Spinal Cord

- Extends from the base of the skull to the coccygeal area of the vertebral canal.
  - 32 - 33 Spinal Nerves designated by region
    - 8 Cervical
    - 12 Thoracic
    - 5 Lumbar
    - 5 Sacral
    - 2 - 4 Coccygeal

The Spinal Cord ends at the level of the body of lumbar vertebra 2 to form the Conus Medullaris. The Lumbar and Sacral spinal nerves travel through a meningeal encased cerebrospinal fluid filled space called the lumbosacral cistern, to form the portion of the spinal cord referred to as the Cauda Equina.

The core of each spinal cord segment if viewed in transverse section demonstrates two distinct regions:
- White Matter - the outer shell of the cord consisting of myelinated fibers.
- Gray Matter - the central core consisting of non-myelinated nerve cell bodies.

A Typical Spinal Cord Region

The Gray Matter of the Spinal cord can be divided into two functional regions behind or in front of a developmental groove called the sulcus limitans.
- Posterior (Dorsal) Gray Horn: consists of sensory or afferent nerve cell populations.
- Anterior (Ventral) Gray Horn: consists of motor or efferent nerve cell populations.
Entering and leaving the spinal cord are two nerve trunks called Roots.

- Posterior or Dorsal Root: is the point of entry of sensory or afferent nerve cell processes to the spinal cord.

- Anterior or Ventral Root: is the point of exit of motor or efferent nerve processes from the spinal cord.

Posterior roots contain pseudounipolar sensory neurons whose cell bodies are found in specialized structures called Dorsal Root Ganglia.

The anterior and posterior roots come together to form a spinal nerve, or Primary Rami. The primary rami divide into a short posteriorly directed rami and a long anteriorly directed rami. All of the rami are mixed nerves containing both muscular and cutaneous components.

These fibers will impact the cells of the CNS or will arise from nuclei of the CNS.

* Ganglia are aggregations of nerve cell bodies outside the central nervous system.
Spinal Cord Nuclei (Lamina of Rexed)

**Sensory:**
- I Posterior Marginal Nucleus
- II Substantia Gelatinosa
- III (similar to II)
- IV-V Nuclei Proprius
- VII Nucleus Dorsalis of Clarke
- VII Intermediolateral Nucleus

**Motor:**
- VII Intermediolateral Cell Column
- VII Nucleus of Onufrowicz
- VIII Interneuron Pool
- IX α Motoneurons
  - Dorsomedial
  - Ventrolateral
  - Dorsolateral
  - Retrodorsolateral
- Central
- Spinal Accessory
- X Periependymal Gray Matter

### Spinal Cord Lamina (Nuclei & Tracts)

- **AST- Anterior Spinothalamic Tract**
- **SRT- Spinoreticular Tract**

### Table: Spinal Cord Lamina (Nuclei)

<table>
<thead>
<tr>
<th>Lamina</th>
<th>Lamina Name</th>
<th>Input</th>
<th>Output</th>
<th>Functional Role</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Posterior Marginal Nucleus</td>
<td>Small non-myelinated afferent fibers for pain &amp; temperature</td>
<td>Fibers ascend crossed and uncrossed to brainstem and thalamus</td>
<td>Contributes to contralateral spinothalamic tract perception of light touch, pain &amp; temperature stimuli</td>
</tr>
<tr>
<td>II</td>
<td>Substantia Gelatinosa</td>
<td>Nociceptive fibers via Lissauers tract</td>
<td>Ascend and descend in Lissauers tract, synapse on fibers of lamina III,IV</td>
<td>Relay nuclei for pain and temperature, modulation of pain, pain gate</td>
</tr>
<tr>
<td>III</td>
<td>IV</td>
<td>Nucleus Proprius</td>
<td>Large caliber fibers for light touch</td>
<td>Fibers crossed or uncrossed to the brainstem and thalamus</td>
</tr>
<tr>
<td>V</td>
<td>Reticular Nucleus</td>
<td>Receives info from II,III, &amp; IV, receives from corticospinal, rubrospinal, reticulospinal, and spinothalamic tract anterior spinthalamic tract, lateral spinthalamic tract</td>
<td>Pain, temperature &amp; light touch</td>
<td></td>
</tr>
<tr>
<td>VI</td>
<td>Commissural Nucleus</td>
<td>Propriospinal afferents</td>
<td>Projections to cells of lamina IX</td>
<td>Motor control and integration</td>
</tr>
</tbody>
</table>

### Diagram: Spinal Cord Lamina

- [Image of Spinal Cord Lamina with labels and legends]

### Image: Spinal Cord Lamina & Tracts

- [Image of Spinal Cord Lamina & Tracts with labels]

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NMS for Independent Study Neuroanatomy, 2nd ed., W. DeMyer, Williams & Wilkins, Baltimore, 1998, pp.113

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This page contains a table and diagrams illustrating the spinal cord lamina and nuclei, along with sensory and motor functions. The table outlines the laminae, their names, inputs, outputs, and functional roles. The diagrams provide visual aids for understanding the anatomical locations and connections.
Table 13.1 The somatomotor cell columns

<table>
<thead>
<tr>
<th>Cell column</th>
<th>Muscles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ventromedial (all segments)</td>
<td>Erector spinae, intercostals, abdominals</td>
</tr>
<tr>
<td>Dorsomedial (T1-L2)</td>
<td>Arm/thigh</td>
</tr>
<tr>
<td>Ventrolateral (C5-8, L2-S2)</td>
<td>Forearm/leg</td>
</tr>
<tr>
<td>Dorsolateral (C6-8, L3-S3)</td>
<td>Hand/foot</td>
</tr>
<tr>
<td>Retrodorsolateral (C8, T1, S1-2)</td>
<td>Hand/foot</td>
</tr>
<tr>
<td>Central (C3-S)</td>
<td>Diaphragm</td>
</tr>
</tbody>
</table>

Figure 13.1 Cell columns in the anterior gray horn of the spinal cord: somatosensory organization.