

Glossary of Neural Engineering Terms for K-12 Students

Axon: The part of a neuron that takes information away from the cell body.

Brain: An organ contained in the skull that functions as the body's command center. The brain, along with the spinal cord, is part of the central nervous system. It controls movement, functions, sensations, memory, and thoughts.

Brain-Computer Interface (BCI): A communication pathway linking neural signals from the brain with an external device. The neural signals are decoded by a computer using an algorithm that translates the signals into a motor output (action), such as controlling a neuroprosthetic hand or steering a wheelchair. BCIs may operate using either EEG or ECoG recordings or single unit activity from neurons. Also called a Brain-Machine Interface or a Brain-Control Interface.

Closed control loop: A closed loop sensorimotor device receives signals from the nervous system and provides feedback to the body. With a Brain-Computer Interface, a closed loop is achieved by providing sensory feedback to the user of the device, such as visual feedback (seeing the position and movement of the device) or tactile feedback (feeling the position and movement of the device).

Cochlear implant: An electronic device manufactured for people (most often children) with significant hearing loss known as sensorineural hearing loss. A cochlear implant bypasses damaged hair cells in a part of the inner ear known as the cochlea. It consists of an implanted (internal) receiver and electrodes, external microphone, speech processor, and transmitter.

Dendrite: The part of a neuron that brings information to the cell body.

Electroencephalography (EEG): A technique for recording electrical activity of the brain obtained from electrodes placed on the scalp. EEG is a non-invasive way to record brain signals.

Electrocorticography (ECoG): A technique for recording the electrical activity of the brain obtained from electrodes placed on the surface of the brain. ECoG is an invasive way to record signals from the brain, requiring surgery to access the brain's surface.

Electrode: An electrical conductor. Electrodes are used in EEG, EMG, ECoG, and signal units to record the electrical activity within neurons.

Electromyography (EMG): A technique for recording the electrical activity of skeletal muscles obtained from electrodes placed on the skin. EMG is a non-invasive way to record motor neuron activity.

Implant: A medical device manufactured to replace or enhance a structure in the body. For example, a cochlear implant used to restore hearing, a retinal implant used to restore vision, or

an electrode array implanted in the brain to stimulate a damaged area.

Motor neuron: A neuron that carries information from the central nervous system to muscles, sending a message for the muscle to activate and initiate movement.

Neuroanatomy: The structure of the nervous system.

Neurotransmitter: Special chemicals that transmit information from one neuron to another.

Neural engineering: An engineering discipline that uses concepts from math and science to connect to and interact with the nervous system.

Neurological disorder: A disorder of the nervous system.

Nervous system: Consists of the central nervous system (brain and spinal cord) and peripheral nervous system (all nerves throughout the body not part of the brain or spinal cord).

Neuron: A specialized cell within the nervous system that transmits information. It is characterized by the axon and dendrite. Also called a nerve cell.

Neuroscience: The study of the brain and nervous system.

Peripheral nerves: Nerves located outside of the brain and spinal cord. Peripheral nerves connect the parts of the body with the spinal cord.

Prosthesis: Device manufactured to replace a missing or damaged body part, such as a hand or leg.

Sensorimotor: A term that describes motor (movement) and sensory functions of the body. Sensorimotor neural engineering is specifically involved with the parts of the brain that control movement and process sensory information related to movement. Neurological injury or disease can cause a person to lose sensorimotor function.

Sensory neuron: A neuron that carries information from the body's sensory receptors (eyes, nose, ears, tongue, skin, muscles, joints) to the central nervous system.

Spinal cord: A component of the central nervous system located within the backbone. The spinal cord connects the brain to the other parts of the body.

Synapse: Chemical or electrical junctions that allow signals to pass from a neuron to another cell.