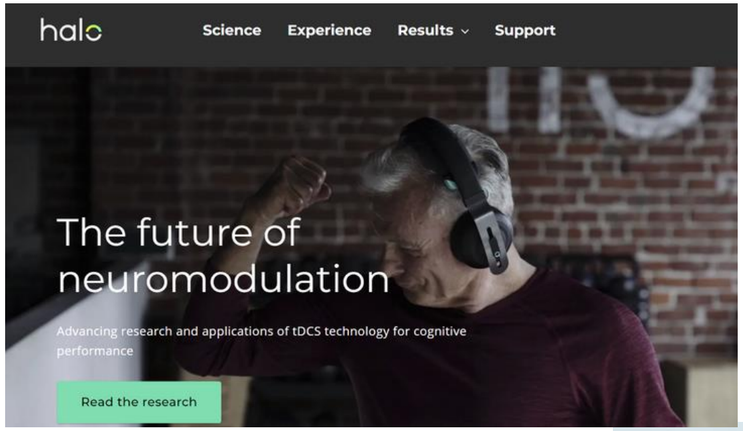
Motor Control

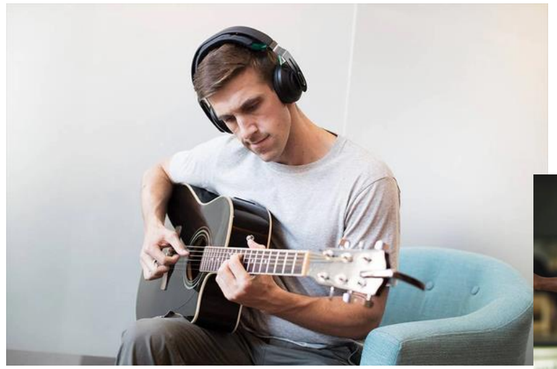
Neural adaptation

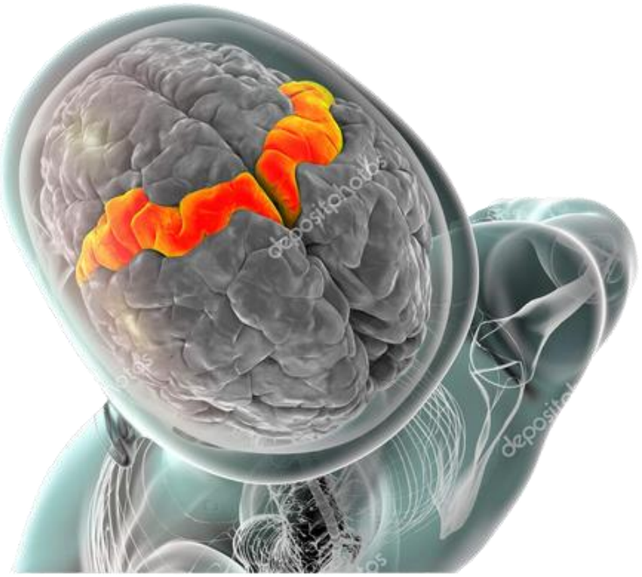
Continuous practice of neuromuscular trains the reflexes to automatically respond to sensory stimuli

Motor Control

Application in sport practice







Motor Control

Application in sport practice

Does high-definition transcranial direct current stimulation change brain electrical activity in professional female basketball players during free-throw shooting?

Luciane Aparecida Moscaleski[1], André Fonseca[1], Rodrigo Brito[2], Edgard Morya[3], Ryland Morgans[4], Alexandre Moreira[5]* and Alexandre Hideki Okano[1]

In summary, this study suggests that HD-tDCS may induce changes in slow frontal frequency brain activities in the preparation for free-throw shooting and that these alterations seem to be greater in players demonstrating higher variability in free-throw shooting performance. Moreover, the present results also suggest that employing HD-tDCS and EEG in combination during a closed-specific sports skill, such as free-throw shooting used in the present study, may potentially provide benefits in knowledge advancement in the neural mechanisms supporting elite-level athletic performance. Indeed, adopting the qEEG ratio index, for PRI and DAR, between slower and faster frequencies may contribute to further examination into the changes in brain rhythms related to optimal performance.

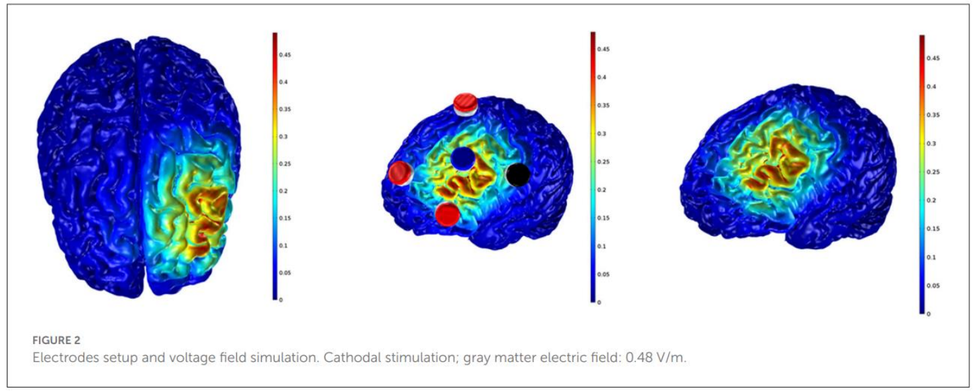
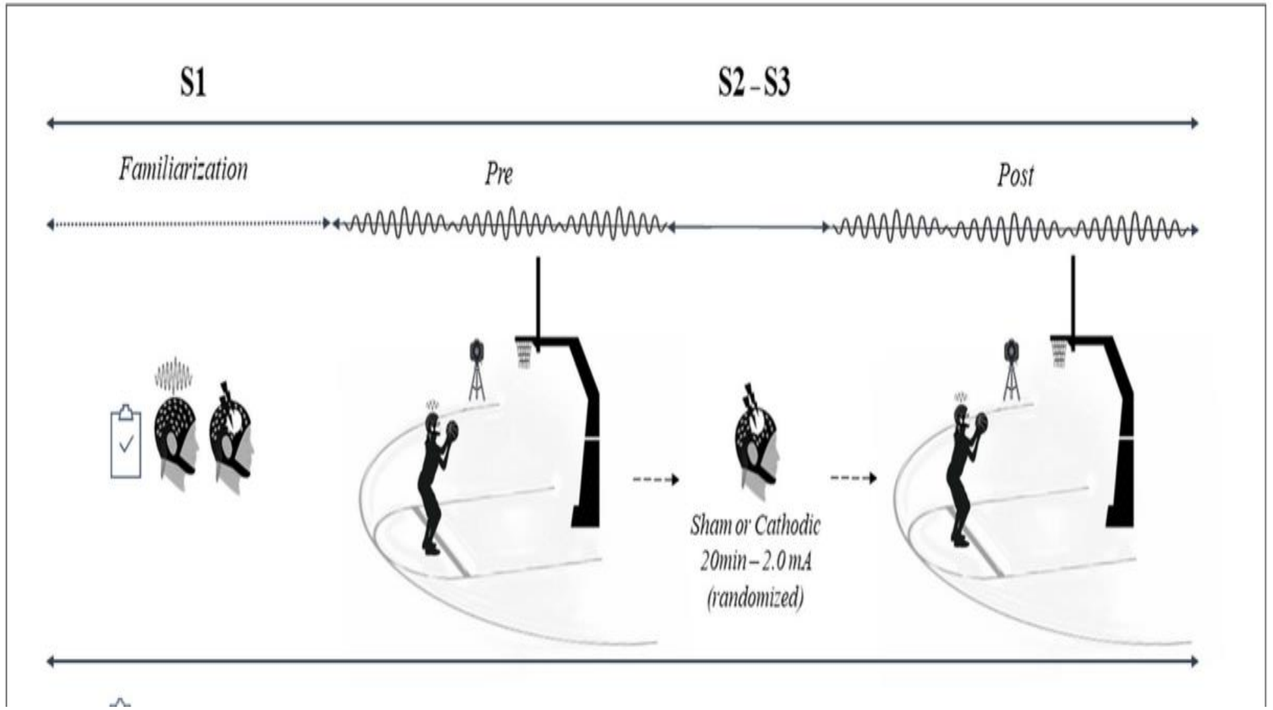


FIGURE 2
Electrodes setup and voltage field simulation. Cathodal stimulation; gray matter electric field: 0.48 V/m.



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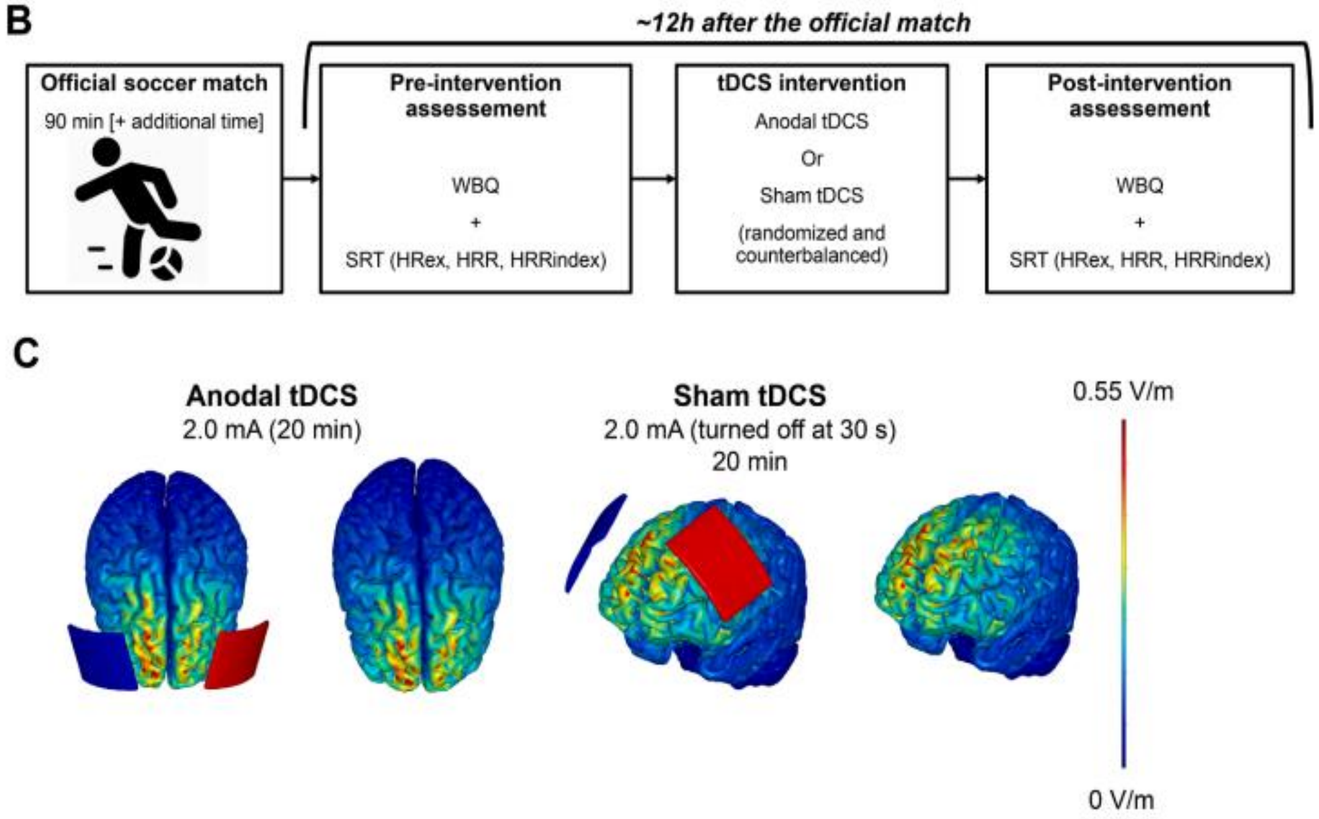
Effect of tDCS on well-being and autonomic function in professional male players after official soccer matches

Alexandre Moreira [a,i,#,*], Daniel Gomes da Silva Machado [b,#], Luciane Moscaleski [c,i], Marom Bikson [d], Gozde Unal [d], Paul S Bradley [e], Abrahão F Baptista [c,i], Edgard Morya [f,i], Thais Cevada [g], Lucas Marques [h], Vinicius Zanetti [h], Alexandre Hideki Okano [c,i]

temporal cortex aiming to modulate the left insular cortex. Indeed, it has been demonstrated that applying a-tDCS over the left dorsolateral prefrontal cortex (DLPFC) induced beneficial and long-lasting effects on vigilance, reaction time, and aspects of mood which are negatively influenced by fatigue in active-duty military subjects [20]. These data suggest that applying a-tDCS over the DLPFC might induce improvements in the well-being perception of elite soccer players, which in turn, could contribute to the recovery process.

6. Conclusions

In conclusion, the improved perceived well-being and parasympathetic autonomic responses suggest that brain areas related to emotional and autonomic control might be involved in these changes with a possible interaction effect of tDCS by placebo-related effects. Moreover, the findings also suggest that HRR and HRRindex, together with WBQ, could be used to evaluate the possible short-term changes from recovery induced by tDCS in soccer players.



https://i.ytimg.com/vi/lI7AhwdHNrc/maxresdefault.jpg

Obrigada

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Complementary:

What are Nerve Cells, Neurons & Synapses?

https://www.youtube.com/watch?v=n0Zc01e1Frw&list=PLW0gavSzhMlQPcIX1RcT3TgrmRoWYbwLW&index=7

What is a Reflex Arc

https://www.youtube.com/watch?v=Nn2RHLWST-k&list=PLW0gavSzhMlQPcIX1RcT3TgrmRoWYbwLW&index=31