ORAL BIOLOGY AND PHYSIOLOGY

COURSE CODE: 1601106

2 credit Units

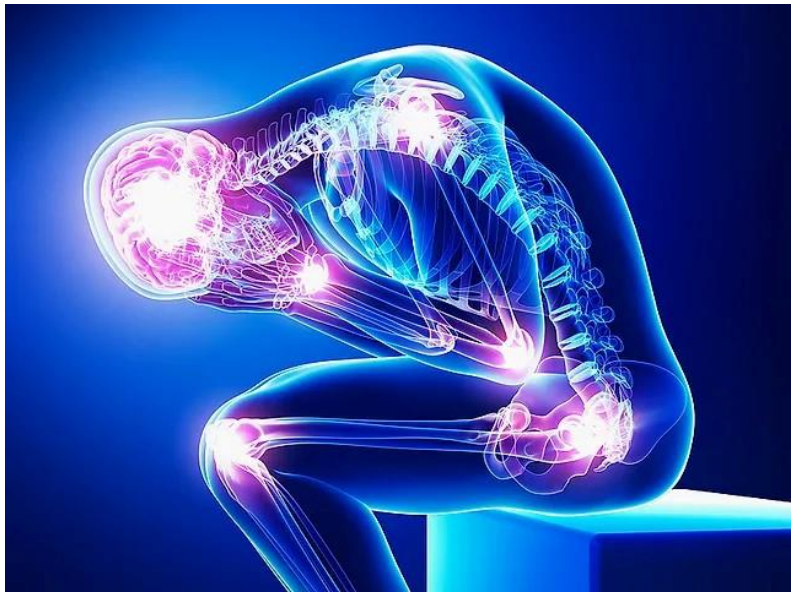
Dr Kasimu Ghandi Ibrahim & Dr Ahmad Taha

kibrahim@zu.edu.jo; ataha@zu.edu.jo

Week 6, Lecture 2

Intended Learning Outcomes

- To define pain sensation
- To understand the benefits of pain sensation
- To list the components of pain sensation



Definition of Pain

- Pain is an unpleasant and emotional experience associated with or without actual tissue damage.
- It is produced by real or potential injury to the body.

- The pain sensation is described in many ways such as sharp, pricking, electric, dull ache, shooting, cutting, stabbing, etc.

- Sometimes it induces crying and fainting.

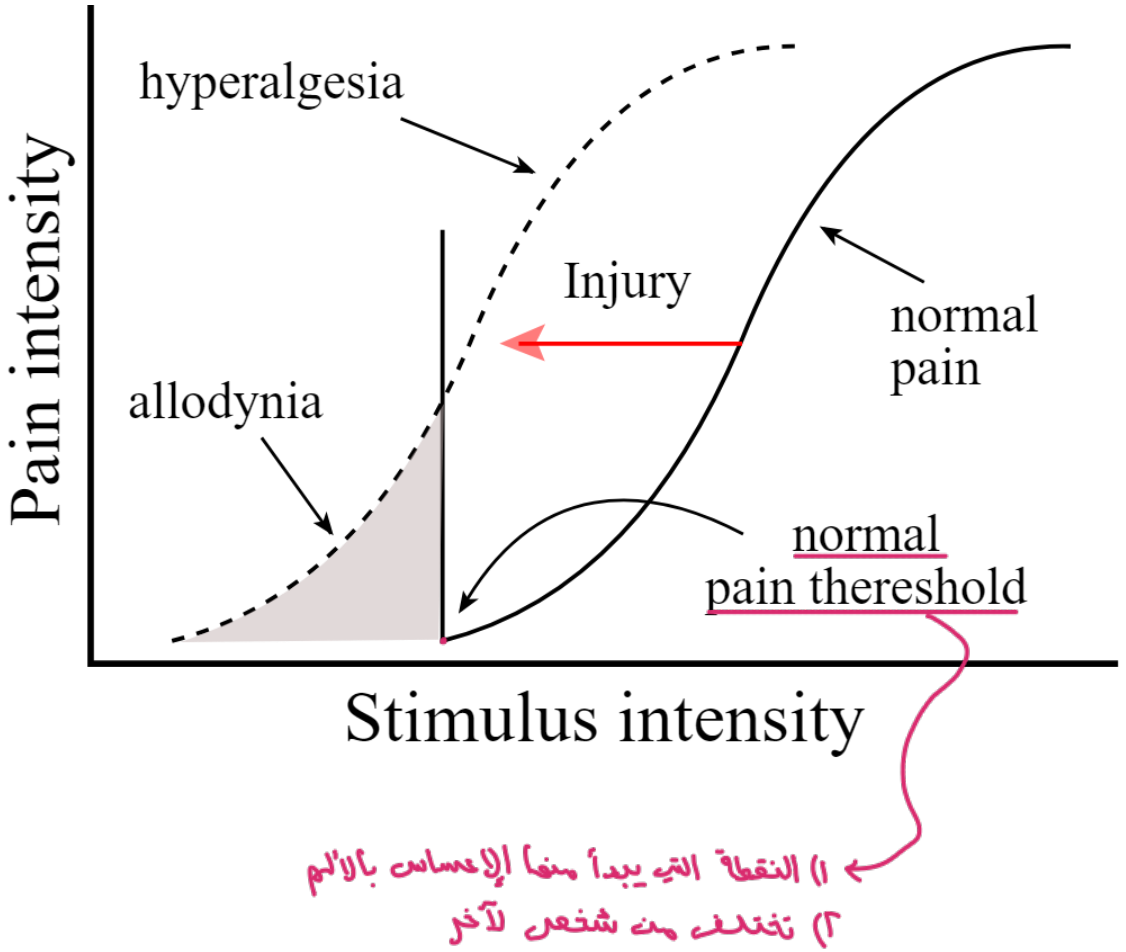
Definition of Pain

- Often it is expressed in terms of injury:

- pain produced by fire is expressed as a burning sensation;
- pain produced by severe sustained contraction of skeletal muscles is expressed as cramps.

Other important definitions

- **Allodynia:** Pain due to a stimulus that does not normally provoke pain.
- **Hyperalgesia:** Increased pain from a stimulus that normally provokes pain. E.g: Trigeminal neuralgia
- **Hypoalgesia:** Diminished pain in response to a normally painful stimulus. E.g : Athletes



Benefits of Pain

1. It gives a warning signal about the existence of a problem or threat.
2. It creates awareness of injury.
3. It prevents further damage by causing reflex withdrawal of the body from the source of injury.
4. It forces the person to rest or to minimize the activities thus enabling the rapid healing of the injured part.
5. It urges the person to take the required treatment to prevent major damage.

Process of Pain Physiology

- Transduction
- Transmission
- Perception
- Modulation

Process of Pain Physiology

- **Transduction:**
  - Pain stimuli are converted to electrical energy
  - This conversion of pain stimuli to electrical energy is known as transduction.
  - This stimulus sends an impulse across a peripheral nerve fiber.

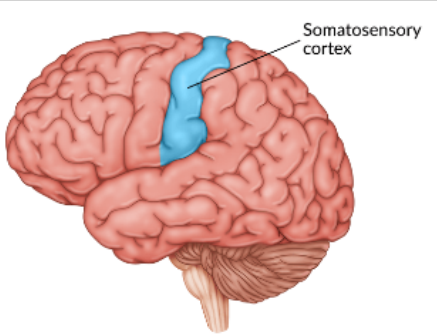
Process of Pain Physiology

- **Transmission**
- **A-delta fibers (myelinated)** send sharp, localized and distinct sensations.
- **C fibers (unmyelinated)** relay impulses that are poorly localized, burning and persistent pain.
- Pain stimuli travel through the spinothalamic tracts.

ascending Posterior

Process of Pain Physiology

- **Perception**
  - This is the awareness of pain– the somatosensory cortex identifies the location and intensity of pain.



- **Modulation**
  - Inhibitory neurotransmitters like endogenous ***opioids*** work to hinder pain transmission.
  - This inhibition of the pain impulse is known as modulation

Components of Pain

- **Fast pain** is the first sensation whenever a pain stimulus is applied.
- It is experienced as a bright, sharp and localized pain sensation.

- The fast pain is followed by the **slow pain** which is experienced as a dull, diffused and unpleasant pain.

Components of Pain

- **Fast pain**
  - detected by myelinated A delta fibres (medium diameter)
  - perception occurs rapidly
  - stimulus causes a sharp, bright localised pain
  - not felt in deeper tissues

Components of Pain

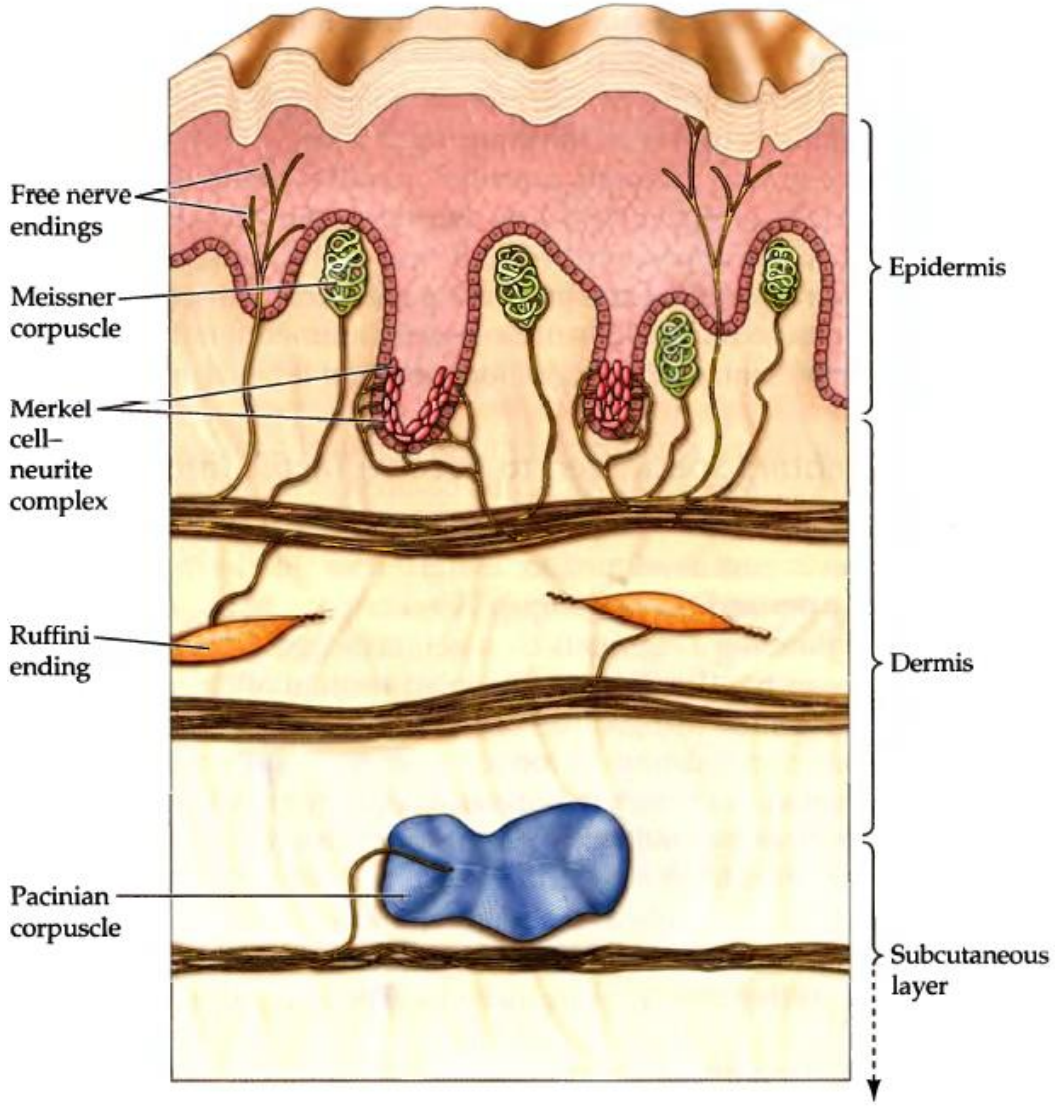
- **Slow pain**
- detected by unmyelinated C fibres (small diameter)
- perception is slow and gradual
- causes a dull, intense, diffuse unpleasant feeling.

Difference between Fast and Slow pain

	Fast pain	Slow pain
perception	Felt within about 0.1 second after a painful stimulus.	Begins after 1 second or more and then increases slowly over many sec. or min.
localization	“Bright," sharp, localized sensation	Dull, intense, diffuse, and unpleasant feeling
quality	sharp pain, pricking pain, acute pain, and electric pain	slow burning pain, aching pain, throbbing pain, nauseous pain, and chronic pain
feeling	Felt mainly in the skin. Not felt in most deeper tissues of the body	It can occur both in the skin and in almost any deep tissue or organ
cause	Pin prick, cutting or burning of skin	Associated with tissue destruction.
stimulus	Caused by mechanical or thermal stimuli.	Caused mainly by chemical stimuli
Afferent nerve	Transmitted by Aδ fibers (velocity 6-30 m/sec) which release Glutamate	Transmitted by C fibers (velocity 0.5-2 m/sec) which release Substance P
Carrying tract	Neo-spinothalamic tract	Paleo-spinothalamic tract

Receptors of Pain

- The **receptors** for both components of pain are the same, i.e. the free nerve endings.
- More in superficial layers of skin, periosteum, arterial walls , joint surfaces and sparse in other deep tissues.
- Non-adapting in nature.



Categories of pain receptors

- There are three categories of pain receptors, or nociceptors:

- **Mechanical nociceptors** respond to mechanical damage such as cutting, crushing, or pinching
- **Thermal nociceptors** respond to temperature extremes, especially heat; and
- **Polymodal** nociceptors respond equally to all kinds of damaging stimuli, including irritating chemicals released from injured tissues.

- Because of their value to survival, nociceptors do not adapt to sustained or repetitive stimulation.

Useful links

- https://www.youtube.com/watch?v=uOaiaYDoUnA
- https://www.youtube.com/watch?v=5c8maFAhqIc