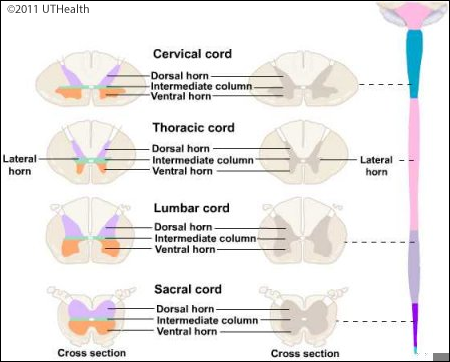
**Spinal Cord – Grey Matter Dr. Gary Mumaugh – Campbellsville University**

**Grey Matter Structure**

* Grey matter
  + Contains cell bodies (soma), dendrites, unmyelinated axons
* Myelin
  + Made of Lipid and Protein - Whitish appearance
  + Formed by oligodendrocytes (central nervous system) and Schwann cells (peripheral nervous system)
* Node of Ranvier
  + Unmyelinated regions between two adjacent myelinated segments of axons in the CNS and PNS
  + Contain a large amount of Na+ channels → allows saltatory conduction → increases the velocity of action potentials

****

**A close-up of a brain

Description automatically generatedA close-up of a brain

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**Note the significant size differences of the grey matter and white matter when going caudally to cranial.**

**Diagram

Description automatically generatedBasic Anatomy of Grey Matter**

* Posterior grey horn
* Anterior grey horn
* Intermediate zone
  + Lateral gray horn T1-L2
* Grey Commissure → connecting the two sides

**Basic Function of Grey Matter**

* Posterior grey horn **-** Sensory function
  + Somatic Sensations
  + Diagram

    Description automatically generatedVisceral Sensations
* Anterior grey horn - Motor function
  + Somatic Motor Function
* Intermediate Zone - Motor function
  + Visceral Motor Function

**Cord Enlargements**

* Cervical Enlargement
  + Needs more grey matter to supply upper extremities
* Lumbar Enlargement
  + Needs more gray matter to supply Lower extremities

**Somatotopic Arrangement of Grey Matter**

* Diagram

  Description automatically generatedSomatotopic Arrangement
* Imaginary Horizontal Line
  + - Nuclei on the Posterior aspect of the line supply the Flexors
    - Nuclei on the Anterior aspect supply the Extensors
* Imaginary Vertical lines
  + - Lateral Nuclear Group → Distal Limbs
    - Central Nuclear Group → Proximal Limbs
    - Medial Nuclear Group → Axial Musculature (Trunk and Neck)
* Cell bodies of the somatic motor neurons in this section of Spinal Cord are the Relay station for the Upper motor neurons of the Corticospinal Tract

Diagram

Description automatically generated

**Lamina Nuclei**

* **Posterior Marginal Nucleus** - Lamina I
  + Important for relaying fast pain and temperature sensation to the brain
  + Leads into Anterior and Lateral Spinothalamic Tract
* **Substantia Gelatinosa - Lamina II**
  + Important for relaying slow pain and temperature to the brain
  + Ascends up to the Trigeminal Nucleus in the medulla (CN V) where it is involved in pain modulation (Gate Theory – more on that latter)
* **Nucleus Proprius - Lamina III & IV**
  + Relays mechanical and temperature sensation to the brain
  + Slow pain and temperature, touch and vibration, proprioception
  + Ascends through the Dorsal Column Medial Lemniscus and Lateral Spinothalamic Tract
* **Nucleus Proprius - Lamina III & IV**
  + Relays mechanical and temperature sensation to the brain
  + Slow pain and temperature, touch and vibration, proprioception
  + Ascends through the Dorsal Column Medial Lemniscus and Lateral Spinothalamic Tract
* **Lamina VI**
  + Contains many small interneurons involved in spinal reflexes
  + Receives sensory information from muscle spindles involved in proprioception
  + Sends information to the brain via ipsilateral spinocerebellar pathways
* **Clarke’s Nucleus or Nucleus of Clarke - Lamina VII**
  + Relays unconscious proprioceptive information to the brain
  + Only found in spinal segments C8 to L3

**Lamina Nuclei**

* **Interomediolateral Nucleus**
  + - * Relays sensory information from viscera to the brain
      * Relays autonomic signals from the brain to the visceral organs.
* **Interomediomedial Nucleus - Lamina VII**
  + - * S2-S4
      * Cell bodies of the Parasympathetic Preganglionic Neurons
* **Lamina VIII**
  + - * Relay Stations for Subcortical Tract
      * Rubrospinal pathway - Limbs Movement
      * Reticulospinal tract – Flexion and extension
      * Vestibulospinal tract – Eye movement, posture, balance
      * Tectospinal tract – Head and eye movement
* **Lamina IX - Lateral Nuclear Group** 
  + - * Only Present in Cervical Enlargement (C5-T1) and Lumbar Enlargement (L2-S3)
      * Supply Distal Limbs
* **Lamina IX**
  + - * Central Nuclear Group

Phrenic Nucleus - (C3-C5)

Diaphragm

Accessory Spinal Nucleus - (C1-C5)

Sternocleidomastoid and Trapezius Muscle

Onuf’s Nucleus (S2-S4)

External Sphincters and Muscles involved in Erection and Ejaculation

* + - * Medial Nuclear Group

Axial muscles

**Clinical Significance of Referred Pain**

* Referred pain” occurs when visceral pain, for example from angina (pain arising from heart muscle that does not have an adequate blood supply), is felt as cutaneous pain, for example, in the left arm and hand.
* Referred pain occurs because there are few, if any, neurons in the dorsal horn that solely send signals of visceral pain to the brain.
* Thus neurons sending signals from the viscera, are also involved in sending signals of cutaneous pain, resulting in potential confusion of the source of the pain.
* However, certain types of visceral pain are associated with specific patterns of cutaneous referred pain.
* Understanding these patterns can aid in diagnosis of the underlying cause.

**Diagram

Description automatically generated**