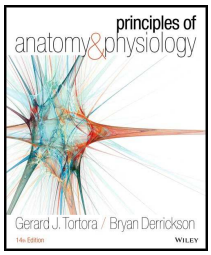


Principles of Anatomy and Physiology

14th Edition

CHAPTER 13

The Spinal Cord and Spinal Nerves

Introduction

The purpose of the chapter is to:

1. Identify and describe the anatomical features of the spinal cord and spinal nerves
2. Discuss the functions of the spinal cord and spinal nerves and understand how they help maintain homeostasis in the body
3. Understand spinal reflex arcs

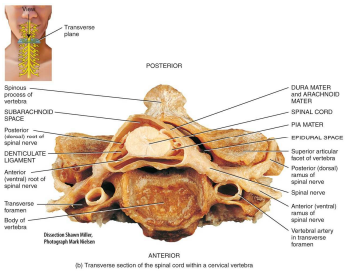
Functions of the Spinal Cord

1. Process reflexes
2. Integrate EPSPs and IPSPs
3. Conduct sensory impulses to the brain and motor impulses to effectors

Protection of the Spinal Cord

The spinal cord is protected by:

- Bone (vertebrae)
- Connective tissue (meninges)
- Fluid (cerebrospinal fluid)

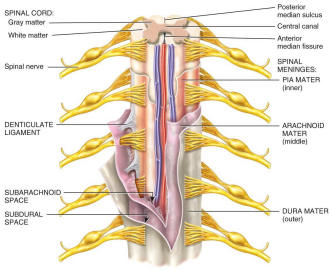


(b) Transverse section of the spinal cord within a cervical vertebra

Meninges

The meninges are composed of three layers

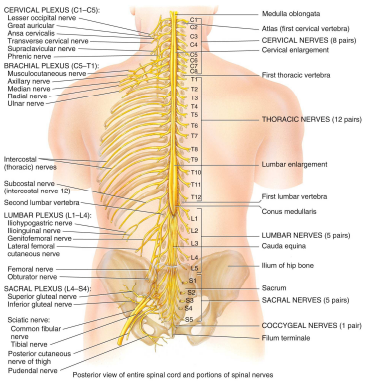
1. Dura mater
2. Arachnoid mater
3. Pia mater



(a) Anterior view and transverse section through spinal cord

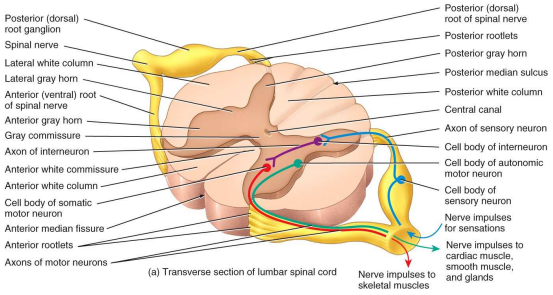
External Anatomy of the Spinal Cord

The spinal cord begins as an extension of the medulla oblongata at the level of the foramen magnum and terminates at the level of L2



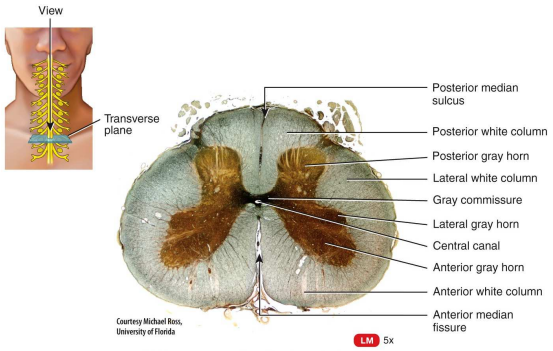
Posterior view of entire spinal cord and portions of spinal nerves

Internal Anatomy of the Spinal Cord



(a) Transverse section of lumbar spinal cord

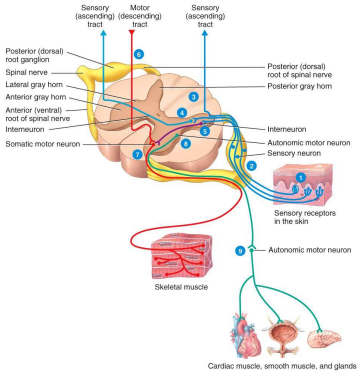
Internal Anatomy of the Spinal Cord



(b) Transverse section of lumbar spinal cord

Sensory and Motor Processing

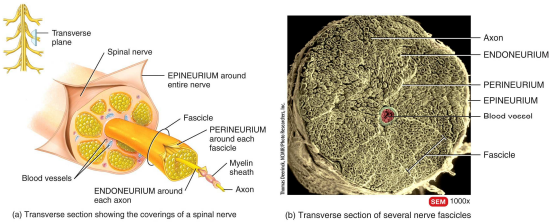
The internal anatomy of the spinal cord allows sensory and motor information to be processed in an organized way



Spinal Nerves

- Spinal nerves connect the CNS to sensory receptors, muscles, and glands and are part of the peripheral nervous system
- 31 pairs of spinal nerves
- Anterior and posterior roots attach a spinal nerve to a segment of the spinal cord

Connective Tissue Covering of Spinal Nerves

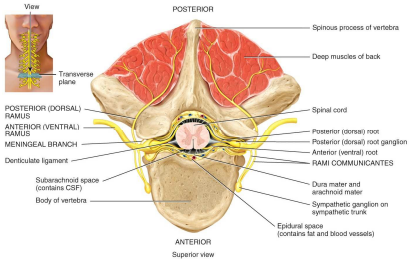


(a) Transverse section showing the coverings of a spinal nerve

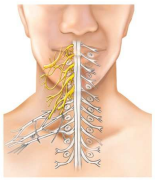
(b) Transverse section of several nerve fascicles

Branches of a Spinal Nerve

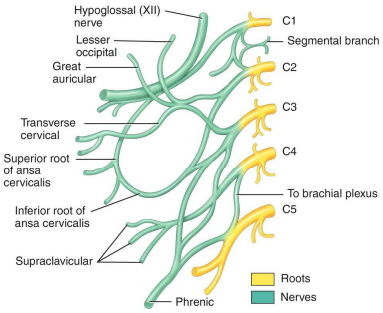
Shortly after passing through its intervertebral foramen a spinal nerve divides into several branches known as rami



Cervical Plexus

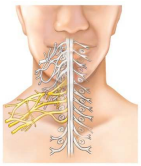


Cervical plexus projected to surface

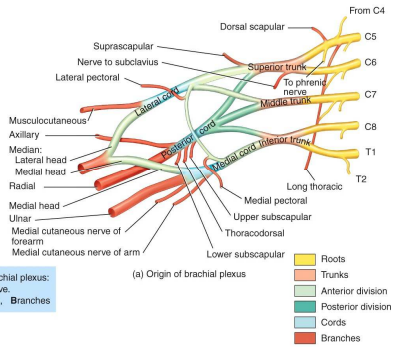


Origin of cervical plexus

Brachial Plexus



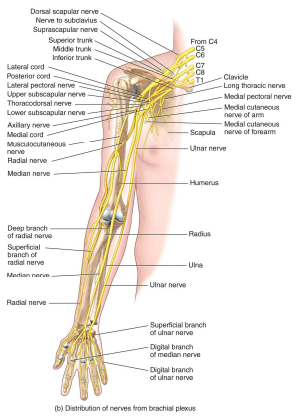
Brachial plexus projected to surface



(a) Origin of brachial plexus

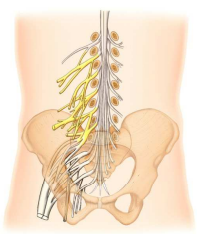
MNEMONIC for subunits of the brachial plexus:
Risk **T**akers **D**on't **C**autiously **B**ehave.
Roots, **T**runks, **D**ivisions, **C**ords, **B**ranches

Brachial Plexus

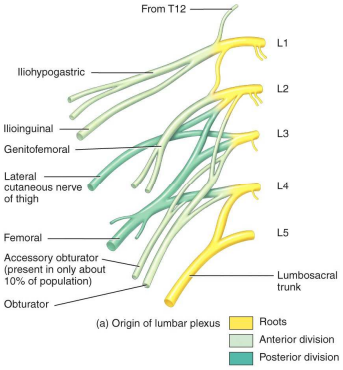


(b) Distribution of nerves from brachial plexus

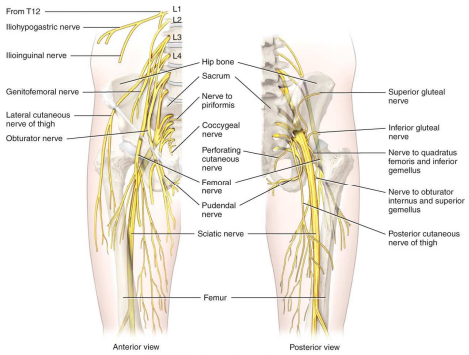
Lumbar Plexus



Lumbar plexus projected to surface

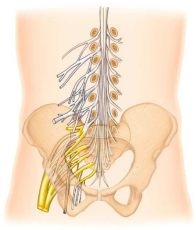


Lumbar Plexus

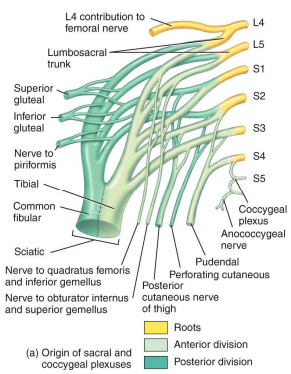


(b) Distribution of nerves from lumbar plexus

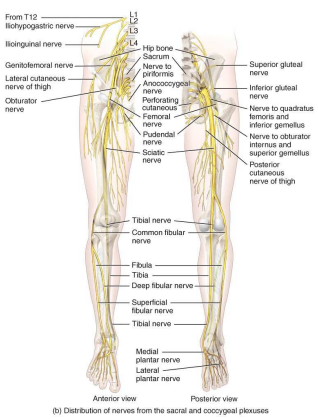
Sacral Plexus



Sacral and coccygeal plexuses projected to surface



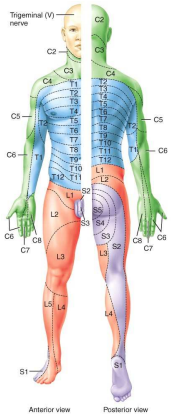
Sacral Plexus



(b) Distribution of nerves from the sacral and coccygeal plexuses

Dermatomes

Certain segments of the skin is supplied by spinal nerves that carry somatic sensory nerve impulses to the brain

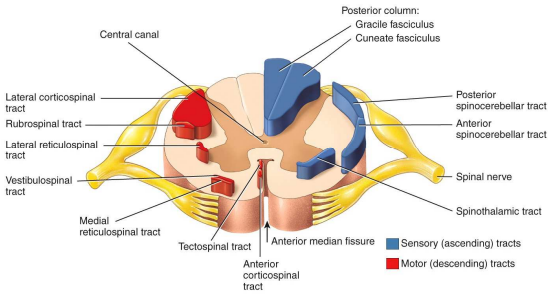


Spinal Cord Physiology

How does information travel in the spinal cord?

- White matter tracts conduct nerve impulses to and from the brain
- Gray matter receives and integrates incoming and outgoing information to perform spinal reflexes

Sensory and Motor Tracts



Reflexes and Reflex Arcs

A reflex is a fast, predictable, automatic response to changes in the environment

- Reflexes help maintain homeostasis
- The spinal cord serves as the integrating center for spinal reflexes
  - Integration takes place in the gray matter of the spinal cord

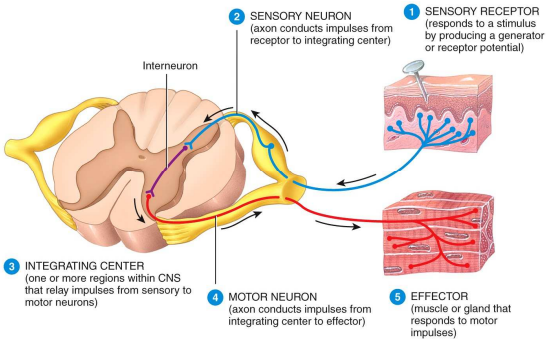
Reflexes

Interactions Animation:

- Reflexes

You must be connected to the Internet and in Slideshow Mode to run this animation.

General Components of a Reflex Arc

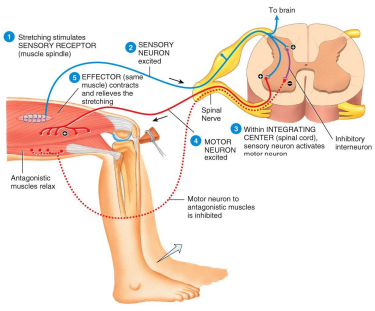


Reflex Arcs: Vocabulary Terms

- Ipsilateral
- Contralateral
- Monosynaptic
- Polysynaptic
- Reciprocal innervation

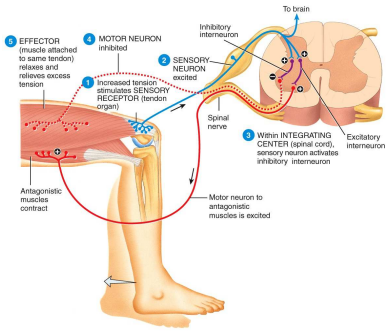
Stretch Reflex

Controls muscle length by causing muscle contraction



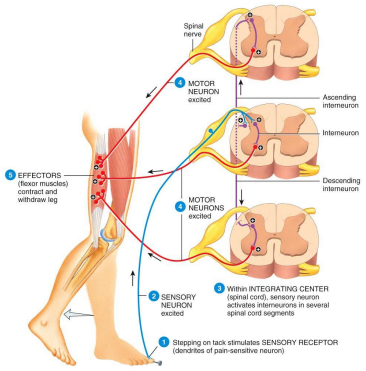
Tendon Reflex

Controls muscle tension by causing muscle relaxation



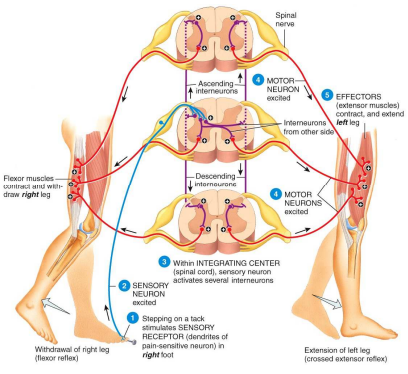
Flexor (Withdrawal) Reflex

Moves a limb to avoid injury or pain



Crossed-Extensor Reflex

Maintains balance



Clinical Connection

Reflexes are often used for diagnosing disorders of the nervous system and locating injured tissue

- If a reflex is absent or abnormal, the damage may be somewhere along a particular conduction pathway

Homeostatic Imbalances

Damage that results from traumatic injuries depends on

- Degree of spinal cord section

or

- Degree of compression of the segments involved

End of Chapter 13