The Workshop Project Newsletter

PROGRESSIONS:
PEER-LED TEAM LEARNING

Volume 7, Issue 3

Spring 2006

Module 12: The Autonomic Nervous System and its Synapses

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I. Introduction

We often fall into the trap of thinking about the process of neuronal transmission (synapse → local potential → action potential) as being a straightforward and relatively unchanging series of events. When we think of nerve impulses, we normally think only of the outcome—whether or not a neuron will "fire"—but there are actually many things which influence whether an action potential will be generated. The reality is that the neuron is a model of true democracy—sensing the will of the majority and acting accordingly. In a true democracy, when a political issue is really important, a majority will form on one side of the issue and will work together to enact political change. The same is true for neuron signaling. When a particular signal is really important, multiple factors will come together to make sure that the neuron receiving the signal passes the signal on down the line by triggering an action potential. This module will introduce you to some of the important strategies and players in the political world of the neuron.

Prepare for your workshop by reading in your textbook (Chapter 12: 463-470; Chapter 15: 564-579) and completing the Pre-Workshop Activities below, ***really!*** Show your work in these pages.

II. Pre-Workshop Activities

Activity A. Define the following terms.

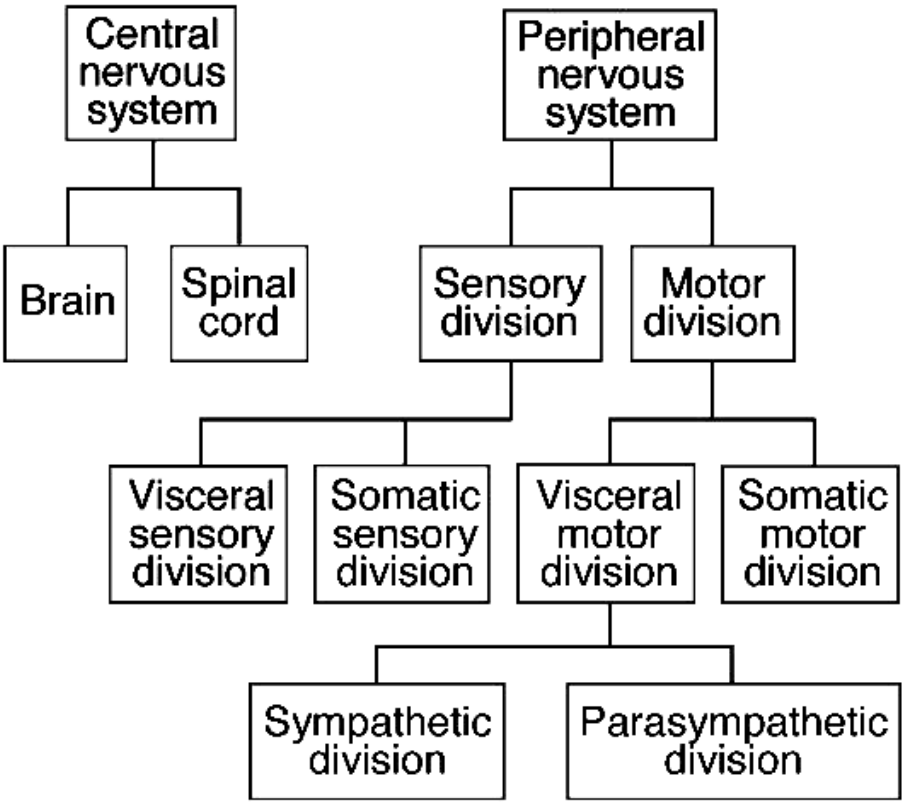
1. adrenergic
2. antagonistic
3. autonomic
4. cholinergic
5. excitatory
6. inhibitory
7. motor
8. muscarinic
9. neurotransmitter
10. nicotinic
11. parasympathetic
12. postsynaptic neuron
13. presynaptic neuron
14. reflex
15. sensory
16. somatic

17. sympathetic

18. synapse

19. visceral

Activity A. Organization of the nervous system
Observe the figure below and answer the questions:



1. Which component of the nervous system carries information to the CNS?

2. Which component of the nervous system carries information from the CNS?

3. What is the difference between somatic and visceral?

4. What is the difference between sympathetic and parasympathetic?

5. Where would cranial and spinal nerves fit into the above organization?

6. On the above figure, indicate the autonomic nervous system. Why is it called that?

For each of the following statements write the down the correct division of the nervous system:

a) Impulses traveling from the CNS to cardiac muscles _____

b) Impulses traveling from stretch receptors in the heart towards the CNS _____

c) Impulses traveling from touch receptors in the skin towards the CNS _____

d) Impulses traveling from the CNS to the biceps muscle _____

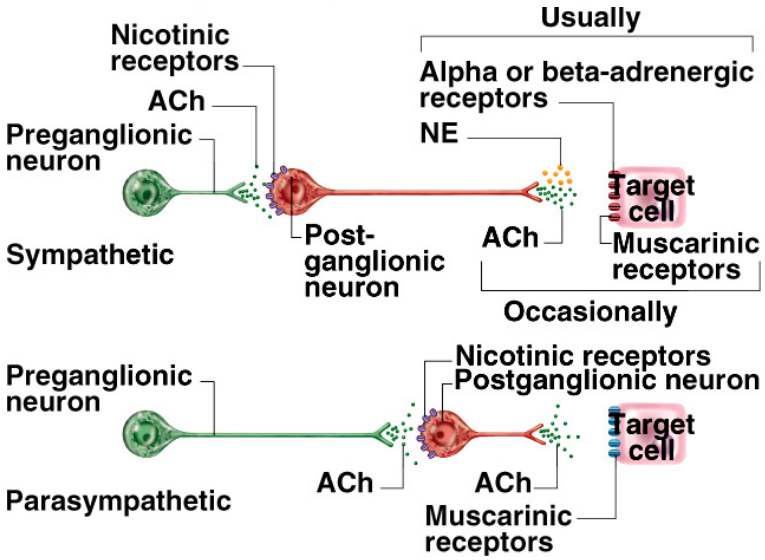
Activity B. The Autonomic Nervous System.

The autonomic nervous system (ANS) controls the internal organs (and blood vessels, and more) and is sometimes called the visceral nervous system. It has two branches: **sympathetic** and **parasympathetic**. The sympathetic branch controls what is commonly referred to as "fight or flight" responses, and the parasympathetic controls "rest and digest" responses. Most organs are controlled by both branches of the ANS—this is called **dual innervation**—and the resulting response of the organ depends on which branch is sending the most signals at a given point in time.

Work with a partner and place a "P" next to events that you think the parasympathetic is causing, and an "S" next to a sympathetic response.

- rapid pulse
- salivation
- sweating
- rapid breathing
- bowel movements
- urination
- digestion
- constricted pupils

Activity C. Observe the following figure and answer the following questions:



a) Which neurotransmitters are involved in the sympathetic division?

b) Which neurotransmitters are involved in the parasympathetic division?

c) What type of receptor responds to Acetylcholine?

d) What type of receptor responds to Nor-epinephrine?

e) Based on the figure above explain how a single target cell can be stimulated by both parasympathetic and sympathetic divisions. (How will the target cell know which one is which?)

f) High blood pressure can be brought back to normal by reducing the heart rate. Beta blockers are drugs prescribed for patients with high blood pressure. Based on your understanding of the autonomic nervous system and by closely observing the figure above explain how beta blockers may help to reduce blood pressure. Discuss this within your group before you answer the question.

Activity D. Neurotransmitters and their effects
Fill in the table with the correct neurotransmitter (GABA, dopamine, serotonin, endorphin, acetylcholine, Substance P). See Table 12.3 on page 466 in your book.

NEUROTRANSMITTER	EFFECT
	Cocaine interferes with the re-uptake of this neurotransmitter thereby producing a feeling of euphoria.
	Natural pain killer that is more potent than morphine. Produces "runner's high" in athletes.
	Anti-anxiety drugs enhance the release of this inhibitory neurotransmitter
	Neurotransmitter that allows you to feel pain
	Neurotransmitter associated with mood and sleep
	Important neurotransmitter in learning and memory
	Excites skeletal muscles

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Spring 2006, Volume 7, Issue 3

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Progressions (ISSN 1539-1752—print; ISSN 1539-7483—online) is published four times a year by the PLTL Workshop Project.

This newsletter is supported by a grant from the National Science Foundation's Division of Undergraduate Education. The views expressed herein do not necessarily represent those of the National Science Foundation.