NERVOUS SYSTEM:
SPINAL CORD AND SPINAL NERVES
Gross Anatomy

- **Size**: 42-45 cm long
- **Regions**
  - Cervical
    - Continuous with medulla oblongata
    - Motor neurons form cervical spinal nerves
  - Thoracic
    - Motor neurons form thoracic spinal nerves
  - Lumbar
    - Motor neurons for lumbar spinal nerves
  - Sacral
    - Motor neurons for sacral spinal nerves
  - Coccygeal

*Note: doesn’t match up exactly to vertebrae*
Regions

• Cervical enlargement
  – Innervates upper limbs

• Lumbar enlargement
  – Innervates lower limbs

• Conus medullaris = end of the spinal cord
  – Cauda equina = axons
  – Filum terminale (also called the coccygeal ligament) = pia mater that anchors conus medularis to coccyx
Meninges

- **Pia mater**
  - Denticulate ligaments
  - Form a lateral shelf separating the dorsal and ventral rootlets

- **Arachnoid mater**
  - Subarachnoid space
  - CSF

- **Dura mater**
  - Only one layer
  - Epidural space
  - Coccygeal ligament
Sectional Anatomy of the Spinal Cord
## Regional Differences

<table>
<thead>
<tr>
<th>Region</th>
<th>Diameter</th>
<th>Shape</th>
<th>Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cervical</td>
<td>Largest (10-15 mm)</td>
<td>Oval with flattening</td>
<td>↑ white vs gray</td>
</tr>
<tr>
<td>Thoracic</td>
<td>Smaller</td>
<td>Oval with flattening</td>
<td>↑ white vs gray</td>
</tr>
<tr>
<td>Lumbar</td>
<td>&gt; thoracic</td>
<td>Almost circular</td>
<td>↓ white</td>
</tr>
<tr>
<td>Sacral</td>
<td>Smallest</td>
<td>Almost circular</td>
<td>white = gray</td>
</tr>
</tbody>
</table>

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Organization of White Matter
Spinal Cord White Matter

• **Columns**
  – segments of myelinated axons that lead up/down the spinal cord

• **Ascending tracts**
  – lead up the spinal cord to the brain
  – Example: spinothalmic tract

• **Descending tracts**
  – lead from the brain down to the spinal cord
  – Example: corticospinal tract
Spinothalamic Tract

- Spinothalamic Tract
  - Info to thalamus
    - Pain
    - Temperature
    - Itch
    - Crude touch
  - Decussates in spinal cord
  - Receives sensory information from skin, viscera
Corticospinal Tract

- Also called Pyrimidal tract
- From cerebral cortex to spinal cord
- Mostly motor axons
- Decussation in the medulla
  - Decussation of the pyramids
  - About 80%
Spinal Nerves

• Connect CNS to muscles, receptors, glands

• 31 pairs
  • 8 pairs Cervical
  • 12 pairs Thoracic
  • 5 pairs Lumbar
  • 5 pairs Sacral
  • 1 pairs Coccygeal
Dermatomes

- Each pair of spinal nerves monitors a specific region of the body’s surface
Anatomy of a Peripheral Nerve

• Each peripheral nerve has 3 layers of connective tissue
• Epineurium
  – Surrounds the outer surface of the nerve
  – Dense irregular CT
  – Blood-nerve barrier
• Perineurium
  – Encloses bundles of axons
  – Fascicles
• Endoneurium
  – Areolar CT
  – Capillaries within supply oxygen and nutrients to the axons and Schwann cells
Anatomy of a Peripheral Nerve
Peripheral Distribution of Spinal Nerves

• Each spinal nerve is formed from the fusion of dorsal and ventral roots as they pass through the intervertebral foramen

• Nerves then divide into several branches
Distribution of Motor Neurons in the Spinal Cord
Distribution of Sensory Neurons in the Spinal Cord
Nerve Plexuses

- Segments controlling skeletal musculature
  - Neck
  - Upper limbs
  - Lower limbs
- Ventral rami of adjacent spinal nerves blend their fibers to form a series of compound nerve trunks
- Nerves plexuses
  - Cervical
  - Brachial
  - Lumbar
  - Sacral
- Occurs during skeletal muscle development
Cranial Nerves

• 12 pairs
  – Arise from the inferior aspect of the brain
  – 2 from the forebrain
  – 10 from the brain stem

• Functions
  – Sensory
  – Motor
  – ....or both
Olfactory bulb, termination of olfactory nerve (N I)

Olfactory tract

Optic chiasm

Optic nerve (N II)

Infundibulum

Oculomotor nerve (N III)

Trochlear nerve (N IV)

Trigeminal nerve (N V)

Abducens nerve (N VI)

Facial nerve (N VII)

Vestibulocochlear nerve (N VIII)

Glossopharyngeal nerve (N IX)

Vagus nerve (N X)

Hypoglossal nerve (N XII)

Accessory nerve (N XI)

(b) Inferior view
## Cranial Nerves

<table>
<thead>
<tr>
<th>CN I</th>
<th>Olfactory</th>
<th>Oh</th>
<th>Some</th>
</tr>
</thead>
<tbody>
<tr>
<td>CN II</td>
<td>Optic</td>
<td>Oh</td>
<td>Say</td>
</tr>
<tr>
<td>CN III</td>
<td>Occulomotor</td>
<td>Oh</td>
<td>Marry</td>
</tr>
<tr>
<td>CN IV</td>
<td>Trochlear</td>
<td>To</td>
<td>Money</td>
</tr>
<tr>
<td>CN V</td>
<td>Trigeminal</td>
<td>Touch</td>
<td>But</td>
</tr>
<tr>
<td>CN VI</td>
<td>Abducesns</td>
<td>And</td>
<td>My</td>
</tr>
<tr>
<td>CN VII</td>
<td>Facial</td>
<td>Feel</td>
<td>Brother</td>
</tr>
<tr>
<td>CN VIII</td>
<td>Vestibulocochlear</td>
<td>Very</td>
<td>Says</td>
</tr>
<tr>
<td>CN IX</td>
<td>Glossopharyngeal</td>
<td>Good</td>
<td>Big</td>
</tr>
<tr>
<td>CN X</td>
<td>Vagus</td>
<td>Velvet</td>
<td>Brains</td>
</tr>
<tr>
<td>CN XI</td>
<td>Accessory</td>
<td>A</td>
<td>Matter</td>
</tr>
<tr>
<td>CN XII</td>
<td>Hypoglossal</td>
<td>H</td>
<td>Most</td>
</tr>
</tbody>
</table>