



# Exercise Stimulates Neuronal Growth

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## Why in News?

A study by the **Massachusetts Institute of Technology (MIT)** has revealed that exercise **not only strengthens muscles** but also **stimulates neuron growth** through biochemical and physical mechanisms.

**Note: Muscle** is a specialized tissue that **generates force and enables movement**. Composed of contractile proteins **like actin and myosin**, it facilitates contraction and relaxation.

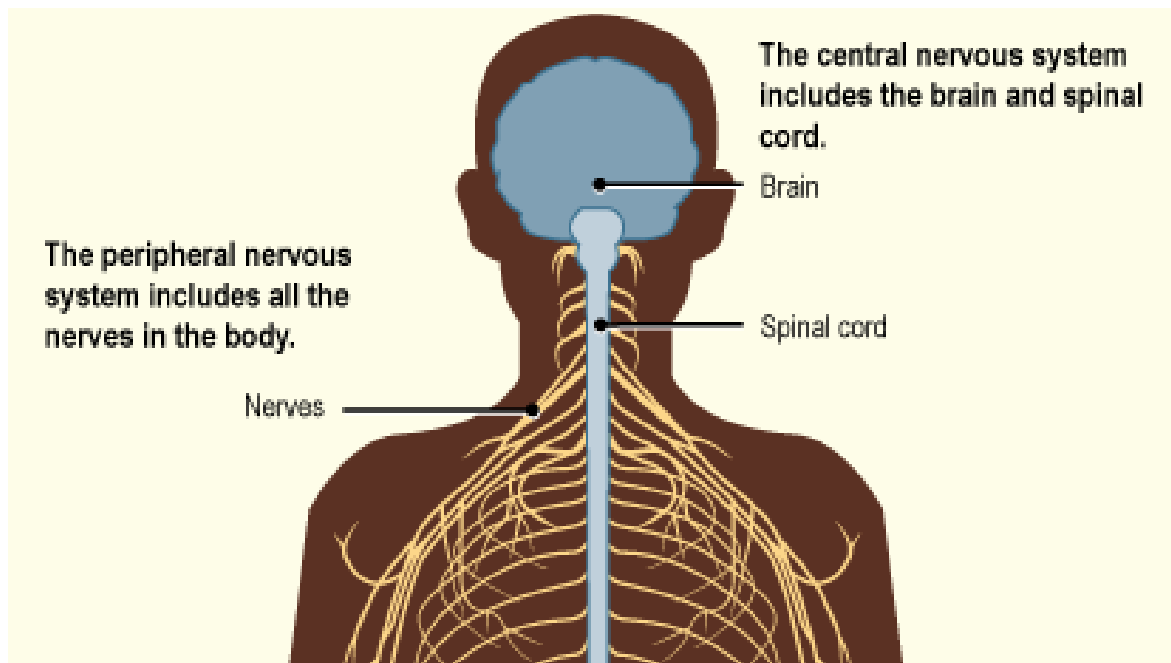
- The human body has three muscle types: **Skeletal** (voluntary, striated, controls movement and posture), **Cardiac** (involuntary, striated, pumps blood), and **Smooth** (involuntary, non-striated, maintains organ functions).

## What are the Key Findings of the Study?

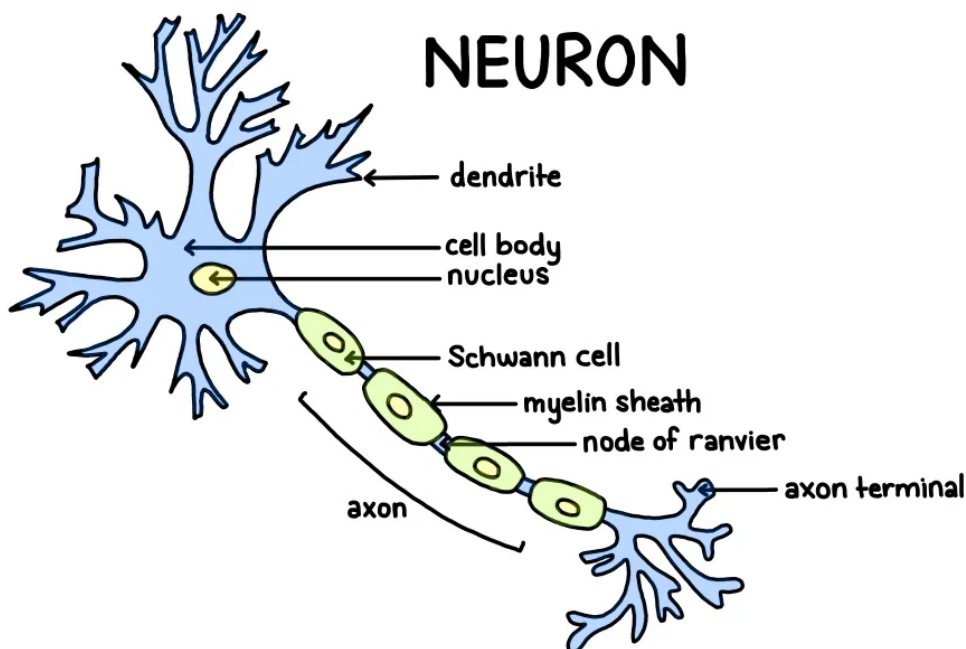
- **Nerve-Muscle Crosstalk:** The study challenges the traditional view that nerves only control muscles, revealing a **bidirectional relationship**:
  - In which muscles promote nerve growth by releasing **chemical signals**, while the **mechanical forces** from muscle contractions help improve nerve structure and support regeneration.
- **Role of Myokines:** Exercise increases the secretion of **myokines, a biochemical compound** released by muscles. Which significantly enhance **neuronal growth** (4x faster) and improve **neural maturity** and functional abilities.
- **Physical Stress and Neuronal Growth:** Physical forces generated during muscle contraction mechanically stimulate nerves, promoting neuronal growth comparable to myokine exposure.

## What are Key facts about Nervous System and Neurons?

- **Nervous System:** The nervous system facilitates communication between body parts using **electrical and chemical signals**, enabling responses to internal and external changes.
- **Types and Function:** It has two main components like **the Central Nervous System (CNS)** and the **Peripheral Nervous System (PNS)**.
  - The CNS includes the **brain (controls body functions and consciousness)**, and the **spinal cord (transmits signals to and from the body)**.
  - The PNS consists of all nerves outside the CNS and is divided into the **Autonomic Nervous System** (which **regulates involuntary functions**, like heart rate and digestion) and the **Somatic Nervous System** (which controls **voluntary movements** and sensory input).



- **Neurons:** Neurons (also called neurones or nerve cells) are the **fundamental units of the brain and nervous system.**
  - The cells responsible for **receiving sensory input from the external world**, for sending motor commands to our muscles, and for transforming and relaying the electrical signals at every step in between. Each neuron has three main parts:
    - **Dendrites:** Receive incoming signals from other neurons or sensory receptors.
    - **Axon:** Carries electrical impulses away from the cell body to other neurons or muscles.
    - **Axon Terminals:** Release neurotransmitters to pass signals to the next cell.
  - **Neurons communicate with each other through synapses**, where neurotransmitters bridge the gap between cells.



**UPSC Civil Services Examination, Previous Year Questions (PYQs)**

**Prelims**

What is the Cas9 protein that is often mentioned in the news? (2019)

- (a) A molecular scissors used in targeted gene editing
- (b) A biosensor used in the accurate detection of pathogens in patients
- (c) A gene that makes plants pest-resistant
- (d) A herbicidal substance synthesised in genetically modified crops

**Ans: (a)**

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