Nervous System

Bridgette Ramlo

Function

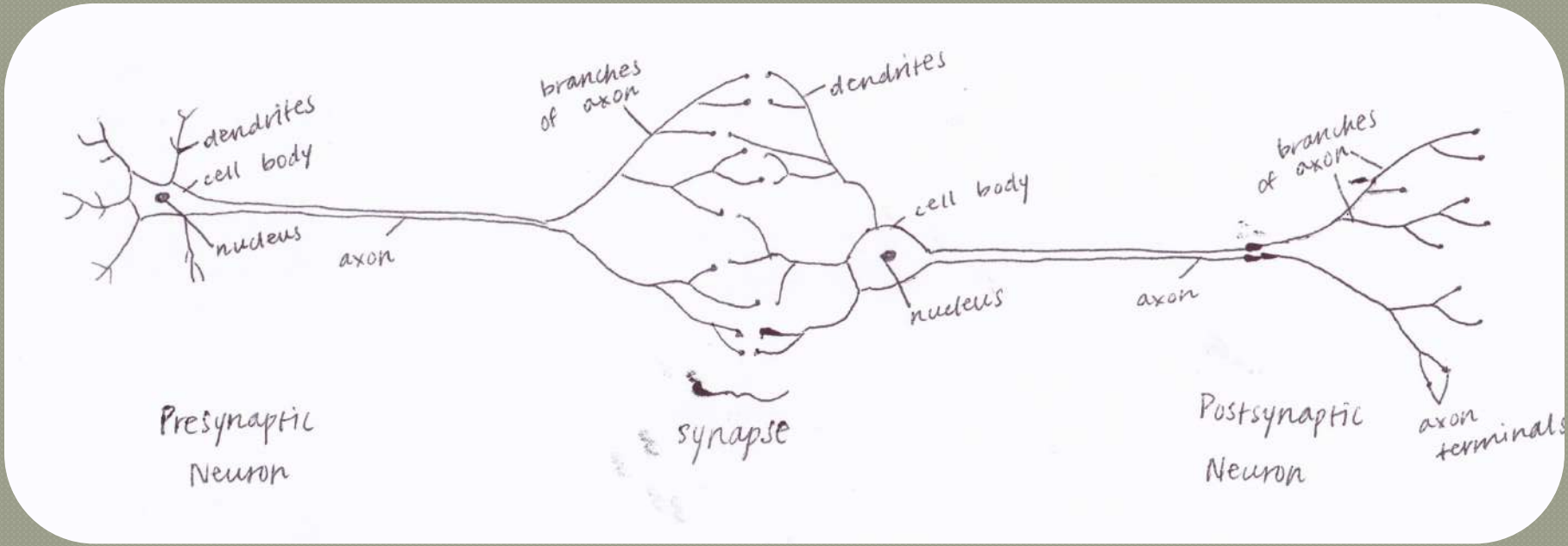
- Transmits signals between different parts of the body

Define

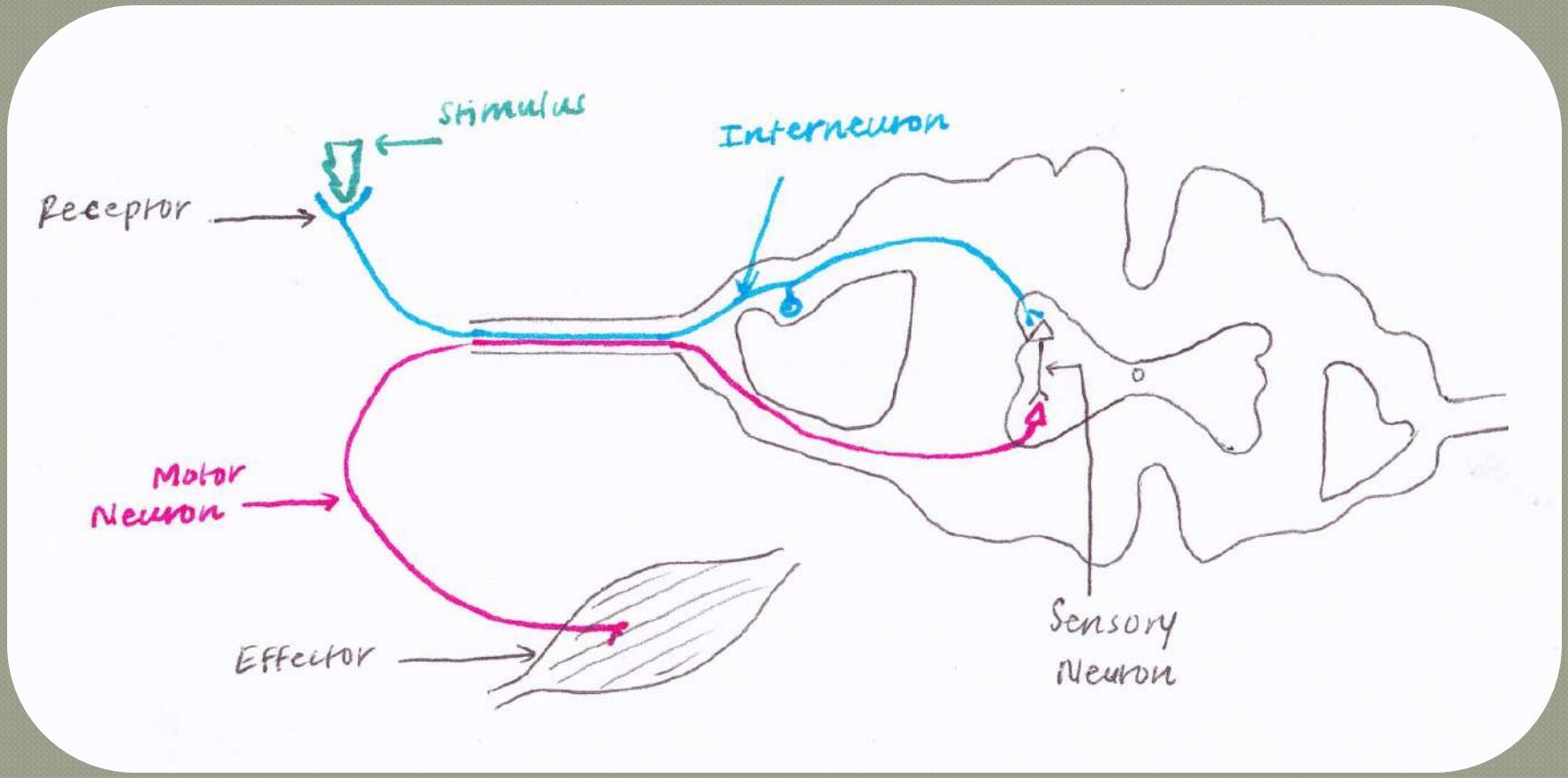
- central nervous system: part of the nervous system that consists of the brain and spinal cord

- peripheral nervous system: connects the central nervous system to sensory organs, other organs of the body, muscles, blood vessels, and glands

Interaction of two Neurons

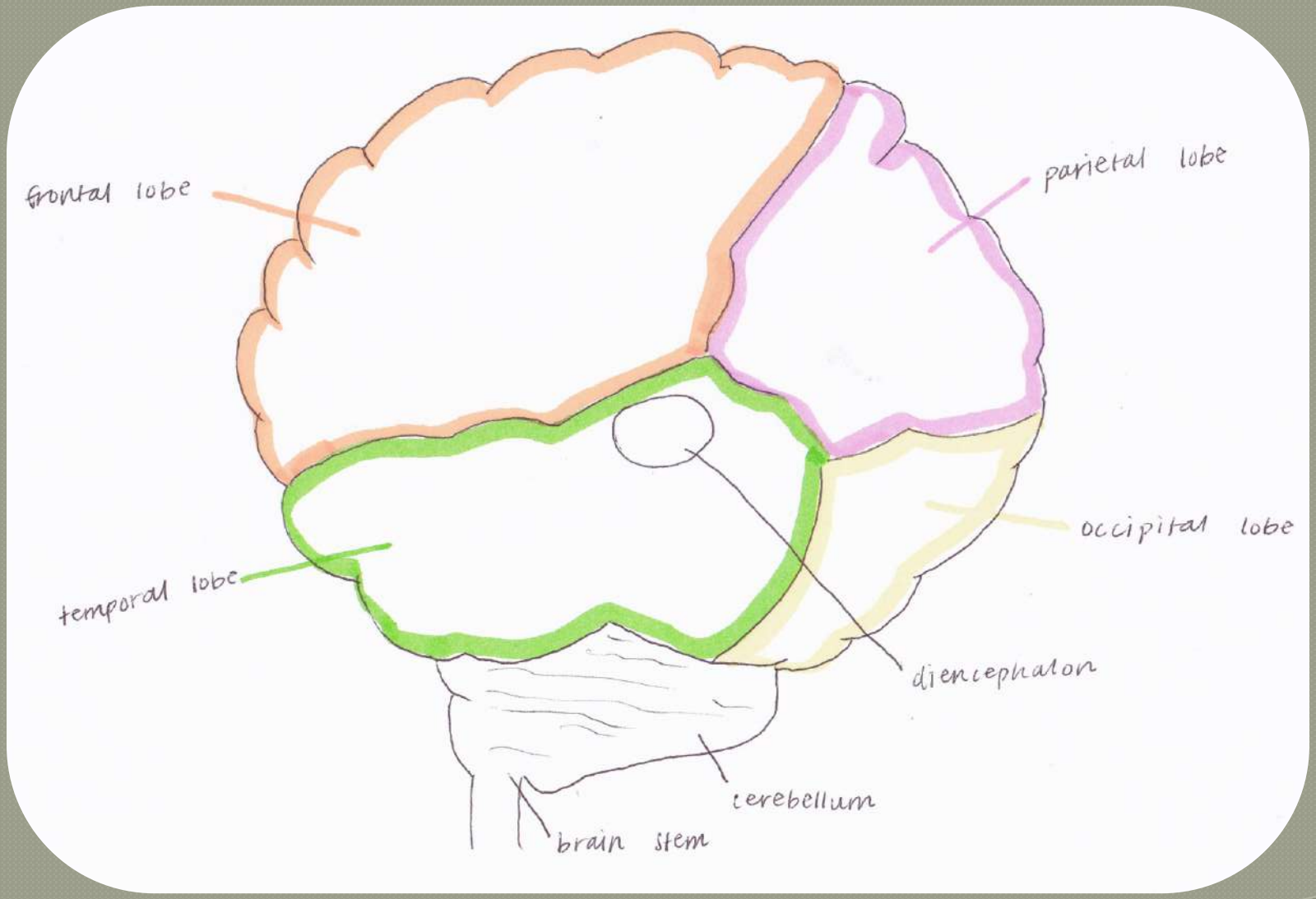


Simple Reflex Arc



- Information flows in single directions in our nervous system
  - Receptor → sensory neuron → neuron in the CNS → motor neuron → effector
- Elements:
  - Neurons that carry sensory information
  - Neurons carrying motor information
  - Interneurons
  - Receptor
  - Stimulus
- Sensory information comes into spinal cord via sensory neurons that are packed with other neurons in nerves
- Sensory neurons from synapses with interneurons and motor neurons
- Motor neurons transmit action potentials generating reflex response
- At same time, interneurons transmit sensory information to the brain

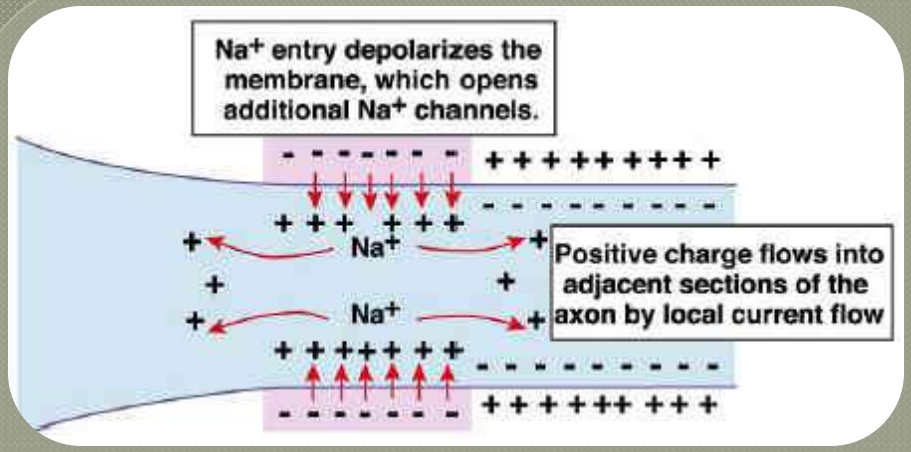
Brain

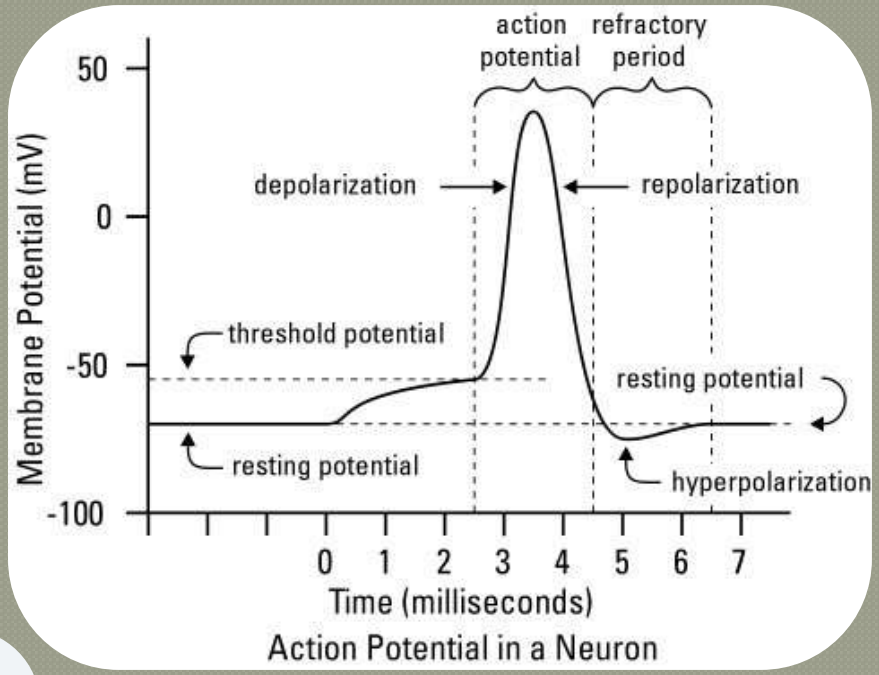

frontal lobe
parietal lobe
occipital lobe
temporal lobe
diencephalon
cerebellum
brain stem

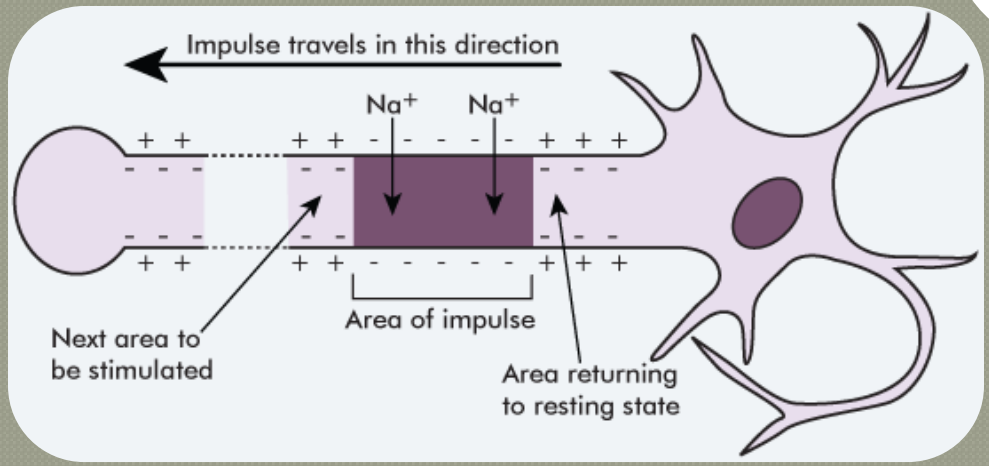
- Frontal lobe: motor function, problem solving, memory, language, impulse control
- Temporal lobe: sensory input, auditory perception, language and speech production, memory
- Parietal lobe: sensory information, sense of touch, language processing
- Occipital lobe: visual processing center, motion perception, color differentiation
- Diencephalon: gives rise to posterior forebrain structures including thalamus, hypothalamus, posterior portion of the pituitary gland, and pineal gland
- Cerebellum: receives information from the sensory systems, the spinal cord, and other parts of the brain and then regulates motor movements; coordinates voluntary movements such as posture, balance, coordination, and speech
- Brain stem: upper part is continuous with pons, medulla is lower half; medulla contains the cardiac, respiratory, vomiting, and vasomotor centers dealing with heart rate, blood pressure, and breathing

Nerve Impulse

- Resting neurons maintain difference in electrical charge across cell membranes, inside being negatively charged and outside being positively charged (**membrane potential**)
  - Established by maintaining excess of sodium ions outside, less potassium ions inside
- Difference in permeability of **resting membrane** to **potassium ions** versus **sodium ions**
  - Resting membrane much more permeable to potassium ions than to sodium ions
  - Results in slightly more net potassium ion diffusion than sodium ion diffusion
  - Neuron stays inactive and polarized at its **resting potential** until a stimulus reaches it
- Nerve impulses are conducted along neuron by wave of membrane polarity reversals (**action potentials**)
  - Sodium ions move inside the membrane
- As Na+ goes into cell, neuron goes from being polarized to **depolarized**
- When inside becomes positive, polarization is removed and the **threshold** is reached
- K+ ions move outside, Na+ ions stay inside membrane
- **Refractory period** returns everything
  - Potassium ions go back inside, sodium ions go to outside


Na+ entry depolarizes the membrane, which opens additional Na+ channels.
Na+
Na+
Positive charge flows into adjacent sections of the axon by local current flow


action potential
refractory period
50
0
-50
-100
depolarization
repolarization
threshold potential
resting potential
resting potential
hyperpolarization
Membrane Potential (mV)
0 1 2 3 4 5 6 7
Time (milliseconds)
Action Potential in a Neuron


Impulse travels in this direction
Na+
Na+
Next area to be stimulated
Area of impulse
Area returning to resting state

Neurotransmitters

- Chemical that is released into the synaptic cleft from axon terminal of a sending neuron, crosses a synapse, and binds to appropriate receptor sites on dendrites or cell body

- Neurotransmitter molecules diffuse across synaptic cleft where they can bind with receptor sites on postsynaptic end to influence electrical response in neuron
  - If number of excitatory postsynaptic events is large enough, will cause action potential in postsynaptic cell and continuation of message

IPSP versus EPSP

- Excitatory (EPSP): increase the likelihood of a postsynaptic action potential occuring
- Inhibitory (IPSP): decrease likelihood of postsynaptic action potential occuring

Multiple Sclerosis

- "many hardenings"
- Disease of unknown cause that manifests as multiple hard plaques of degeneration of insulating layer of nerve fibers in the central nervous system, allowing short circuiting of nerve impulses
- Patients may suffer paralysis, blindness, or sensory disturbances
- Affects about 400,000 people in United States, 2.5 million worldwide
- Treatment options
  - Disease-modifying drugs
  - Deep brain stimulation (surgical procedure)
  - Plasma exchange
  - Cytoxan therapy (suppresses immune system)
  - Baclofen pump
  - Botox
    - Slow progression of MS

Aphasia

- Loss of speech, caused by stroke or traumatic brain injury
- Speech centers located on left side of brain in majority of people
- Signs include:
  - Speaking in single words or fragments
  - Omitting smaller words such as “the,” “of,” and “was”
  - Putting words in the wrong order
  - Making up words
- Estimated 80,000 new cases annually in the United States
  - 43% are 85 years or older
- Treatment options:
  - Speech therapy
  - Computer-aided rehabilitation

- https://www.google.com/search?q=function+of+nervous+system&oq=function+of+nervous+system&aqs=chrome..69i57j0l3.8496j0j1&sourceid=chrome&ie=UTF-8
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