Optimizing exercise effects on neuroplasticity to promote motor rehabilitation

Speakers:

Lara Boyd, PT, PhD
Professor
University of British Columbia
Vancouver, Canada

Cameron Mang, R.Kin., PhD
Postdoctoral Scholar
University of Calgary
Calgary, Canada

Learning Objectives

1. Review motor learning-related neuroplasticity, with focus on BDNF and dopamine.
2. Examine long-term and acute aerobic exercise effects on brain function.
3. Consider acute aerobic exercise effects on neurophysiological and behavioural outcomes related to motor learning.
4. Discuss potential genetic and epigenetic influences on exercise effects on motor learning.
5. Consider how this information can apply to the development of optimal aerobic exercise strategies to facilitate post-stroke motor rehabilitation.

Key References:


**Summaries of Learning Objectives and Presentation References:**

**Learning Objective 1:**

Review motor learning-related neuroplasticity, with focus on BDNF and dopamine.

- Neuroplasticity underlies motor learning.
- Long-term potentiation and long-term depression are key mechanisms of motor learning-related neuroplasticity.
- Through involvement in these cellular mechanisms of neuroplasticity, BDNF and dopamine impact motor learning.

**References:**


**Learning Objective 2:**

Examine long-term and acute aerobic exercise effects on brain function.

- Long-term and acute aerobic exercise can both impact brain function, but possibly through separate mechanisms.
- Studies of acute aerobic exercise have yielded larger effects on memory processes than long-term studies.
- By pairing exercise with specific experiences (i.e. cognitive training), acute exercise strategies may maximize exercise effects.

**References**


**Learning Objective 3:**

Consider acute aerobic exercise effects on neurophysiological and behavioural outcomes related to motor learning.

- Acute aerobic exercise reduces inhibition and enhances facilitation in the motor system.
- These changes appear to create a neural environment supportive of neuroplasticity (LTP/LTD).
- Acute aerobic exercise can facilitate various aspects of motor learning.
- High-intensity aerobic exercise may elicit behavioural effects on motor learning to a greater extent than moderate-intensity aerobic exercise; additional work is needed to explore this potential effect.

**References**


Mang et al. (unpublished) Promoting motor cortical plasticity with acute aerobic exercise: a role for cerebellar circuits. In revision *Neural Plast.*
Learning Objective 4:

Discuss potential genetic and epigenetic influences on exercise effects on motor learning.

- Genetic and epigenetic variation impacts various molecular signaling pathways.
- Such variation can modulate the basic cellular processes of neuroplasticity and memory.
- Genetic and epigenetic variation impacting BDNF and dopamine signaling may interact with exercise effects on neuroplasticity and motor learning.

References


Learning Objective 5:

Consider how this information can apply to the development of optimal aerobic exercise strategies to facilitate post-stroke motor rehabilitation.

- Neuroplasticity and motor learning are central to post-stroke motor rehabilitation.
- Aerobic exercise effects on plasticity and motor learning may be better harnessed to benefit rehabilitation.
- Determining optimal and individualized exercise prescriptions is an important topic for future research.


