بسم الله الرحمن الرحيم

DOPAMINE SCIENTIFIC TEAM

Pain

MID | Lecture 3

﴿ إِنِّي تَوَكَّلْتُ عَلَى اللَّهِ رَبِّي وَرَبِّكُمْ ۚ مَا مِن دَابَّةٍ إِلَّا هُوَ آخِذٌ بِنَاصِيَتِهَا ۚ إِنَّ رَبِّي عَلَىٰ صِرَاطٍ مُّسْتَقِيمٍ ﴾

Written by: Mazen Nashash
Awab Al-Hamdan

Reviewed by: Almothana Khalil

PHYSIOLOGY

رحلة اليقين مع سورة يس

بِسۡمِ ٱللَّهِ ٱلرَّحۡمَٰنِ ٱلرَّحِيمِ

وَٱضۡرِبۡ لَهُم مَّثَلًا أَصۡحَٰبَ ٱلۡقَرۡيَةِ إِذۡ جَآءَهَا ٱلۡمُرۡسَلُونَ ﴿١٣﴾ إِذۡ أَرۡسَلۡنَآ إِلَيۡهِمُ ٱثۡنَيۡنِ فَكَذَّبُوهُمَا فَعَزَّزۡنَا بِثَالِثٖ فَقَالُوٓاْ إِنَّآ إِلَيۡكُم مُّرۡسَلُونَ ﴿١٤﴾

أي: واضرب لهؤلاء المكذبين برسالتك، الرادين لدعوتك، مثلا يعتبرون به، ويكون لهم موعظة إن وفقوا للخير، وذلك المثل: أصحاب القرية، وما جرى منهم من التكذيب لرسل الله، وما جرى عليهم من عقوبته ونكاله. وتعيين تلك القرية، لو كان فيه فائدة، لعينها الله، فالتعرض لذلك وما أشبهه من باب التكلف والتكلم بلا علم، ولهذا إذا تكلم أحد في مثل هذا تجد عنده من الخبط والخلط والاختلاف الذي لا يستقر له قرار، ما تعرف به أن طريق العلم الصحيح، الوقوف مع الحقائق، وترك التعرض لما لا فائدة فيه، وبذلك تزكو النفس، ويزيد العلم، من حيث يظن الجاهل أن زيادته بذكر الأقوال التي لا دليل عليها، ولا حجة عليها ولا يحصل منها من الفائدة إلا تشويش الذهن واعتياد الأمور المشكوك فيها. والشاهد أن هذه القرية جعلها الله مثلا للمخاطبين. {إِذْ جَاءَهَا الْمُرْسَلُونَ} من الله تعالى يأمرونهم بعبادة الله وحده، وإخلاص الدين له، وينهونهم عن الشرك والمعاصي.

{إِذْ أَرْسَلْنَا إِلَيْهِمُ اثْنَيْنِ فَكَذَّبُوهُمَا فَعَزَّزْنَا بِثَالِثٍ} أي: قويناهما بثالث، فصاروا ثلاثة رسل، اعتناء من الله بهم، وإقامة للحجة بتوالي الرسل إليهم، {فَقَالُوا} لهم: {إِنَّا إِلَيْكُمْ مُرْسَلُونَ} .

Remember from Previous Lectures

- Pain is the most common presentation to the healthcare system, and it is the specific concern patients usually ask doctors about. At the physiological level, pain is detected by sensory receptors called **nociceptors**, which are essentially **free nerve endings**. These receptors are triggered by **tissue injury** due to **extreme mechanical**, **extreme thermal**, or **chemical stimuli**.
- Once triggered, pain signals are transmitted through **two primary types of fibers**:

1. **A-delta fibers**: These are **lightly myelinated** and slightly larger, allowing for a **faster conduction velocity** resulting in **fast pain**. Characteristics include **sharp, burning, or electrical sensations**, which may indicate **neuropathic pain**.
2. **C fibers**: These are **small, unmyelinated fibers** with a **slow conduction velocity** resulting in **slow pain**. Characteristics include **dull, vague, or aching sensations**.

Physiological and Anatomical Pathways of Pain

- The transmission of pain follows the anterolateral (spinothalamic) pathway, where the first-order neuron synapses in the dorsal horn of gray matter. At this level, decussation occurs in the spinal cord, after which the second-order neuron ascends via the contralateral spinothalamic tract to the thalamus (VPL). From there, signals reach the primary somatosensory area and the sensory homunculus, which allows the body to localize pain

- This system is divided into two distinct pathways:

1. Neo-spinothalamic pathway (fast pain): This pathway mainly involves A-delta fibers that synapse between lamina 1 and 2 of the dorsal horn. It is characterized by rapid conduction, resulting in sharp, acute pain.
2. Paleo-spinothalamic pathway (slow pain): This pathway mainly involves C fibers, which are responsible for slow conduction, resulting in dull, aching pain.

Reticular Formation and the Reticular Activating System (RAS)

- **Fibers from pain pathways** branch directly to the **reticular formation**, which consists of a **network of gray and white matter** extending from the **spinal cord** through the **brainstem** to the **diencephalon**. This structure is a core part of the **RAS**, often described as the **"switch on button"** for consciousness. When the system is **active**, it maintains an **alert and conscious** state; conversely, if it becomes **inactive**, it can lead to **reversible sleep** or an **irreversible coma**. Therefore, a **pain signal increases the arousal state**, ensuring that the individual remains in a state of **awareness**.

Fast Pain

- The fast-sharp pain signals are elicited by either mechanical or thermal pain stimuli.
- Fast-sharp pain is not felt in most deep tissues of the body.
- They are transmitted in the peripheral nerves to the spinal cord by small type Aδ fibers.
- The sharp pain plays an important role in making the person react immediately to remove themselves from the stimulus.
- Fast pain, which is transmitted via A-delta fibers, is typically triggered by extreme mechanical and extreme thermal stimuli, as well as chemical factors. In contrast, slow pain, transmitted via C fibers, is primarily activated by chemical stimuli.

Slow Pain

- Slow pain can occur in the skin and in almost any deep tissue or organ.
- this type of pain is elicited mostly by chemical types of pain stimuli.
- It is transmitted to the spinal cord by type C fibers.
- This feeling is a dull, aching, poorly localized sensation that persists for a longer time and is more unpleasant.

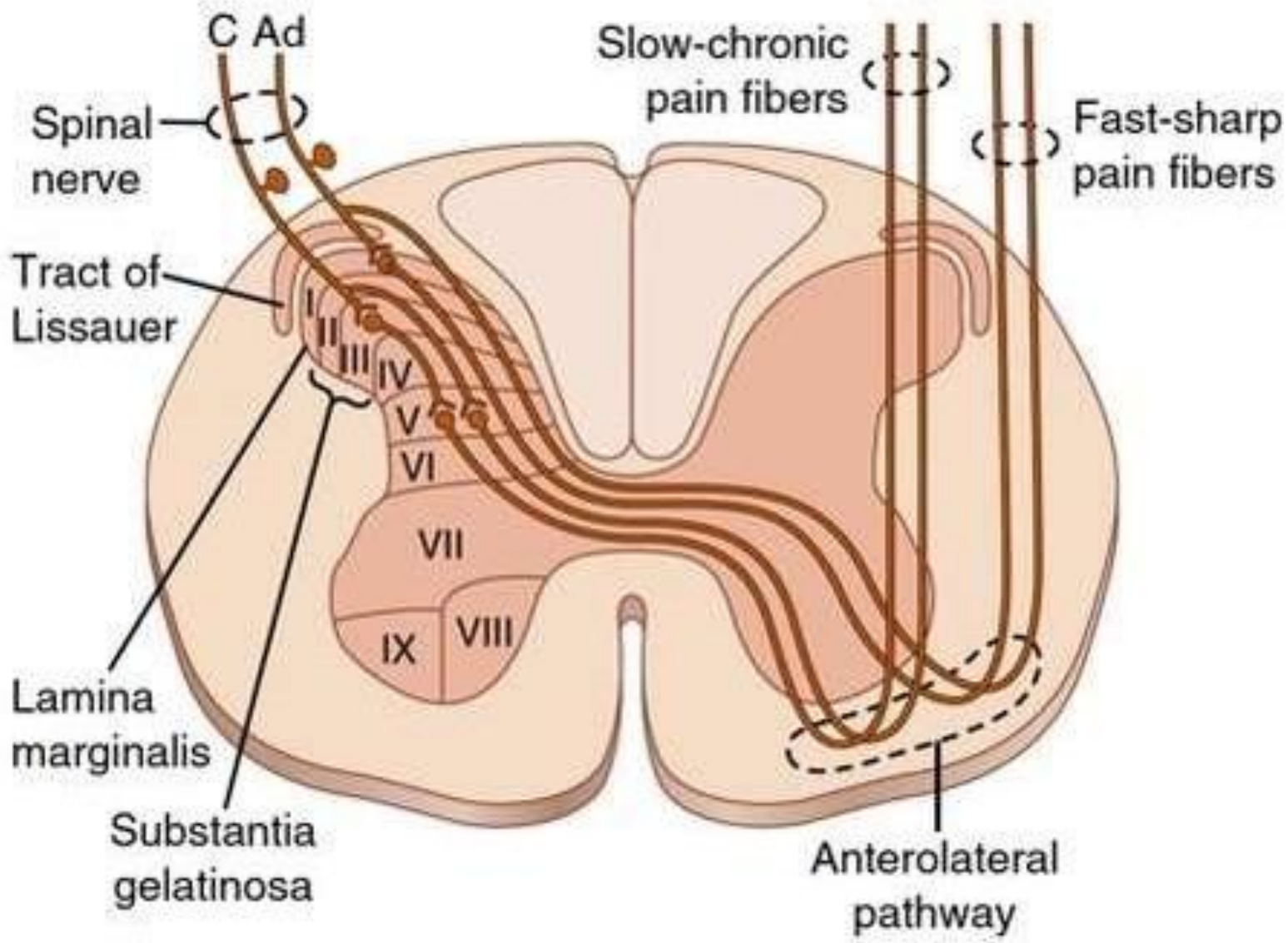
Pain

- Even though all pain receptors are free nerve endings, these endings use two separate pathways for transmitting pain signals into the central nervous system.

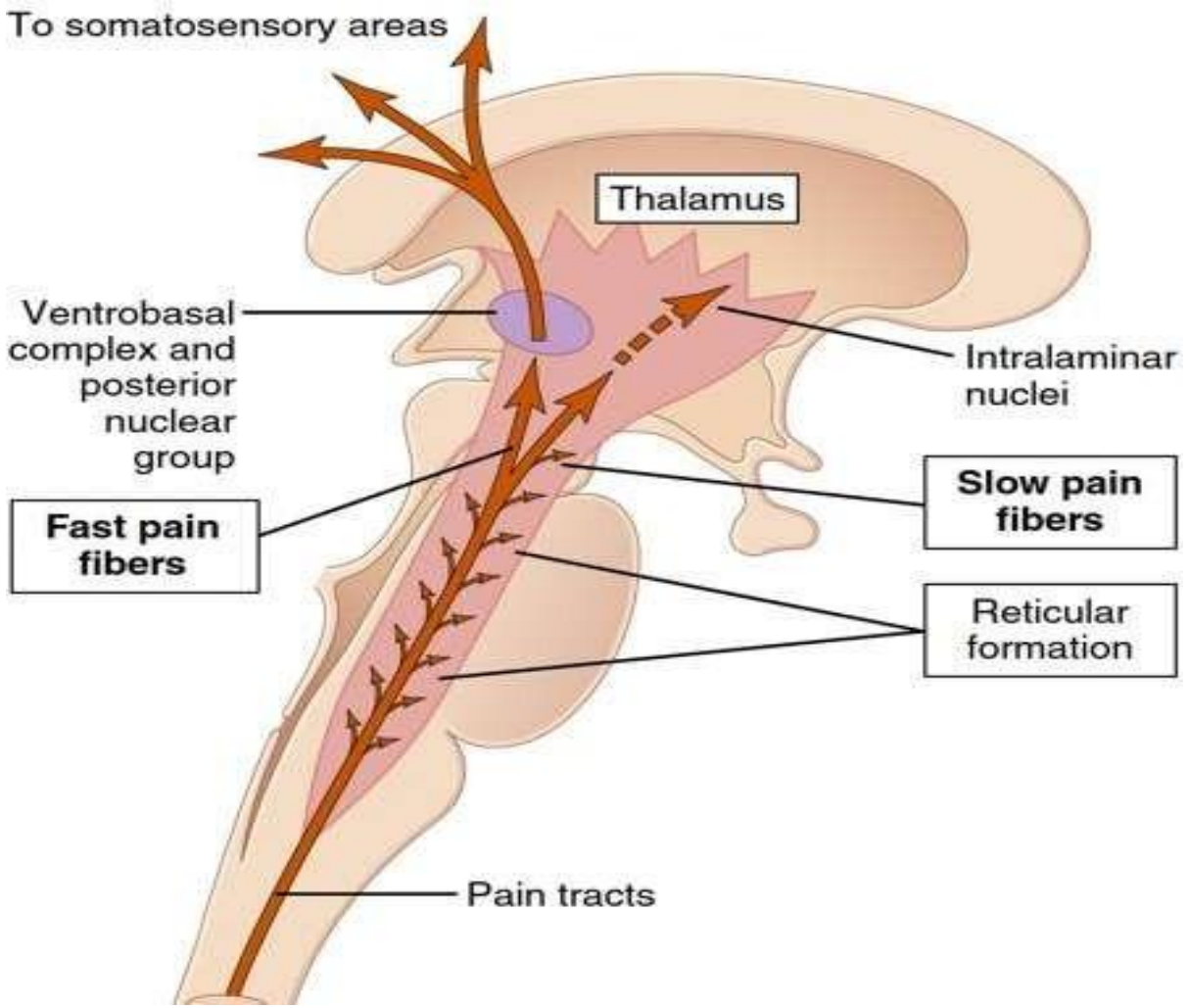
- The two pathways mainly correspond to the two types of pain:
- a fast-sharp pain pathway.
- a slow-chronic pain pathway.

Neospinothalamic tract

- A few fibers of the neospinothalamic tract terminate in the reticular areas of the brain stem, but most pass all the way to the thalamus without interruption, terminating in the ventrobasal complex along with the dorsal column–medial lemniscal tract for tactile sensations.


C Ad
Spinal nerve
Tract of Lissauer
I
II
III
IV
V
VI
VII
VIII
IX
Lamina marginalis
Substantia gelatinosa
Slow-chronic pain fibers
Fast-sharp pain fibers
Anterolateral pathway

See next slides



Slow Pain Pathway (C Fibers): The Paleospinothalamic Pathway-Previous slide explanation

- **Slow pain** is transmitted via **C fibers** through the **paleospinothalamic pathway**, which is an evolutionarily older and less sophisticated system compared to the fast pain pathway. Due to having **more synapses** and the presence of **interneurons** in the **dorsal horn**, there is a significant **synaptic delay**. Specifically, these fibers synapse between **Layer II and III (substantia gelatinosa)** of the spinal cord.

Slow Pain Pathway (C Fibers): The Paleospinothalamic Pathway

- After the initial synapse, the **second-order neuron decussates** and enters the **anterior spinothalamic tract**. Unlike fast pain, only a **minority of fibers reach the thalamus (VPL)** or the primary somatosensory area, resulting in **poor localization** of slow pain. Instead, the signals are directed toward:
- **Reticular formation:** To increase **alertness and arousal**.
- **Hypothalamus:** Triggering **autonomic changes** (HR, BP, sweating) and **endocrine stress responses** (cortisol release).
- **Intralaminar nuclei:** Providing diffuse projections to the cerebral cortex to maintain an arousal state.
- **Limbic system:** Mediating the **emotional and affective component** of pain.

Functional Significance and Neurotransmitters

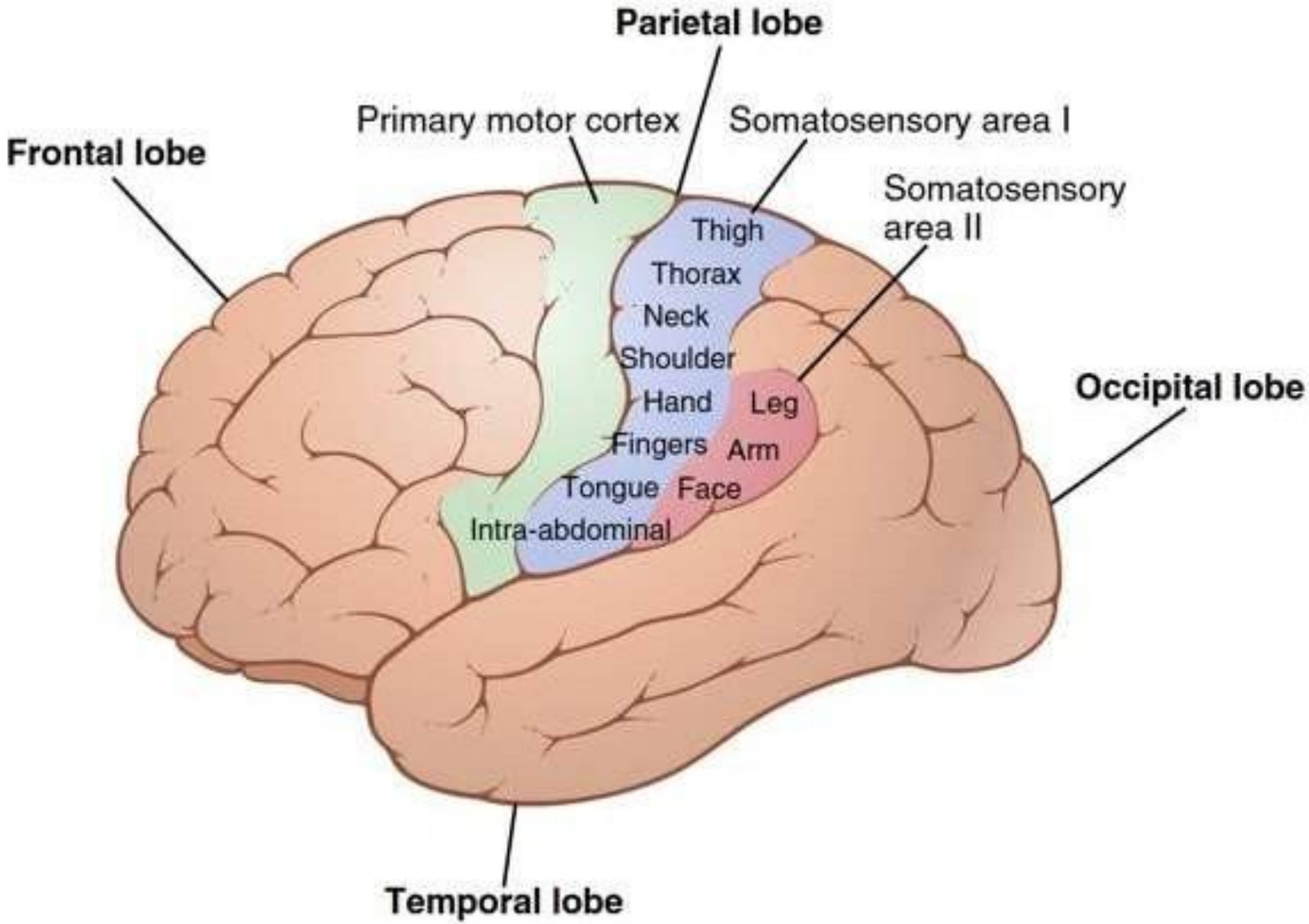
- Slow pain is characterized as **dull and aching**, and because it activates the limbic system, it carries a heavy **emotional impact**, which can lead to chronic issues like depression or anxiety. The chemical transmission differs by fiber type:
- **C fibers (Slow pain):** Release **Substance P**, which requires synthesis and results in a **slower release**.
- **A-delta fibers (Fast pain):** Release **Glutamate**, which is **vesicle-ready** for rapid transmission.

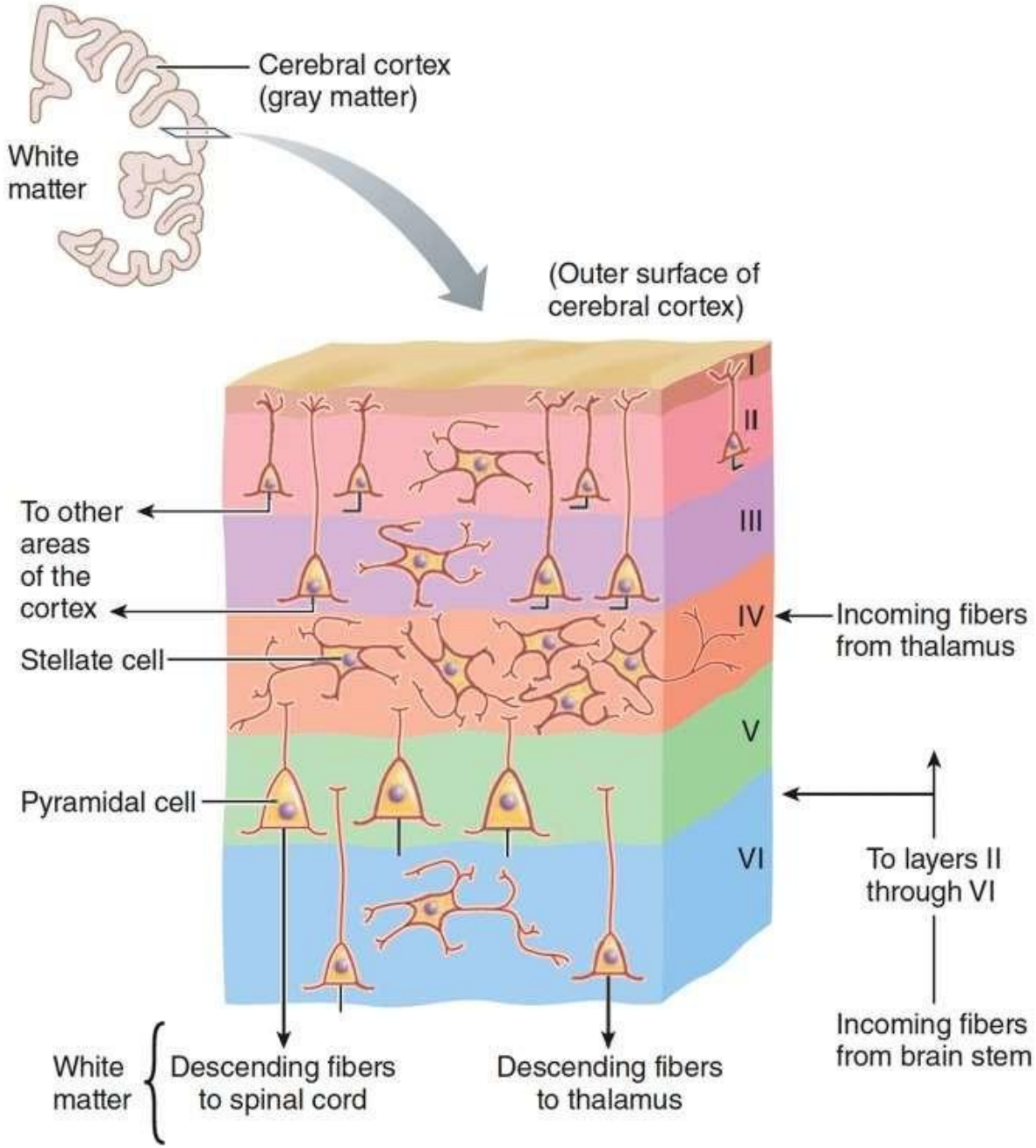
Localization of fast pain

- The fast-sharp type of pain can be localized much more exactly in the different parts of the body than can slow-chronic pain.

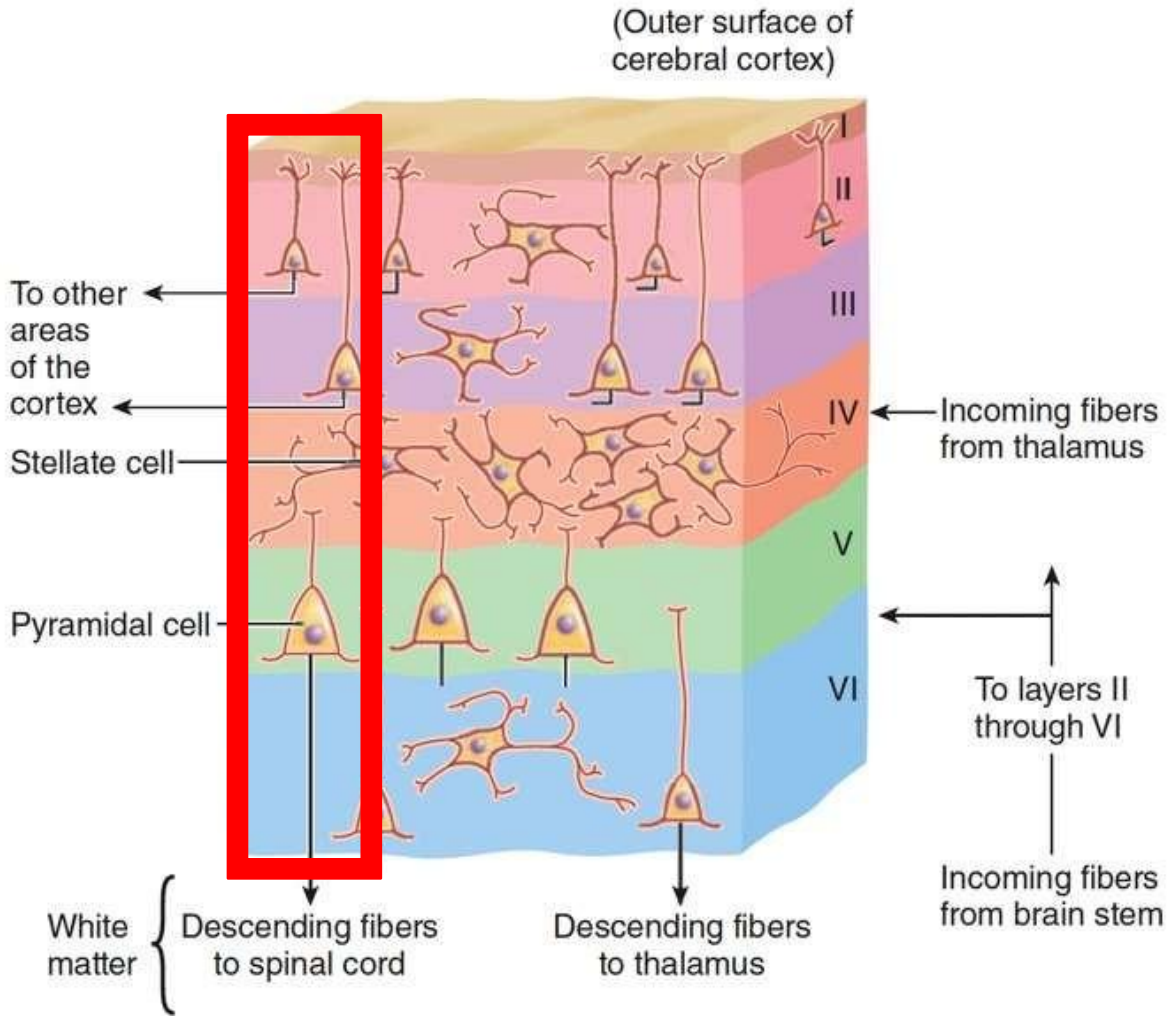
- When tactile receptors that excite the dorsal column–medial lemniscal system are simultaneously stimulated, the localization can be nearly exact.

- It is believed that glutamate is the neurotransmitter substance secreted in the spinal cord at the type Aδ pain nerve fiber endings.


Parietal lobe
Primary motor cortex
Somatosensory area I
Frontal lobe
Somatosensory area II
Thigh
Thorax
Neck
Shoulder
Hand
Leg
Fingers
Arm
Tongue
Face
Intra-abdominal
Occipital lobe
Temporal lobe


Cerebral cortex
(gray matter)
White
matter
(Outer surface of
cerebral cortex)
I
II
III
IV
V
VI
To other
areas
of the
cortex
Stellate cell
Pyramidal cell
Incoming fibers
from thalamus
To layers II
through VI
Incoming fibers
from brain stem
White
matter
Descending fibers
to spinal cord
Descending fibers
to thalamus

See next slides



Cerebral Cortex Organization and Columnar Function-Previous slide explanation

- The **cerebral cortex** is not a single uniform layer; it consists of **6 distinct layers**, each possessing a **specific function**. The **thickness and sophistication** of these layers vary depending on the specific cortical area. The general functions of these layers include:
- **Incoming signals:** The cortex **receives input from the thalamus** primarily in **Layer IV**.
- **Thalamic feedback:** It **sends input back to the thalamus** via **Layer VI**.
- **Motor output:** The cortex **sends output to the spinal cord** through **Layer V**.
- **Cortical communication:** It **communicates with neighboring cortical areas** using **Layers I, II, and III**.
- **Integration: Layers V and VI** (along with others) **integrate and process incoming information** for the specific area.

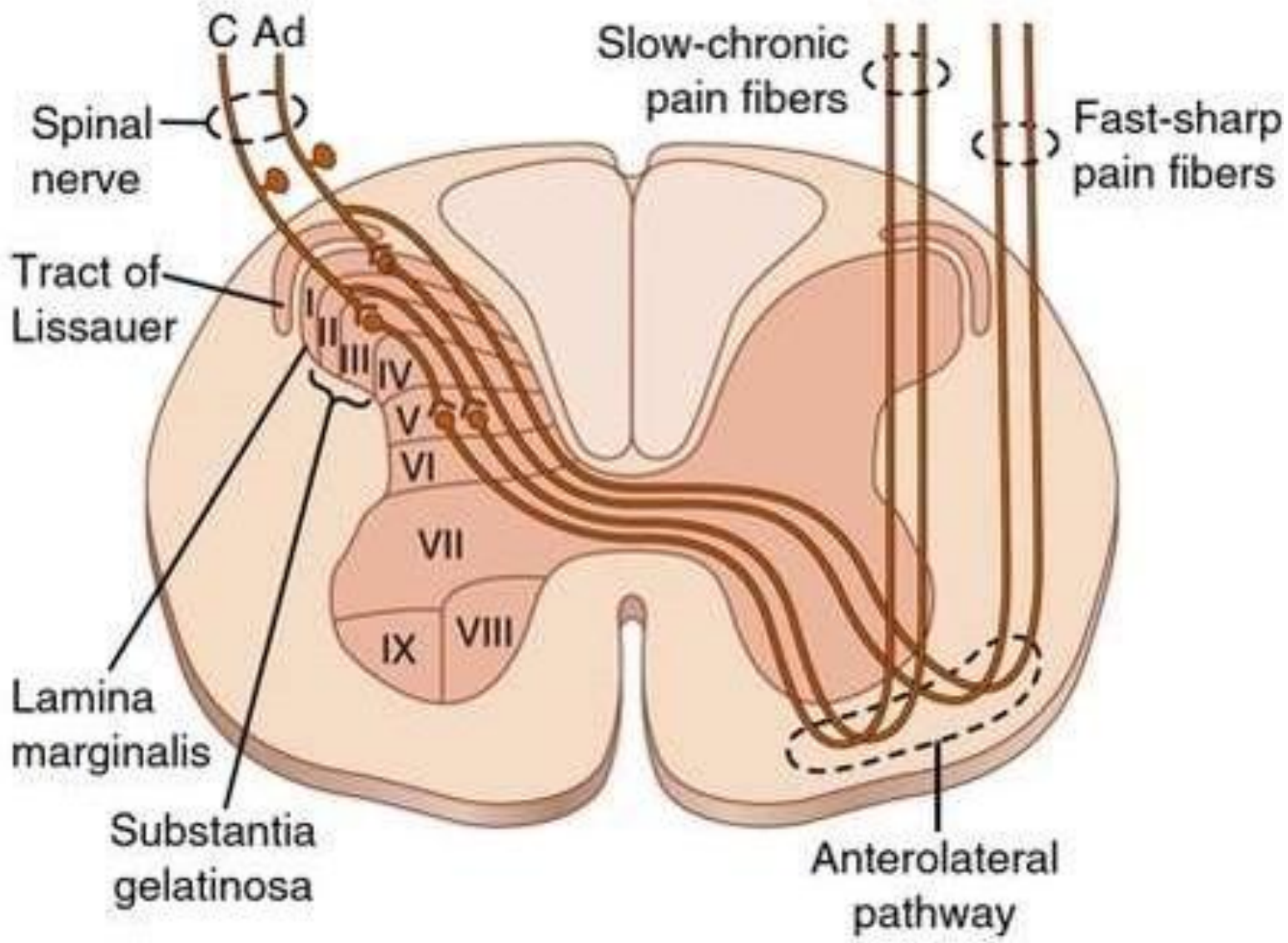
Cerebral Cortex Organization and Columnar Function

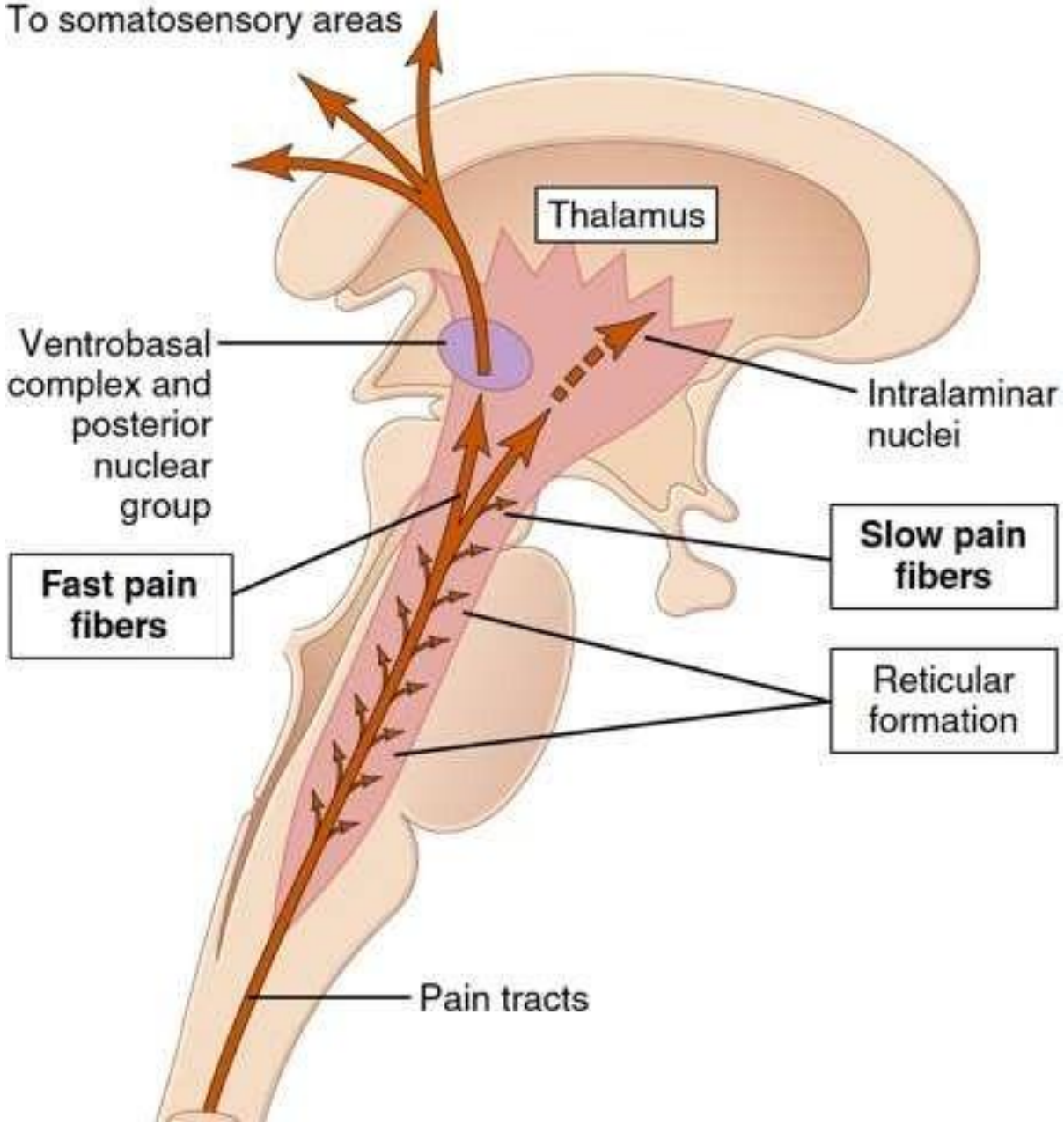
- **Area-Specific Differences and Columnar Organization**
- Cortical structure adapts to its role: in the **motor cortex**, the **motor layers are thicker**, whereas in the **sensory cortex**, the **sensory layers are thicker**. The cortex is further organized into **modality-specific columns**, where each part of the body (e.g., the thumb) is represented by a set of columns. For instance:
- One column may process **position sense**.
- An adjacent column handles **temperature**.
- The next column manages **touch**.
- All columns within a specific region work together to **integrate somatic sensations** corresponding to that particular part of the body.

Paleospinothalamic pathway

- The slow-chronic paleospinothalamic pathway terminates widely in the brain stem.

- Only 10% to 25% of the fibers pass all the way to the thalamus. Instead, most terminate in one of three areas:
- (1) the reticular nuclei of the medulla, pons, and mesencephalon.
- (2) the tectal area of the mesencephalon deep to the superior and inferior colliculi.
- (3) the periaqueductal gray region surrounding the aqueduct of Sylvius.


C Ad
Spinal nerve
Tract of Lissauer
I
II
III
IV
V
VI
VII
VIII
IX
Lamina marginalis
Substantia gelatinosa
Slow-chronic pain fibers
Fast-sharp pain fibers
Anterolateral pathway


To somatosensory areas
Thalamus
Ventrobasal complex and posterior nuclear group
Intralaminar nuclei
Fast pain fibers
Slow pain fibers
Reticular formation
Pain tracts

Paleospinothalamic pathway

- These **lower regions of the brain** appear to be important for feeling the **suffering types of pain**.

- From the brain stem pain areas, multiple short-fiber neurons relay the pain signals upward into the intralaminar and ventrolateral nuclei of the thalamus and into certain portions of the hypothalamus and other basal regions of the brain.

Paleospinothalamic pathway

- Electrical stimulation in the reticular areas of the brain stem and in the intralaminar nuclei of the thalamus, the areas where the slow-suffering type of pain terminates, has a strong **arousal effect** on nervous activity throughout the entire brain.

- This explains why it is almost impossible for a person to sleep when in severe pain.

Paleospinothalamic pathway

- **Localization** of pain transmitted via the paleospinothalamic pathway is **imprecise**.
- For example, slow-chronic pain can usually be localized only to a major part of the body, such as to one arm or leg but not to a specific point on the arm or leg.

- This phenomenon is in keeping with the **multisynaptic, diffuse connectivity of this pathway.** It explains why patients often have serious difficulty in localizing the source of some chronic types of pain.

Visceral pain

- Essentially all visceral pain that originates in the thoracic and abdominal cavities is transmitted through small type C pain fibers and, therefore, can transmit only the chronic, aching, suffering type of pain.

- One of the most important differences between surface pain and visceral pain is that highly localized types of damage to the viscera seldom cause severe pain.

- Conversely, any stimulus that causes diffuse stimulation of pain nerve endings throughout a viscus causes pain that can be severe.

Visceral pain

- Any stimulus that excites pain nerve endings in diffuse areas of the viscera can cause visceral pain.

- Such stimuli include ischemia of visceral tissue, chemical damage to the surfaces of the viscera, spasm of the smooth muscle of a hollow viscus, excess distention of a hollow viscus, and stretching of the connective tissue surrounding or within the viscus.

- Due to lower receptor density (sparse distribution), most visceral mechanoreception is subconsciously integrated, making us unaware of normal organ stretch. Pain is only perceived when stimuli are extreme, such as overstretching, inflammation, or ischemia.

Visceral pain

- A few visceral areas are almost insensitive to pain.
- These areas include the parenchyma of the liver and the alveoli of the lungs
- Yet, the liver capsule is extremely sensitive to both direct trauma and stretch, and the bile ducts are also sensitive to pain. In the lungs, even though the alveoli are insensitive, both the bronchi and the parietal pleura are very sensitive to pain.

Visceral Pain

- True visceral pain is transmitted via pain sensory fibers in the autonomic nerve bundles, and the sensations are referred to surface areas of the body that are often far from the painful organ.

- Main neurotransmitter is substance P.

Visceral Pain Pathway and Autonomic Association

- All visceral nociceptive stimuli are transmitted exclusively by **C fibers**, resulting in **slow pain**. This transmission is closely linked with **autonomic fibers**:
- **Abdominal organs** associate with **sympathetic fibers**, while **pelvic organs** associate with **parasympathetic fibers**.
- **C fibers** travel alongside autonomic sensory neurons, entering the **spinal cord via dorsal roots** and synapsing in the **dorsal horn**. Some integration also occurs in **ganglia** surrounding the spinal cord.

- **Functional Key Points:**
- **Poor Localization:** Visceral pain is **always slow and poorly localized** because its sensory integration is **mostly subcortical**, unlike somatic pain which reaches the primary somatosensory cortex.
- **Autonomic Signs:** Because the transmission is linked to the autonomic nervous system, visceral pain is often accompanied by **changes in heart rate, blood pressure, and sweating**.

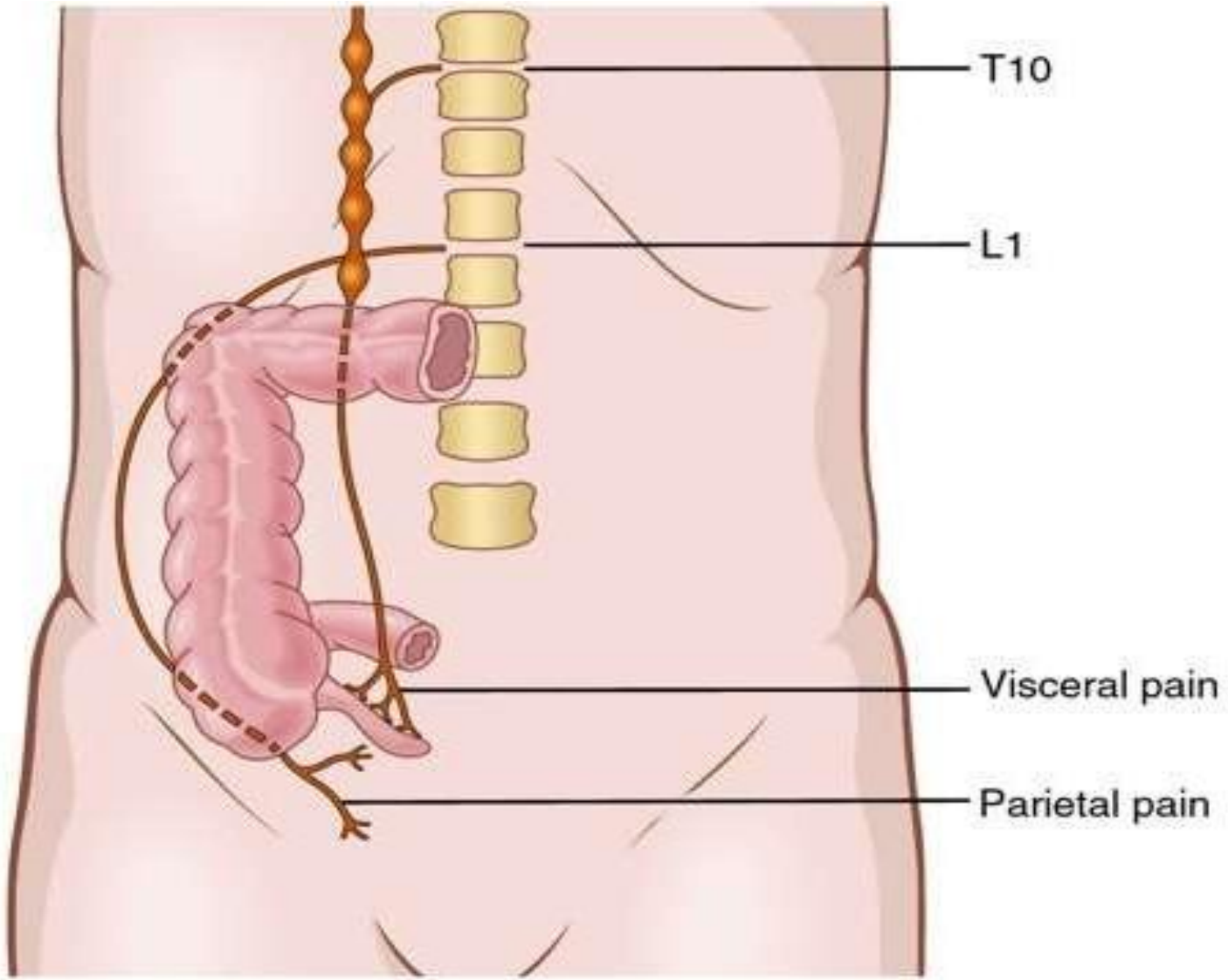
Parietal pain

- When a disease affects a viscus, the disease process often spreads to the parietal peritoneum, pleura, or pericardium.

- These parietal surfaces, like the skin, are supplied with extensive pain innervation from the peripheral spinal nerves.

- parietal sensations are conducted directly into local spinal nerves from the parietal peritoneum, pleura, or pericardium, and these sensations are usually localized directly over the painful area and sharp.

See next slides



The Relationship Between Visceral and Parietal Pain in Appendicitis

- **Initial Visceral Phase**
- In the early stages, the patient reports **periumbilical pain**. This is **visceral pain**, characterized as being **poorly localized**, **dull, aching**, and non-specific, primarily transmitted via **C fibers (slow pain)**. At this point, the pain is often assessed on a scale (e.g., 6/10) and must be differentiated from other conditions like gastroenteritis.
- **Transition to Parietal Pain**
- As the inflammation worsens and reaches the **parietal peritoneum**, the nature of the pain changes significantly. Unlike the visceral organs, parietal structures (peritoneum, pleura, pericardium) have **somatic sensation**. This activates **A-delta fibers**, leading to **fast, sharp, and well-localized pain** specifically in the **Right Lower Quadrant (RLQ)**. This progression often marks the need for urgent surgical intervention.

The Relationship Between Visceral and Parietal Pain in Appendicitis

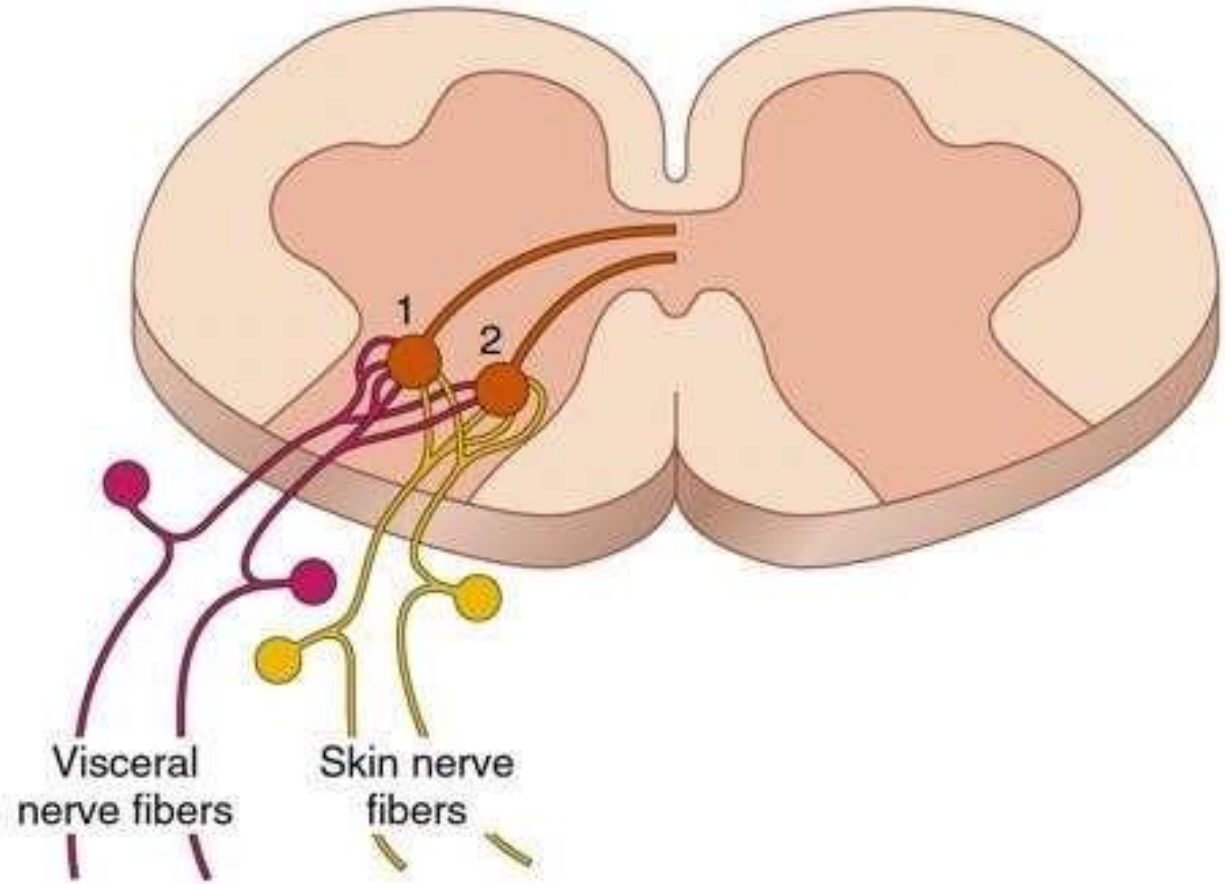
- During a physical exam, doctors look for specific muscular responses to differentiate the severity of the inflammation:
- **Guarding:** This is a **voluntary contraction** of the abdominal skeletal muscles. The patient anticipates pain and tenses the abdomen to protect the inflamed organ.
- **Rigidity:** This is an **involuntary, pathological contraction** caused by severe inflammation or **peritonitis**. Unlike guarding, rigidity is persistent and does not relax.
- **Differentiation Technique**
- To distinguish between the two, clinicians use **distraction techniques** while palpating the abdomen:
- If the muscle **relaxes**, it is classified as **guarding**.
- If the muscle **remains tense**, it is classified as **rigidity**, indicating a medical emergency like severe peritonitis.

Referred pain

- When visceral pain is referred to the surface of the body, the person generally localizes it in the **dermatomal** segment from which the visceral organ originated in the embryo, not necessarily where the visceral organ now lies.

- For example, the heart originated in the neck and upper thorax, so the heart's visceral pain fibers pass upward along the sympathetic sensory

See next slides



Convergence of Visceral and Somatic Fibers

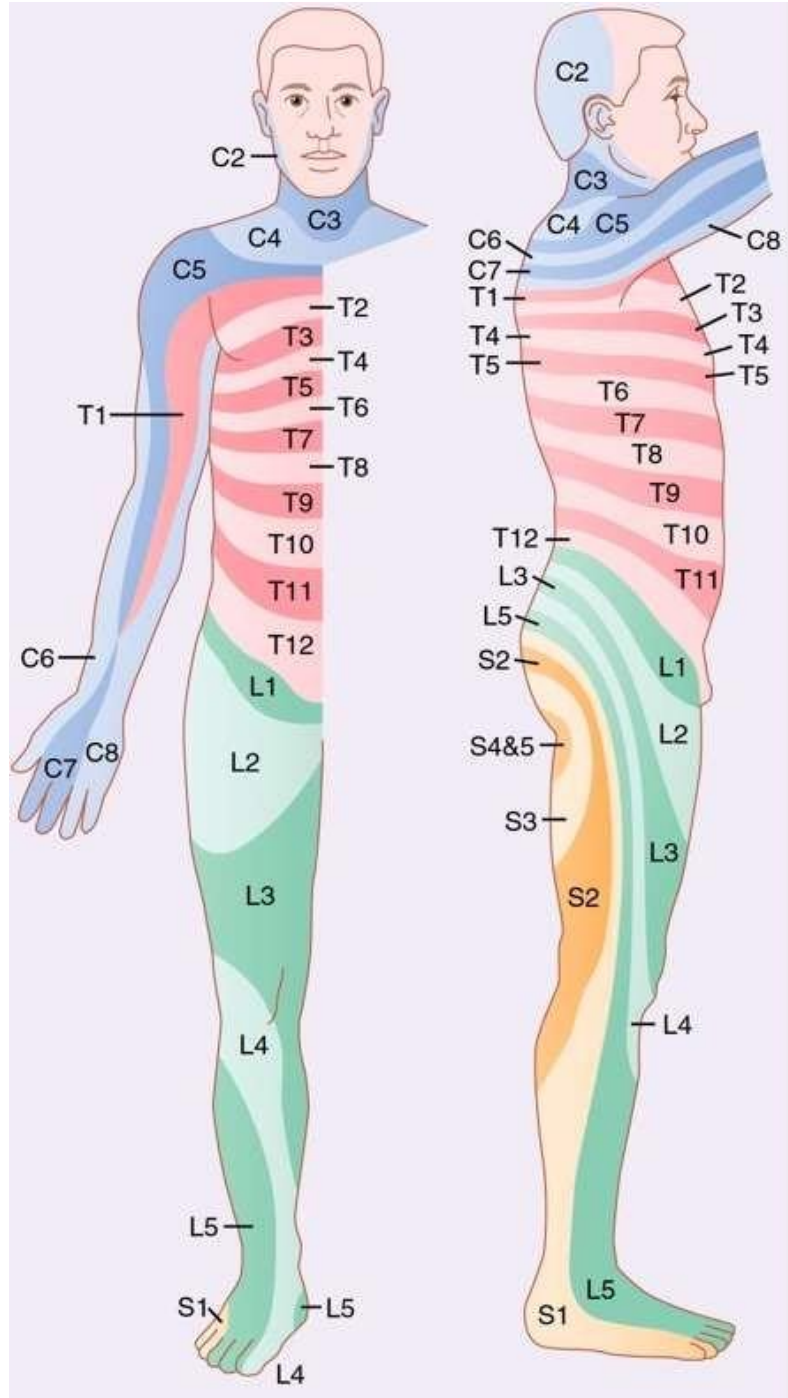
- The phenomenon of **referred pain** occurs due to the **convergence** of sensory signals. **Visceral nerve fibers** carrying pain from internal organs enter the **spinal cord** at the same segments as **somatic nerve fibers** from the skin and muscles. As shown in the diagram, visceral fibers branch and synapse onto the **same second-order neurons** that somatic fibers use. Consequently, both signals are processed by the same neural pathway.

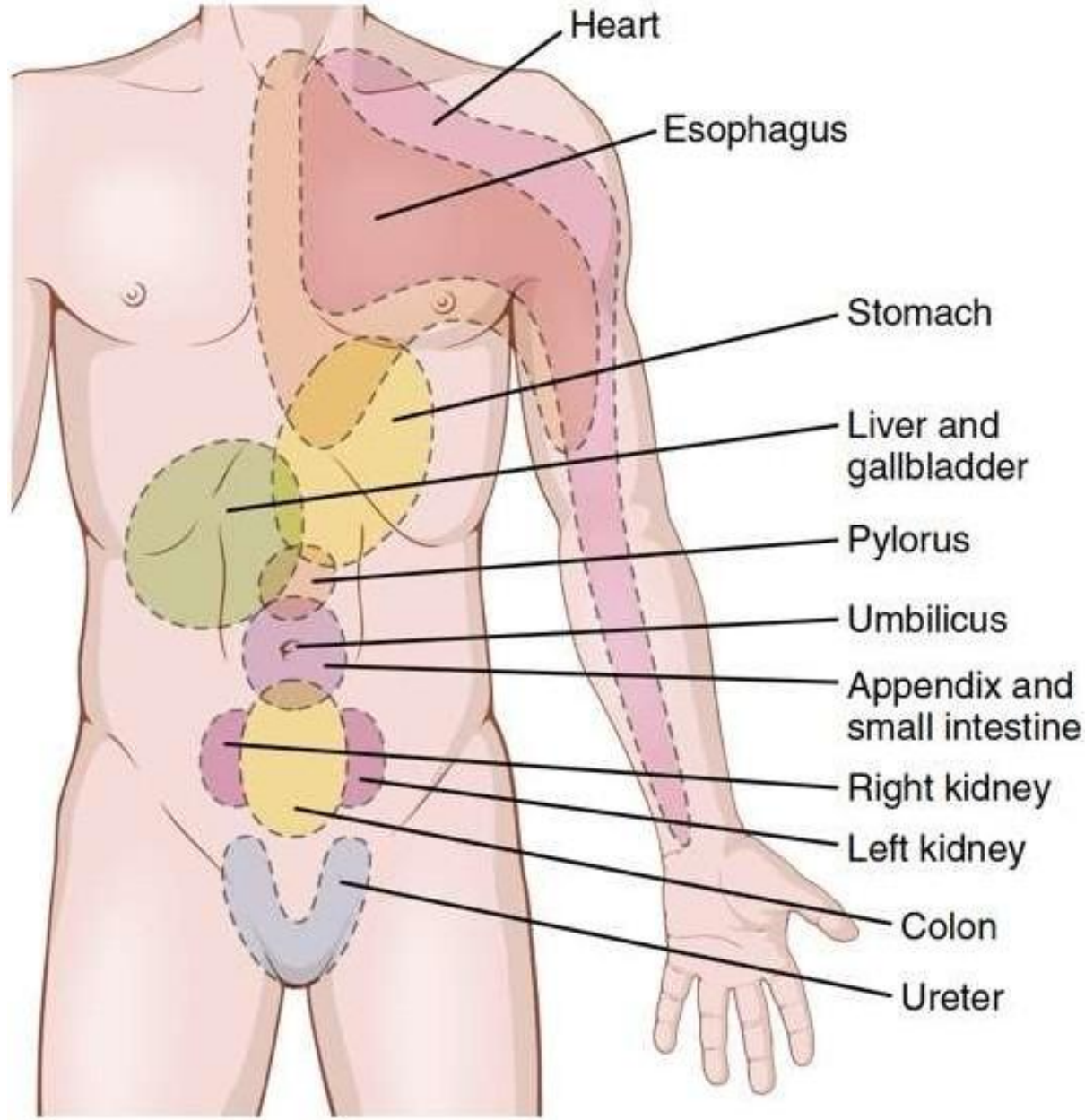
• Pathway to the CNS and Localization:

- Once these signals reach the **second-order neuron**, it decussates and ascends to several brain regions:
- **Primary somatosensory area:** For **localization** of the pain.
- **Reticular formation:** To trigger **arousal and awareness**.
- **Hypothalamus:** To initiate **autonomic and emotional responses**.

The Mechanism of Referred Pain

- The brain is more accustomed to receiving precise **somatic signals** from the skin, which it can easily localize on the **cortical map**. When visceral and somatic fibers **converge on the same neurons**, the brain often misinterprets the diffuse visceral signal as coming from the corresponding **somatic dermatome**.
- **Clinical Examples of Referred Pain**
- **Appendicitis:** Initial pain is often felt in the **periumbilical region** (around the navel) rather than the **right lower quadrant (RLQ)** because the appendix shares spinal segments with that area of the skin.
- **Cardiac Ischemia:** Pain is frequently referred from the **left chest wall** to the **left arm, shoulder, or neck**.
- **Ureteric Colic:** Pain typically radiates from the **flank to the groin**.


C2
C3
C4
C5
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5
S1
C6
C7
C8
C2
C3
C4
C5
C6
C7
C8
T1
T2
T3
T4
T5
T6
T7
T8
T9
T10
T11
T12
L1
L2
L3
L4
L5
S1
S2
S3
S4&5


Heart
Esophagus
Stomach
Liver and gallbladder
Pylorus
Umbilicus
Appendix and small intestine
Right kidney
Left kidney
Colon
Ureter

Mechanism of referred pain

- branches of visceral pain fibers are shown to synapse in the spinal cord on the same second-order neurons that receive pain signals from the skin.

- When the visceral pain fibers are stimulated, pain signals from the viscera are conducted through at least some of the same neurons that conduct pain signals from the skin, and the person has the feeling that the sensations originate in the skin.

Pain suppression

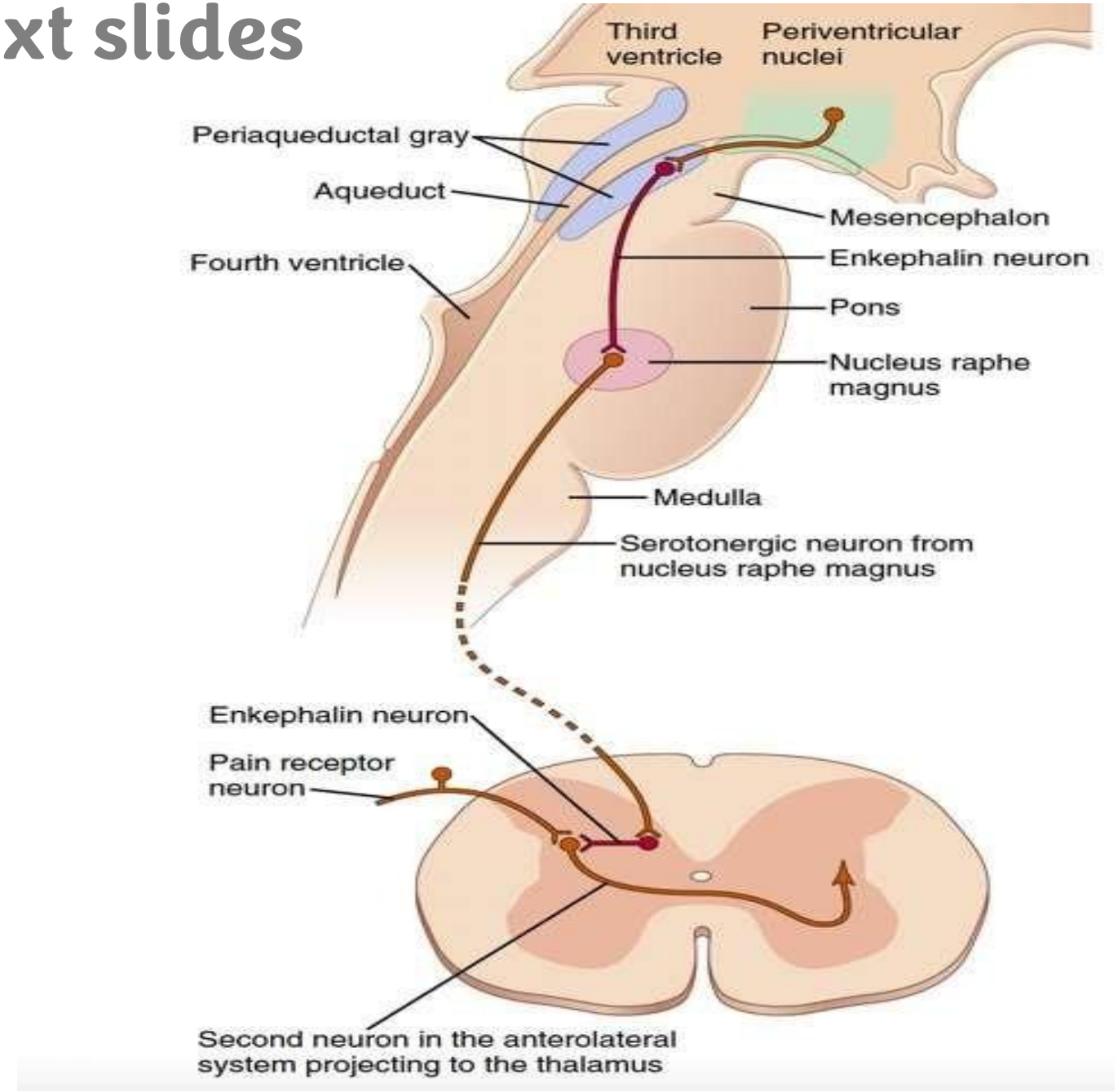
- The degree to which different **people react to pain varies** tremendously.

- This variation results partly from a capability of the brain itself to suppress input of pain signals to the nervous system by activating a pain control system, called an **analgesia system**.

The endogenous analgesia system

- (1) The periaqueductal gray and periventricular areas of the mesencephalon and upper pons. Neurons from these areas send signals to
- (2) the raphe magnus nucleus, located in the lower pons and upper medulla, and the nucleus reticularis paragigantocellularis, located laterally in the medulla. From these nuclei, second order signals are transmitted down the dorsolateral columns in the spinal cord to
- (3) a pain inhibitory complex located in the dorsal horns of the spinal cord. At this point, the analgesia signals can block the pain before it is relayed to the brain.

See next slides



The Relationship Between the Endogenous Analgesic System and Pain Control

- The body possesses an **endogenous analgesic system** designed to reduce or prevent the transmission of pain signals. This system primarily relies on **opioid compounds**, including **Beta-endorphin, enkephalin, and serotonin**, which act as natural painkillers within the central nervous system.
- **Key Anatomical Areas and the Descending Pathway**
- The analgesic response involves a coordinated pathway between several brain regions, as shown in the provided diagram:
- **Hypothalamus:** Including the **paraventricular nuclei**.
- **Mesencephalon (Midbrain):** Specifically the **periaqueductal gray (PAG)** area surrounding the cerebral aqueduct.
- **Pons and Medulla:** Particularly the **nucleus raphe magnus**.

The Relationship Between the Endogenous Analgesic System and Pain Control

Mechanism of Action:

- When a painful stimulus ascends, the **PAG** communicates with the **raphe magnus**, which sends **descending fibers** to the spinal cord. In the dorsal horn, the release of enkephalin and serotonin leads to:
- **Presynaptic Inhibition:** Inhibiting the release of neurotransmitters (like Substance P) from the primary pain fibers.
- **Postsynaptic Inhibition: Hyperpolarizing** second-order neurons, making them less likely to fire.
- **Overall Effect:** This dual action effectively **blocks or reduces the transmission** of pain signals to higher brain centers.

Stress-Induced Analgesia:

- Under conditions of **severe, life-threatening stress** (such as accidents or combat), the endogenous opioid system is strongly activated. This **stress-induced analgesia** explains why individuals can tolerate severe injuries in emergency situations, as the brain temporarily shuts down pain perception to focus on survival.

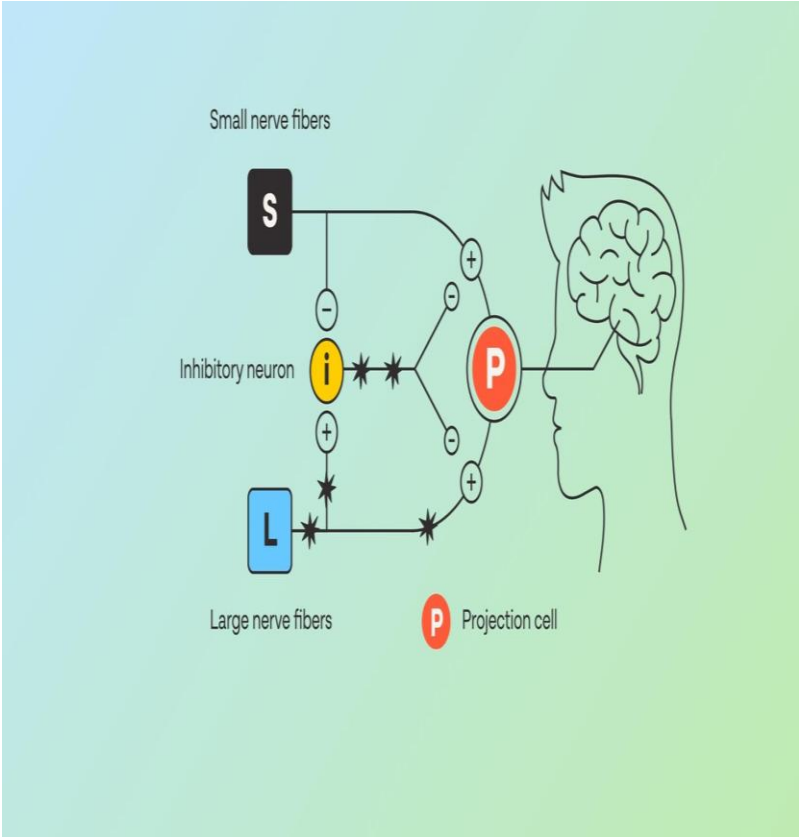
The endogenous analgesia system

- Several transmitter substances, especially **enkephalin and serotonin**, are involved in the analgesia system.

- The enkephalin is believed to cause both **presynaptic and postsynaptic inhibition** of incoming type C and type Aδ pain fibers where they synapse in the dorsal horns.

Gate Control Theory of Pain

- **Core Concept**
- Pain signals can be modulated or "filtered" at the spinal cord level before reaching the brain.
- **Mechanism:**
- **Fiber Competition**: Fast **A-beta fibers** (touch/pressure) compete with slower **A-delta and C fibers** (pain).
- **Closing the Gate**: Activating A-beta fibers stimulates **inhibitory interneurons** in the dorsal horn.
- **Inhibition**: These interneurons block pain signals from ascending, effectively "closing the gate" to the brain.
- **Practical Example**
- When you rub your elbow after hitting it, you stimulate **A-beta fibers**. This triggers the inhibitory interneurons to reduce the sensation of pain.



Pain control

- Electrical stimulation either in the periaqueductal gray area or in the raphe magnus nucleus can suppress many strong pain signals entering via the dorsal spinal roots.

- Also, stimulation of areas at higher levels of the brain that excite the periaqueductal gray area can also suppress pain. Such as the periventricular nuclei in the hypothalamus.

Pain control

- Stimulation of large-type Aβ sensory fibers from peripheral tactile receptors can depress transmission of pain signals from the same body area.

- This effect presumably results from local lateral inhibition in the spinal cord.

Pain sensitization

- Primary (peripheral): at the receptor level: Increased responsiveness and reduced threshold of nociceptors at the site of tissue injury.

- Secondary (central): in the CNS: Increased excitability of neurons in the central nervous system, leading to pain hypersensitivity outside the area of tissue injury.

Pain Sensitization: Primary vs. Central

1. Primary (Peripheral) Sensitization

- **Location:** Occurs at the level of the **tissue and sensory receptors**.
- **Mechanism:** Tissue injury triggers the release of **chemical mediators** like Bradykinin, Prostaglandins, Interleukins, and Protons (H^+).
- **Effect:** These chemicals cause an **increased responsiveness** to stimuli by lowering the receptor threshold and **upregulating ion channels**. This results in a stronger receptor potential and a more intense signal.
- **Clinical Context:** Typical of inflammatory pain; managed effectively with **anti-inflammatory drugs or steroids** to reduce chemical mediators.

2. Central Sensitization

- **Location:** Occurs within the **Central Nervous System**, primarily the **spinal cord**.
- **Mechanism:** Characterized by an **increased frequency of action potentials** and enhanced synaptic transmission. It can occur around an injury site or even in the absence of direct tissue damage.
- **Clinical Example (Fibromyalgia):** Often seen in middle-aged female patients presenting with **widespread pain and painful trigger points**, despite having normal lab results and imaging.
- **Treatment:** Primarily involves **neuropathic agents** (e.g., gabapentin, pregabalin) and cognitive/psychological approaches, as NSAIDs and steroids are usually ineffective.

Pain sensitization

- Hyperalgesia: An increased pain response to a stimulus that is normally painful.
  - Example: A needle prick that normally rates 3/10 feels like a 7/10 in inflamed skin.
  - Cause: Can be due to either primary or central sensitization.

- Allodynia: Pain due to a stimulus that does not normally provoke pain.
  - Example: The touch of clothing or a warm shower causing pain on sunburned skin.
  - Mechanism: Resulting from the sensitization of peripheral or central pathways.

Pain Assessment

Mnemonic :- **SOCRATES**

S - Site

O - Onset

C - Character

R - Radiates

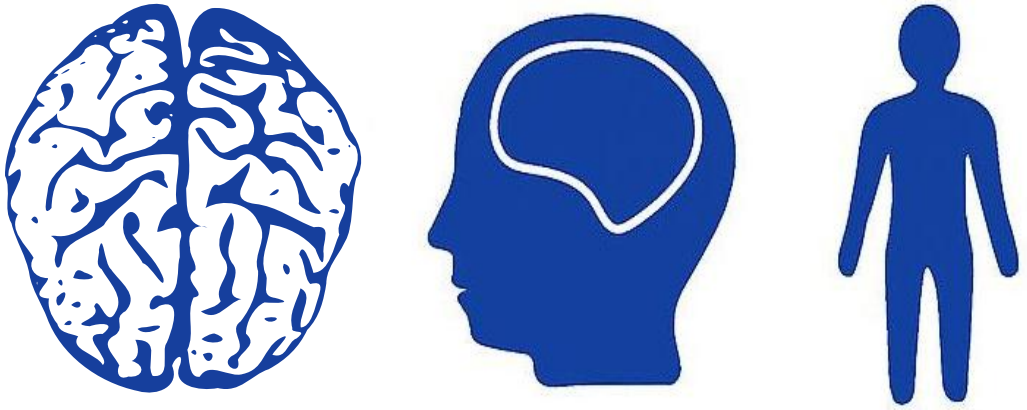
A - Associated Symt

T - Time/duration

E - Exacerbating

S - Severity

Doctors-online



PHYSIOLOGY QUIZ LECTURE 3

رسالة من الفريق العلمي

External Resources

اللهم إن عمر عطية في ذمتك وحبل جوارك، فقِه من فتنة القبر وعذاب النار، أنت أهل الوفاء والحق، فاغفر له وارحمه إنك أنت الغفور الرحيم.

(قالوا لن نؤثرك على ما جاءنا من البينات)
يعنون : لا نختارك على فاطرنا وخالقنا الذي أنشأنا من العدم ، المبتدئ خلقنا من الطين ، فهو المستحق للعبادة والخضوع لا أنت .

(فاقض ما أنت قاض) أي : فافعل ما شئت وما وصلت إليه يدك ، (إنما تقضي هذه الحياة الدنيا) أي : إنما لك تسلط في هذه الدار ، وهي دار الزوال ونحن قد رغبنا في دار القرار .

Scan the QR code or click it for FEEDBACK

Corrections from previous versions:

Versions	Slide # and Place of Error	Before Correction	After Correction
V0 → V1			
V1 → V2			