

The Nervous System:
A Background Information Guide

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Introduction

Every minute of every day, your nervous system is sending and receiving countless messages about what is happening both inside and around your body. Right now, your nervous system is receiving sensory input from your eyes about the words on the screen, from your ears about the sound of the computer, from your skin about the feel of your clothes, etc. At the same time, your brain is receiving information from sensors that monitor your heartrate, blood pressure, levels of oxygen and the contents of your stomach and intestines. Your brain then interprets all of these signals, which allows for an understanding of the words on the screen, the recognition of the noise as computer noise, and the development of motor responses such as moving your eyeballs, changing positions in your chair, and decreasing or increasing your heartrate and digestion. In short, your nervous system coordinates all the activities of your body. This module will provide a general overview of the nervous system as a whole. A word of caution: A system capable of so many sophisticated and complicated functions has to be extremely complex. One module cannot possibly present all the information about the nervous system, and it will probably take a few trips through the nervous system before the pieces fall into place, so don't despair if you're a bit confused.

A Description of the Nervous System

The nerves and their roots form the peripheral nervous system. This system of nerve fibres is divided into Somatic and Autonomic.

The somatic nervous system is responsible for the voluntary control of skeletal muscle and for the collection of sensory information from the body. The sensory information collected by the somatic nervous system arises from the skin and from the musculoskeletal system. The information reaches our consciousness, and is precisely mapped on the cerebral cortex.

The autonomic nervous system is concerned with the control of the viscera. Motor fibres from the sympathetic and parasympathetic divisions of this system control involuntary striated muscle such as that in the heart, and involuntary smooth muscle such as that in the respiratory, digestive, cardiovascular, renal and reproductive systems. The motor fibres are also responsible for controlling the secretion from glands. Sensory information from the viscera is carried back to the spinal cord or brainstem and enters the central nervous system at the same site as the origin of motor fibres to the same visceral tissue.

Somatic Nerves

The somatic nerves of the body are divided according to which part of the central nervous system they are connected. The cranial nerves are connected to the brainstem and diencephalon. The spinal nerves are connected to the spinal cord. Each somite during

development has one somatic nerve. The structures which develop from that somite receive innervation from that nerve, even if later during development the structure moves its location. For most of the body the somatic nerves preserve their original orderly pattern. However in the head the tissues tend to migrate during development relative to each other producing what seems to be a complicated nerve arrangement after birth. The spinal nerves are more orderly, although the somites involved in limb formation tend to drag the nerves out into the limb with them. The skin innervated by a single somatic nerve is a dermatome. The dermatomes overlap somewhat, making it difficult to detect the loss of innervation due to a single nerve.

Autonomic Nerve Fibres

The efferent or motor autonomic fibres are described as either sympathetic or parasympathetic. The fibres of the parasympathetic system are found in some cranial nerves and in the sacral 2,3,4 spinal nerves. The parasympathetic system is therefore referred to as a cranio-sacral outflow. Some of the cranial nerves carry both somatic fibres and components of the autonomic nervous system. This can range from a few parasympathetic fibres which supply an involuntary striated muscle such as those that travel in the oculomotor nerve to supply the ciliaris muscle, to the majority of fibres in a cranial nerve such as the vagus (CN X). The fibres of the parasympathetic nervous system on reaching their terminal tissue synapse in a ganglion. The postganglionic fibres are short. The fibres of the sympathetic nervous system leave the spinal cord to enter the T1 - L2 spinal nerves. This is referred to as the thoracolumbar outflow. The efferent fibres of the sympathetic nervous system synapse in a chain of ganglia attached to the ventral

primary rami of the T1-L2 spinal nerves, and extending up into the neck and down to the coccyx. The neurons in the ganglia send their fibres either out in the same spinal nerve or through the sympathetic chain to leave in a different nerve. The postganglionic fibres of the sympathetic system are long.

Visceral Afferent Fibres

Sensory information from the viscera is carried by nerve fibres which tend to follow the sympathetic efferent or parasympathetic efferent fibres. All fibres synapse in either cranial nerve ganglia or dorsal root ganglia of the spinal cord. The segment of entry into the spinal cord is the same as the segment of origin of the equivalent efferent fibres. The central nervous system associates somatic afferents in a segment with visceral afferent information from the same segment. Visceral afferent pain, e.g. from the heart, is therefore associated with a somatic distribution, e.g. the left arm and left side of the thorax. This is known as referred pain.

The Diencephalon

The hemispheres surround the diencephalon, a phylogenetically older part of the brain.

The diencephalon is formed of groups of neurons forming nuclei together with fibre bundles which connect these nuclei and others which pass through the diencephalon on their way to or from the cortex, brainstem and spinal cord.

The Brainstem

The brainstem contains all of the groups of neurons concerned with maintaining activity in the essential systems. Here are grouped centres for the control of respiration and the cardiovascular system. Major sensory systems enter the brainstem and relay in nuclear groups. The sensory and motor pathways of the spinal cord pass up and down through the brainstem.

The Spinal Cord

The spinal cord is an extension from the brainstem through the foramen magnum of the skull into the spinal canal. At each body segment spinal nerves arise. The spinal nerves carry motor fibres to the muscles and sensory fibres from the skin and musculoskeletal system. Each spinal nerve is associated with a section of the spinal cord in which the neurons are concerned with the sensory and motor activities of that nerve. The white matter of the spinal cord is formed of bundles of fibres carrying sensory information to higher centres or fibres of the motor system connecting the cerebral hemispheres, diencephalon and brainstem to the segmental neurons of the spinal cord. There is a high level of organization within the spinal cord. Both fibre bundles and nuclear groups are organized according to their participation in either sensory or motor activity, and according to which part of the body they serve. The dorsal half of the grey matter of the cord is concerned with sensory activity while motor activity is concentrated in the ventral grey matter. Consequently the dorsal roots of the spinal nerves are sensory, while the ventral roots are motor.

The adult spinal cord does not extend throughout the spinal canal as it does in the fetus. Due to differential rates of growth of the vertebrae and spinal cord, the spinal cord in the adult extends only as far as the L2 vertebra. This has significance with respect to the way the roots and nerves pass from the cord to the exit from the intervertebral foramina. At high cervical levels the level of emergence of the nerve is close to the same segment of origin of the roots. Further down the cord the roots must descend a greater and greater distance to reach the foramen of exit. All of the lumbar and sacral nerve roots must leave the cord and travel as the cauda equina before their exit. In practice this means that nerve fibres in the lumbar and sacral nerves will have travelled behind the intervertebral discs between the lumbar vertebrae. It is therefore possible that extrusion of a lumbar disc posteriorly can compress lower lumbar and sacral roots.

The Central Nervous System

The brain and spinal cord are the two components of the central nervous system. The

brain may be subdivided into:

The cerebral hemispheres

The diencephalon

The brainstem

The cerebral hemispheres

The paired cerebral hemispheres are the largest components of the brain. The surface of each hemisphere is folded into gyri with intervening grooves, the sulci.

Each hemisphere is divided into lobes along structural and functional lines:

Frontal lobe

Temporal lobe Auditory cortex

parietal lobe Visual cortex

The two hemispheres are connected by the corpus callosum

Full Page Diagram

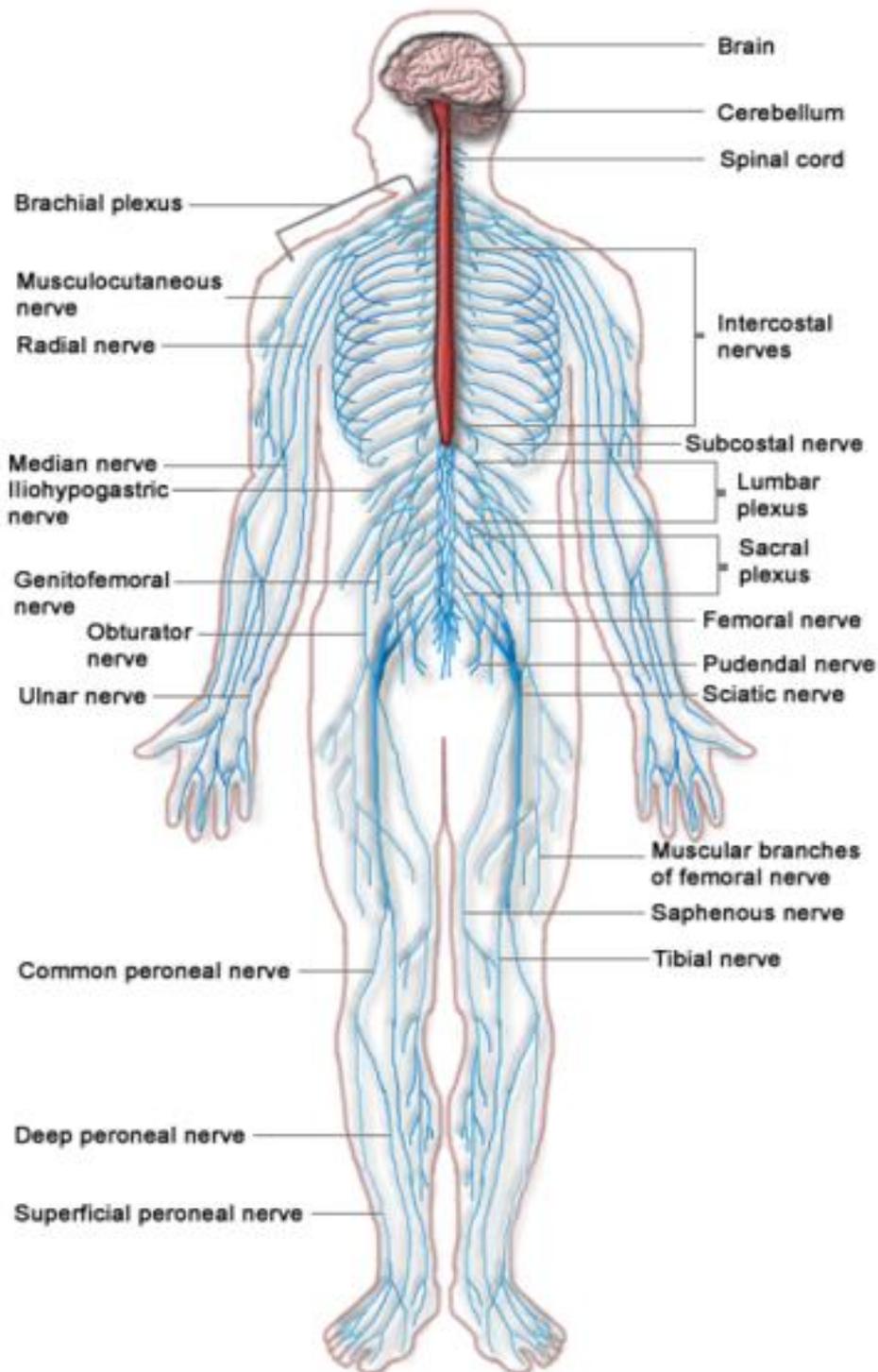


Figure 1. Nervous System of the Human Body. From Nervous system - Wikipedia, the free encyclopedia. Copyright November, 2007, From http://en.wikipedia.org/wiki/Nervous_system

Description of the Parts of the Nervous System

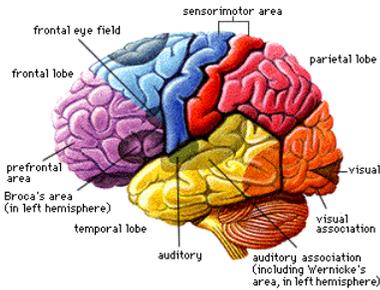


Figure 2. The Brain. From

The Brain

Your brain has many different parts that work together. We're going to talk about these five parts, which are key players on the brain team: cerebrum, cerebellum, brain stem, pituitary gland, hypothalamus.

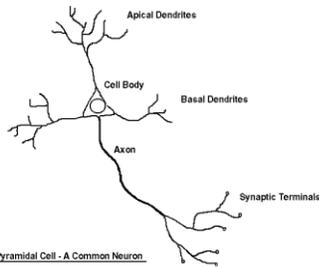


Figure 3. An Example Nerve. From

Nerves

Hsdkjflakjdhflajksdhflkjas hdlkfjas kjfdh salkdjhf lak jsdh
 flkasjdh flkjash flkjasdh flkjasdh fjkhasdlkfjhlsad khflashf
 lkajsdhfljashdljahs dliuf haskdhvc ljxzhbvcka sjdhubfliaweb
 toiuaw hbfkjasbd vfkjasdb flkjasdhbl fkjashdlfkj ahskdlkfj halksj.

Primary Informational Website Review

- Insert Picture w/ Figure Information
- Insert a short review

Nervous System Quiz

- Add quiz questions here.
- Only 10 questions in any format (T/F, Multiple Choice, Short Answer.)

Nervous System Quiz – KEY

- List answers to Quiz Questions

Nervous System Quiz Completed by Student #1

Nervous System Quiz Completed by Student #2

PowerPoint Presentation Images - Nervous System

- Place small thumbnails of PowerPoint slides in this section may take 2-4 pages.

Supporting Presentation Documents

- Add any written portion of the presentation here, notes etc.

Work Cited

- Add all references used for WRITEN work here in APA format.
- DO NOT INCLUDE REFERNCES FOR FIGURE INFORMATION HERE

Student Evaluation Rubrics

Portfolio Evaluation

Student Evaluation

Name: _____

Portfolio	0 - Poor	1- OK	2- Excellent	Score
All Elements Present	Missing 3 or more items from the checklist	Missing 1-2 items from the checklist	All items from the checklist are present	
Spelling & Conventions	There are 7 or more spelling, capitalization or notation errors	There are 3-7 spelling, capitalization or notation errors	There are 3 or fewer spelling, capitalization or notation errors	
Neatness	There are 3 or more areas that are not double spaced or figures neatly arranged.	There are 1-2 areas that are not double spaced or figures neatly arranged.	All text was double spaced and figures are neatly arranged	
Organization	There are 2 or more items out of order or poorly organized	There is at least 1 item out of order or poorly organized	There are no items out of order.	
Quality Diagrams	There are 3 or more diagrams that are wrong, difficult to see, or incorrectly labeled.	There are 1-2 diagrams that are wrong, difficult to see, or incorrectly labeled.	There are no diagram errors	
			Total	

Presentation Evaluation**Student Evaluation**

Name: _____

Presentation	0 - Poor	1- OK	2- Excellent	Score
Complete Information	Information is missing or incomplete. Presentation does not teach about topic completely	Information is complete, but does not present topic for understanding	Information is complete and topic is understood after completing the presentation.	
Spelling & Conventions	There are 7 or more spelling, capitalization or notation errors	There are 3-7 spelling, capitalization or notation errors	There are 3 or fewer spelling, capitalization or notation errors	
Neatness	There are many errors. Little time was spent working on presentation	There are few errors. There was some time given to prepare presentation	There are no errors. There is evidence that ample time was used to prepare presentation.	
Organization	Placement of items seem out of place or done without planning	Placement of items seem planned but are not effective and could be improved	Placement of items has been carefully planned and help in understanding the topic	
Attention to Detail	There are no items present that surprise or enhance the presentation	There are 1 or 2 items present that surprise or enhance the presentation	The presentation is full of elements that enhance the presentation.	
			Total	

Teacher Evaluation Rubrics & Final Score

Teacher Evaluation				
Portfolio	0 - Poor	1- OK	2- Excellent	Score
All Elements Present	Missing 3 or more items from the checklist	Missing 1-2 items from the checklist	All items from the checklist are present	
Spelling & Conventions	There are 7 or more spelling, capitalization or notation errors	There are 3-7 spelling, capitalization or notation errors	There are 3 or fewer spelling, capitalization or notation errors	
Neatness	There are 3 or more areas that are not double spaced or figures neatly arranged.	There are 1-2 areas that are not double spaced or figures neatly arranged.	All text was double spaced and figures are neatly arranged	
Organization	There are 2 or more items out of order or poorly organized	There is at least 1 item out of order or poorly organized	There are no items out of order.	
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Attention to Detail	There are no items present that surprise or enhance the presentation	There are 1 or 2 items present that surprise or enhance the presentation	The presentation is full of elements that enhance the presentation.	
			Total	
Quizzes				
Grade 4 Digestive System	Grade 5 Respiratory System	Grade 6 Circulatory System	Average Score	
Total Student	Total Teacher	Average Quiz	TOTAL SCORE	