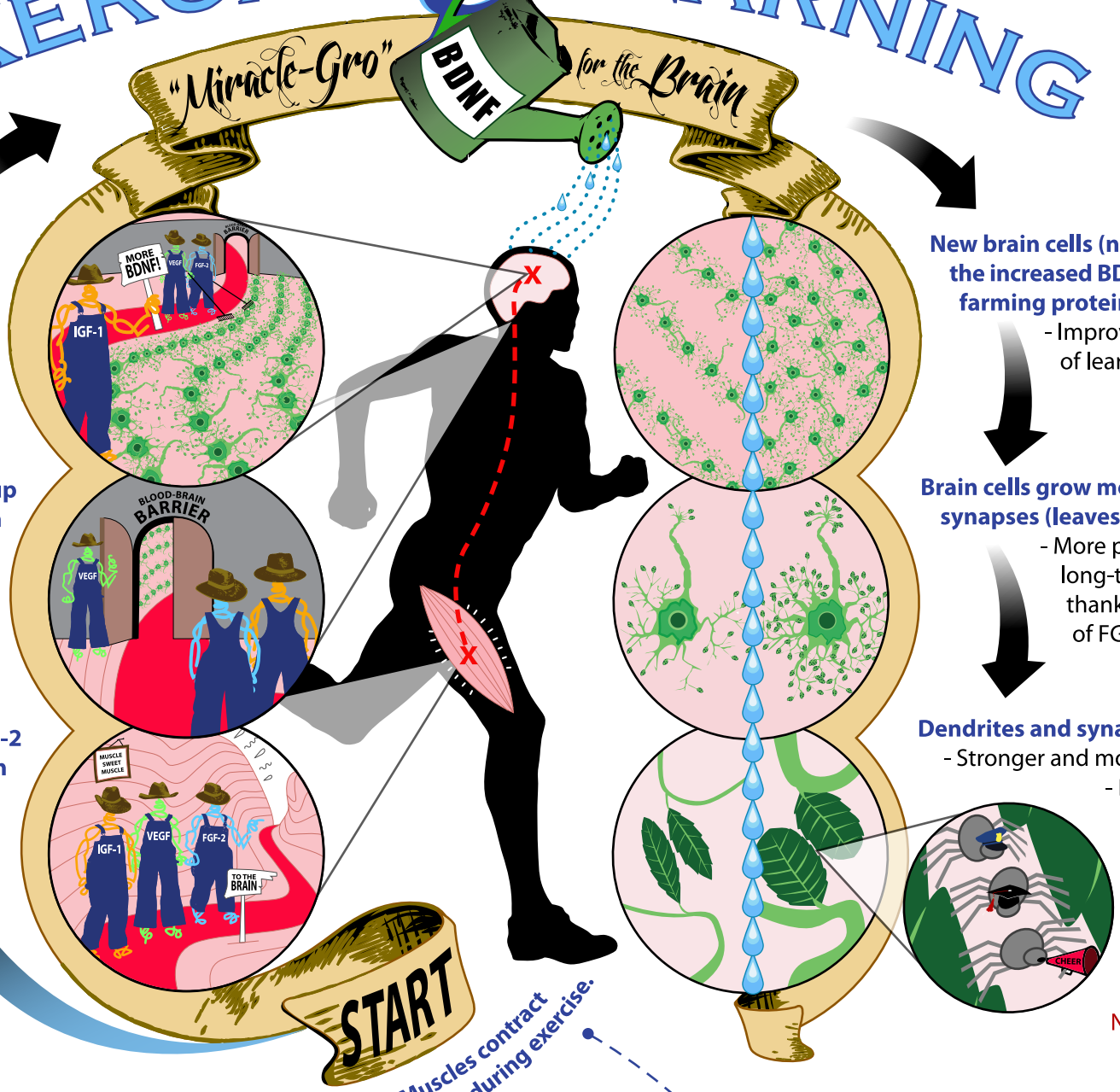
EXERCISE & LEARNING

"Miracle-Gro" for the Brain



IGF-1 orders increased production of BDNF and the other proteins get to work.

VEGF allows the group to swiftly push through the blood-brain barrier.

VEGF, IGF-1 and FGF-2 (nerotrophic growth proteins) begin their journey.

Muscles contract during exercise.

New brain cells (neurons) are grown, thanks to the increased BDNF and the work of the diligent farming proteins:

- Improved capacity and rate of learning.

Brain cells grow more dendrites (branches) and synapses (leaves):

- More plentiful connections increase long-term-protentiation (memory) thanks to the tissue-growing talents of FGF-2.

Dendrites and synapses swell:

- Stronger and more effective connections.
- Better flow and balance of neurotransmitters:

Serotonin (policeman)
**Controls brain activity to improve focus.*

Dopamine (scholar athlete)
**Improves calm learning, alertness, and motor control*

Norepinephrine (cheerleader)
**Inspires concentration, arousal, and motivation.*

Reference: Ratey, J. (2008).
SPARK: The Revolutionary New Science of Exercise and The Brain.
New York: Little-Brown.

According to research, the best type of exercise for learning is a combination of:

- **AEROBIC**
  - elevates neurotransmitters
  - creates new blood vessels to transmit growth factors
  - grows new brain cells
- **COMPLEX**
  - puts growth to use by strengthening and expanding neural networks
  - increases the complexity of synaptic connections to create more cicuitry for learning
- **SOCIAL**
  - sharpens your attention, judgement, and precision of movement
  - stimulates parts of the brain unused during solo exercise
  - promotes adherence because of enjoyment
  - exponentially increases learning potential

The best way to ensure that a person acquires the knowledge and skills necessary to engage in this type of activity is to provide them with access to quality physical education.

eDesigns

Reference: Ratey, J. (2008). *SPARK: The Revolutionary New Science of Exercise and The Brain.* New York: Little-Brown.

Why Physical Education Matters

EXERCISE FOR LEARNING