UNC SCHOOL OF MEDICINE

Pathophysiology of Postoperative Pain

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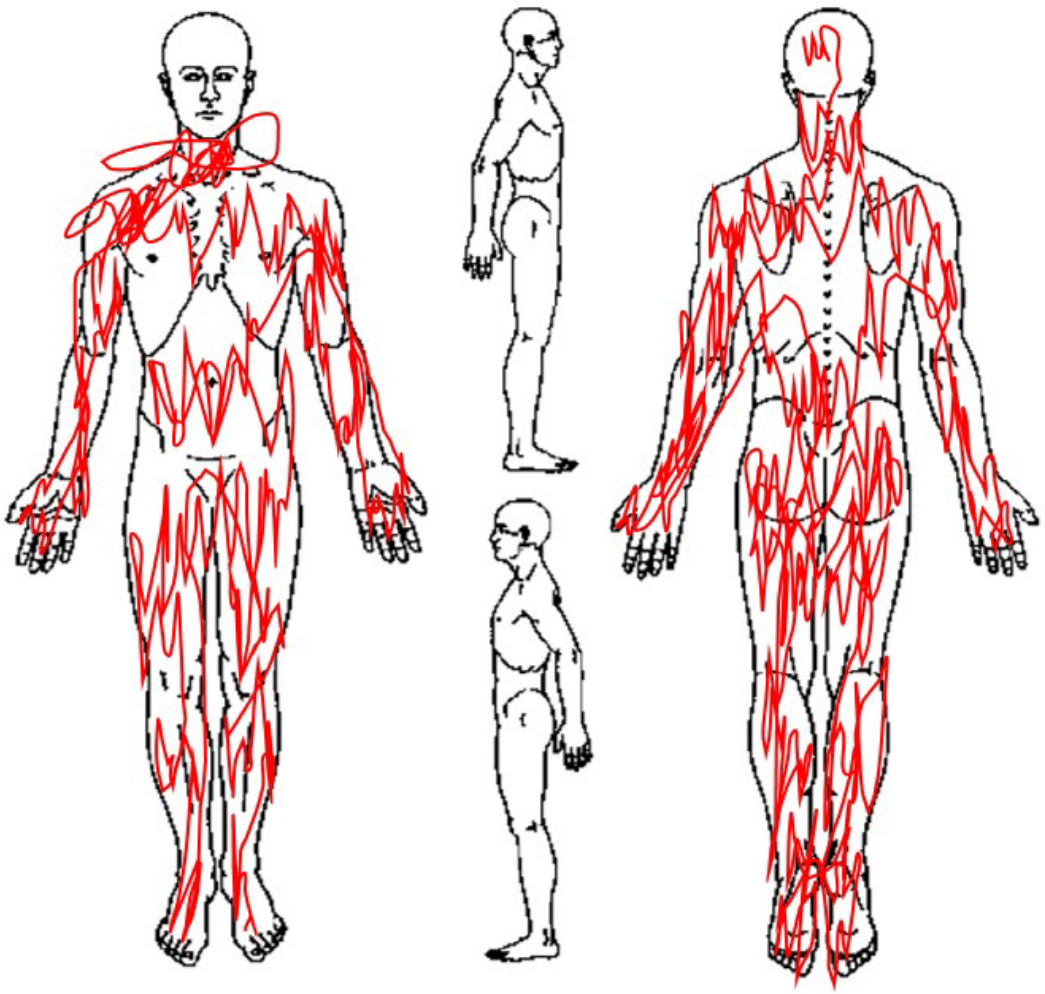
Pain explains a great deal of human conduct, but the fear of pain even more.

— Neil Abramson —

Disclosures



I have no financial disclosures.

Goals

- Define “pain”
- Understand how pain is transmitted
- Identify targets for pain control
- See how acute pain can become chronic

What Is Pain?

"An unpleasant sensory and emotional experience associated with actual or potential damage."

International Association for the Study of Pain

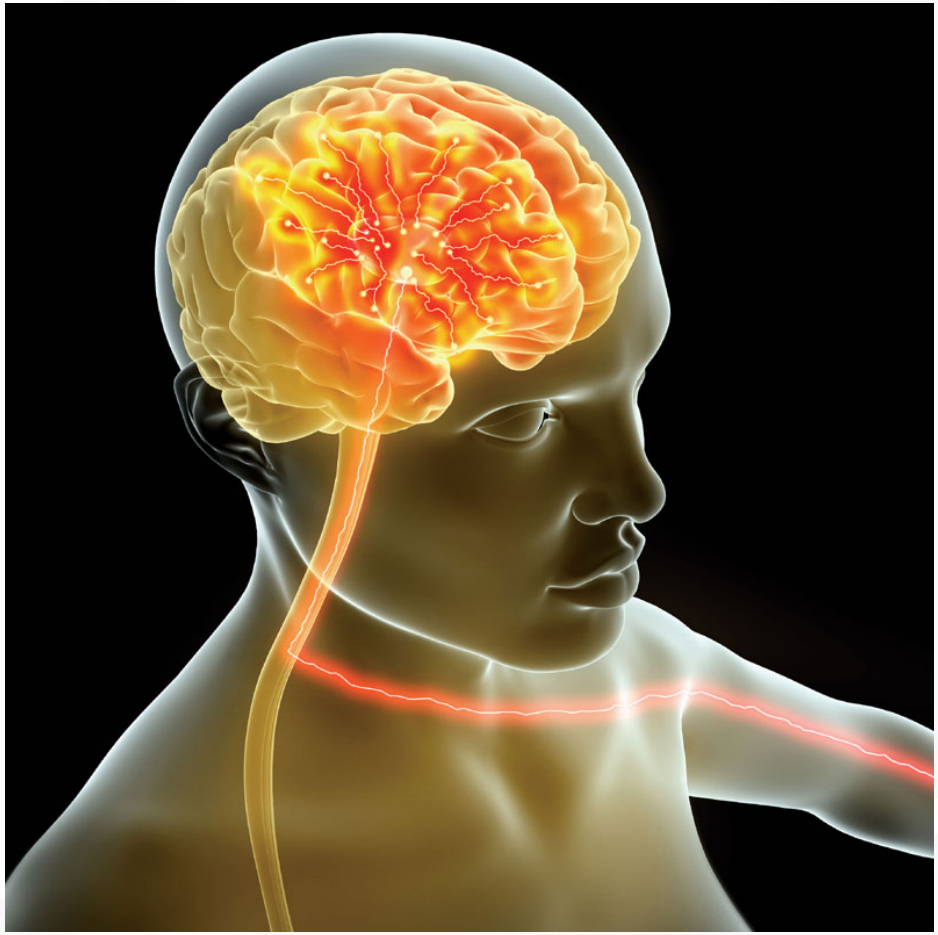
What Pain Is Not…

An Opioid Deficiency

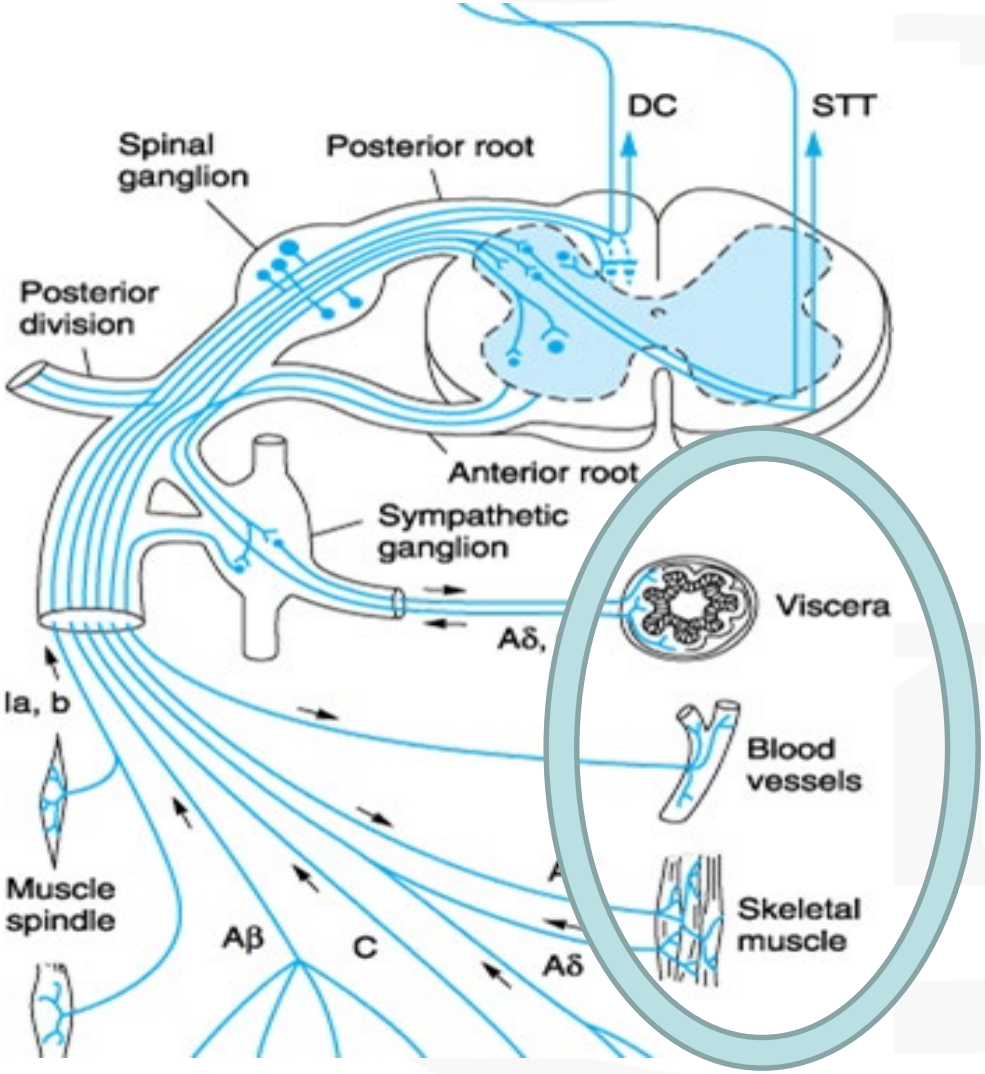
Quote by Dr. Brian Ginsberg, Duke

Physiologic Processing of Pain

- Transduction
- Transmission
- Modulation
- Perception

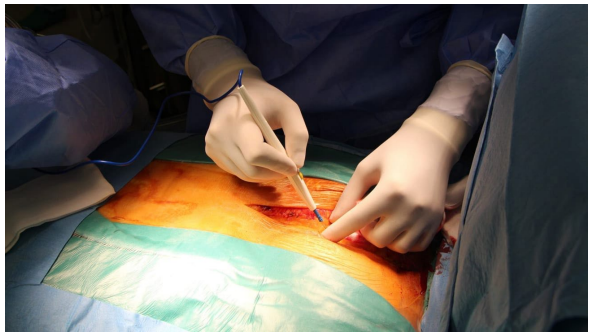


Physiologic Response to Pain



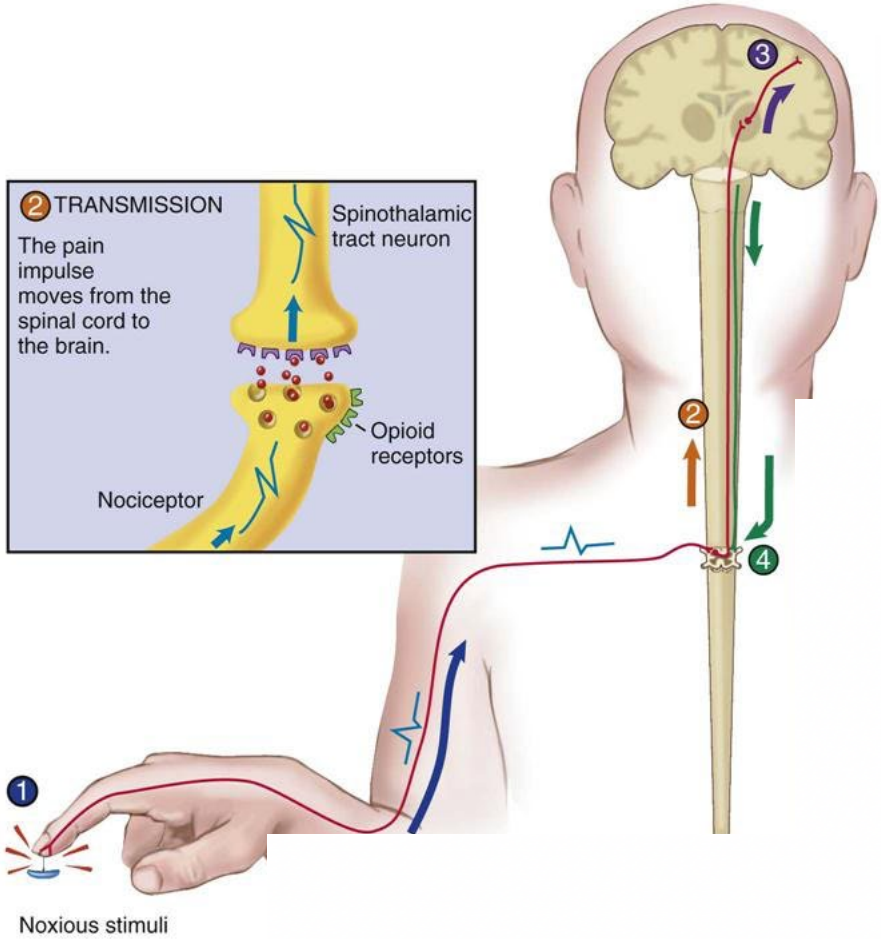
Morgan and Mikail. *Clinical Anesthesia.*

Transduction



- Nociceptors
  - » Different types
  - » Encode intensity by increasing discharge rates
- Neurotransmitters
  - » Excitatory: substance P, glutamate, CGRP…
  - » Inhibitory: endorphins, NE, 5HT3, GABA…

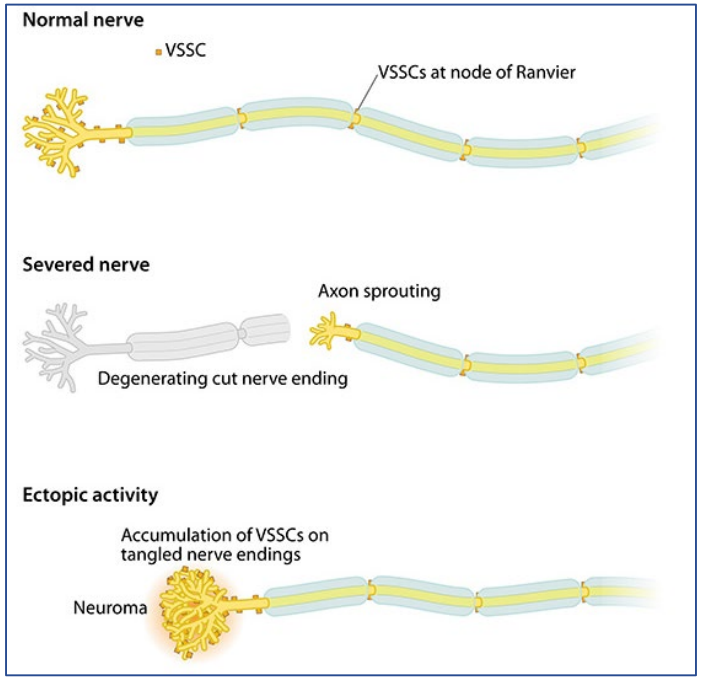
Transmission

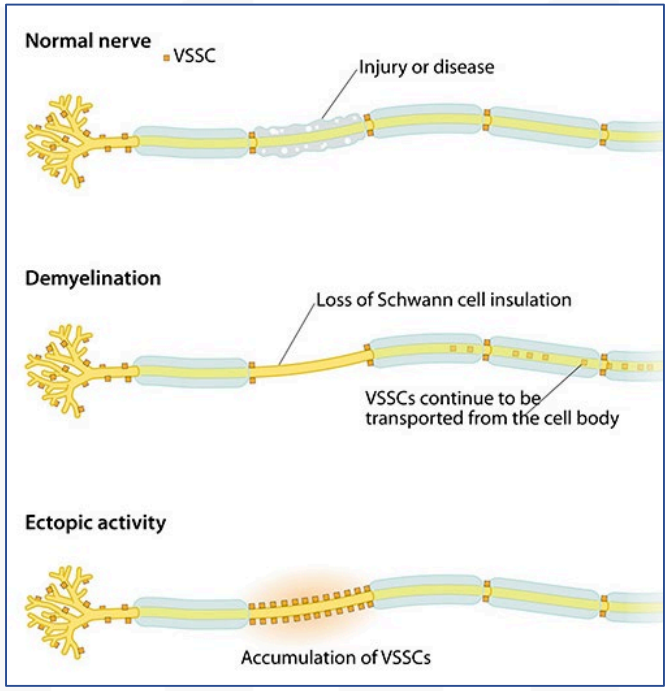


- Aδ fibers
  - » Myelinated
  - » Fast transmission
  - » Sharp
  - » Well-localized
- C fibers
  - » Unmyelinated (“UNC”)
  - » Slower transmission
  - » Dull, aching
  - » Poorly localized

Adapted from Jarvis C: *Physical examination & health assessment*, ed 6, St. Louis, 2011, Saunders. Illustration by Pat Thomas, CMI.

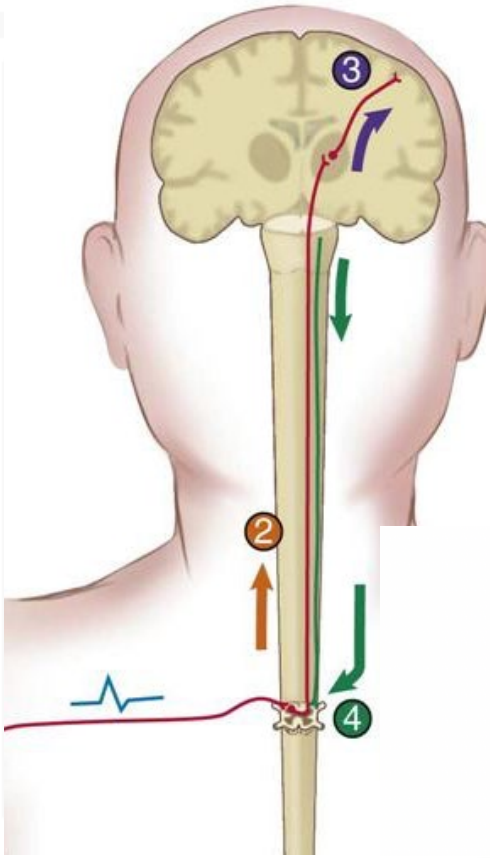
Nerve Injury





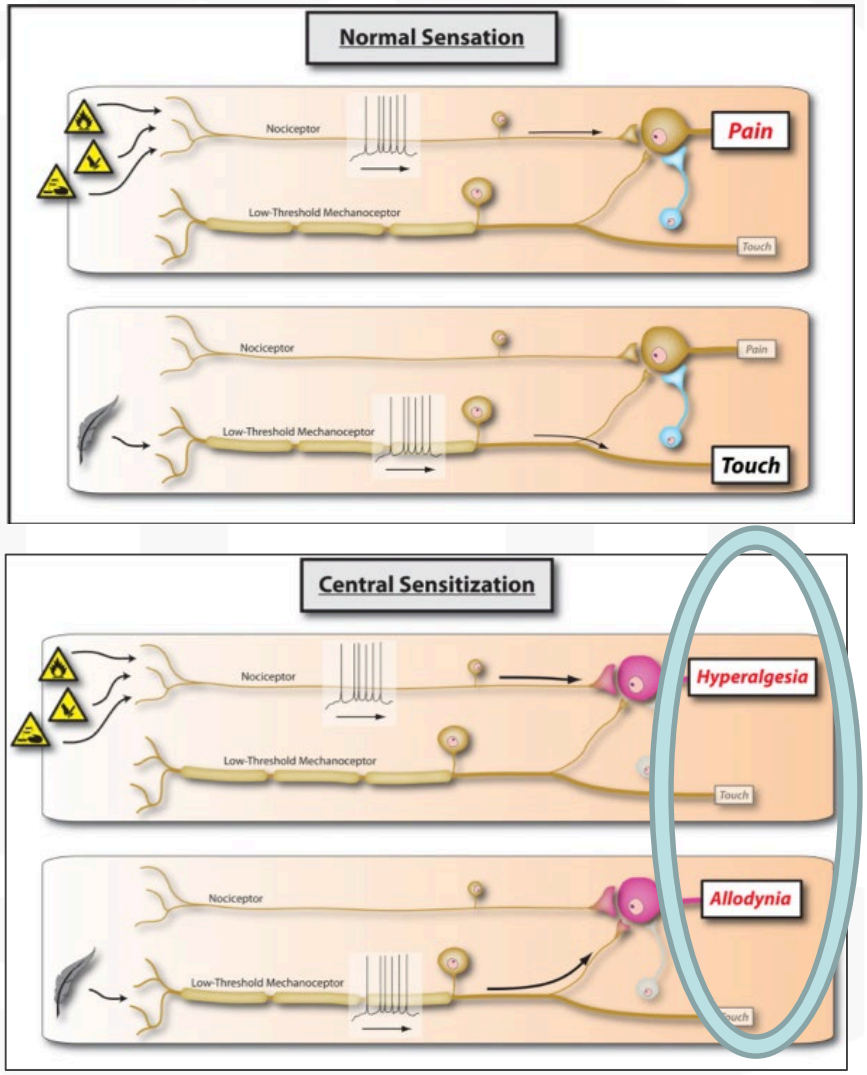
Second Order Neurons

- Nociceptive Specific
- Wide Dynamic Range
  - » Noxious and non-noxious stimuli
  - » Large receptive fields
  - » Wind-up phenomenon



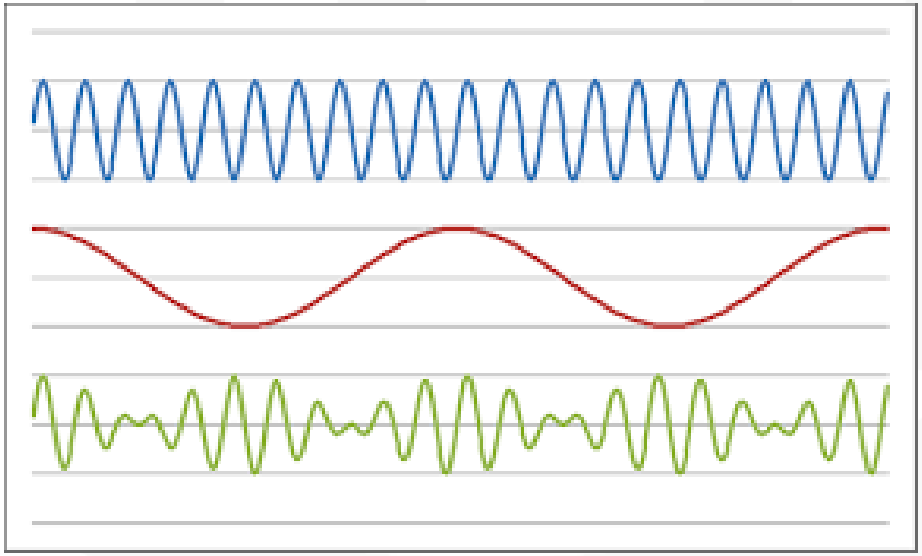
Central Sensitization

- Wind-up
  - » Increasing discharges with same stimulus
  - » Discharges after stimulus ended
- Receptor field expansion



Modulation

- Dampening or amplifying signals
- Peripheral modulation- histamine, serotonin, bradykinin
- Central modulation- spinal and supraspinal mechanisms

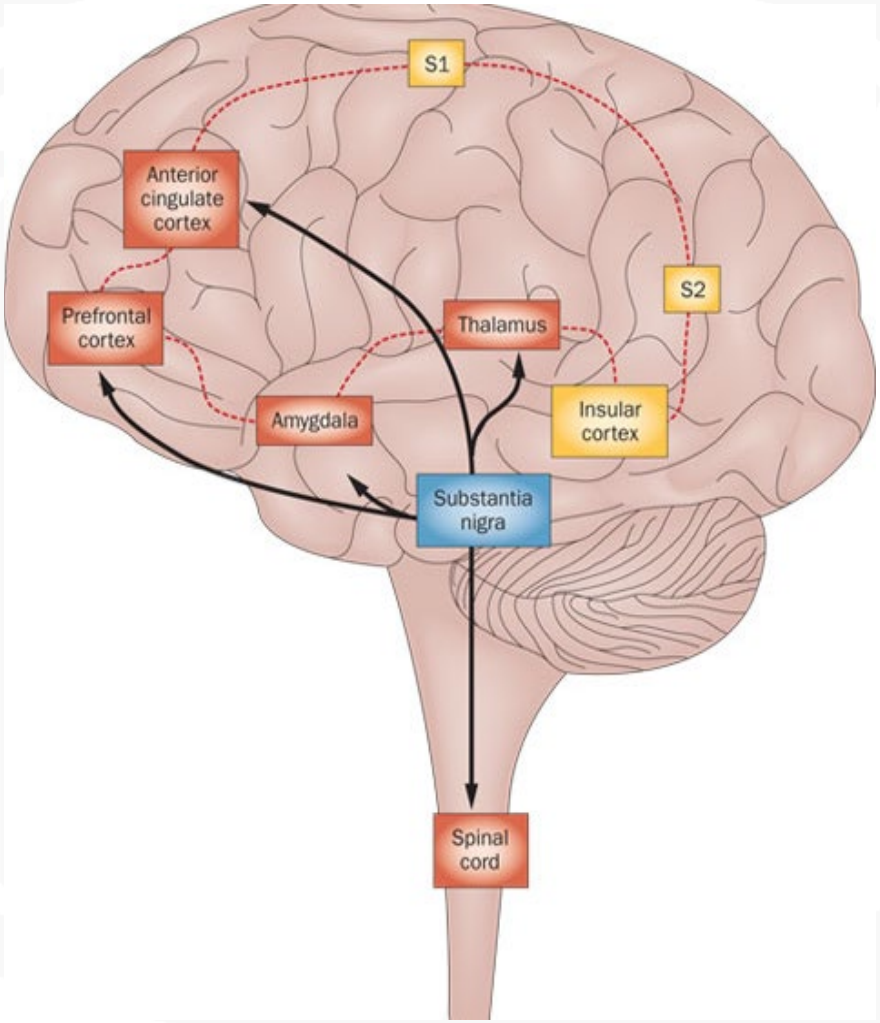


Supraspinal Inhibition

- Pe
  ma
- Re
- Nu
  ma
- Se
  pa

Perception

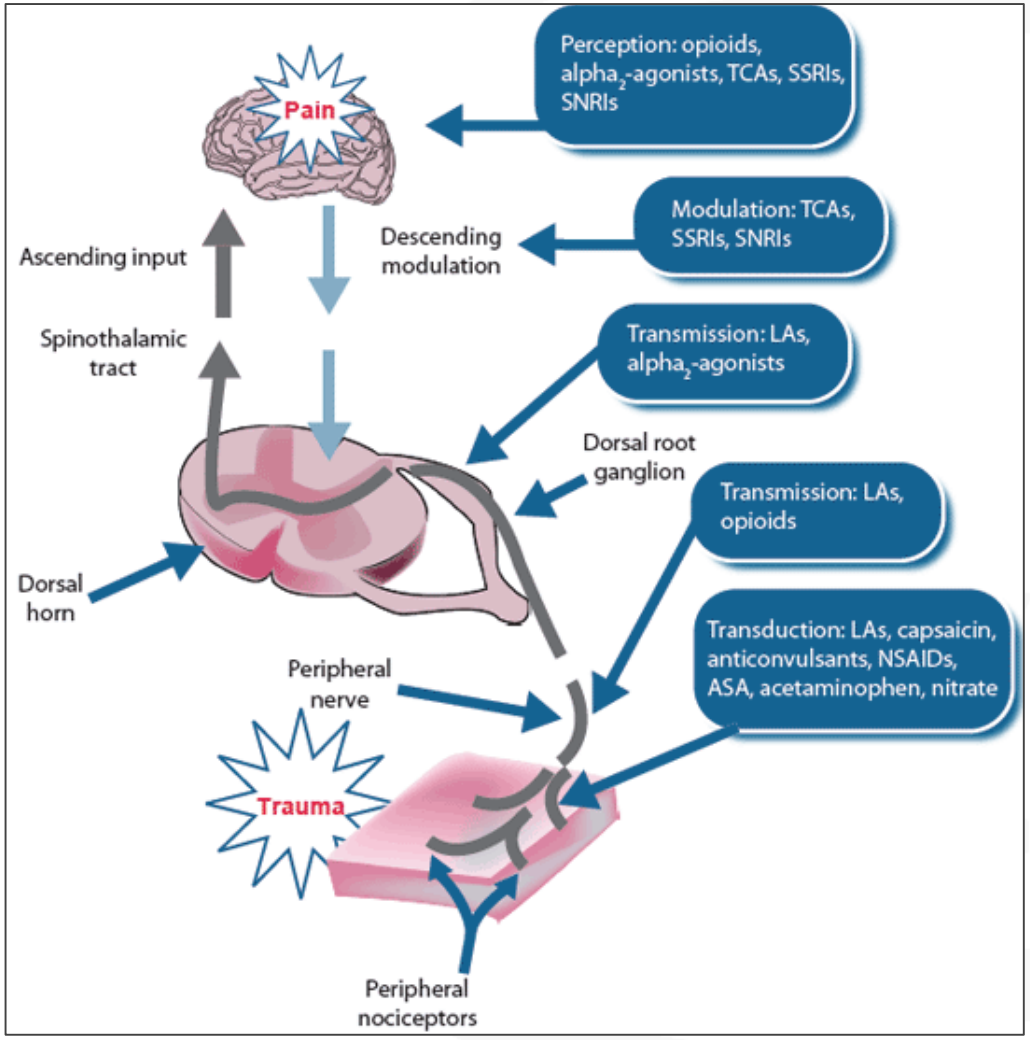
Third order neuron projects from thalamus to cerebral cortex which results in perception and discrete localization



Perception

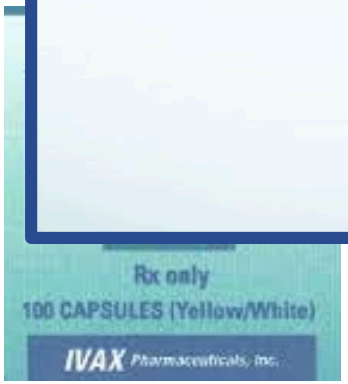
- Cognition
  - » Recognize, discriminate, memorize, judge
  - » Relate a painful experience to another event
- Attention
  - » Only a fixed number of afferent signals can reach cortical centers
  - » Biofeedback, hypnosis

We've Got Lots of Targets!



Medscape

But what are you giving me for pain?



The P Words

- Preemptive analgesia
- Preventive analgesia

<table>
<tr><td>Pre-emptive</td><td colspan="2"></td></tr>
<tr><td>Before surgical incision</td><td>During Surgery</td><td>After Surgery</td></tr>
<tr><td colspan="3">P r e v e n t i v e</td></tr>
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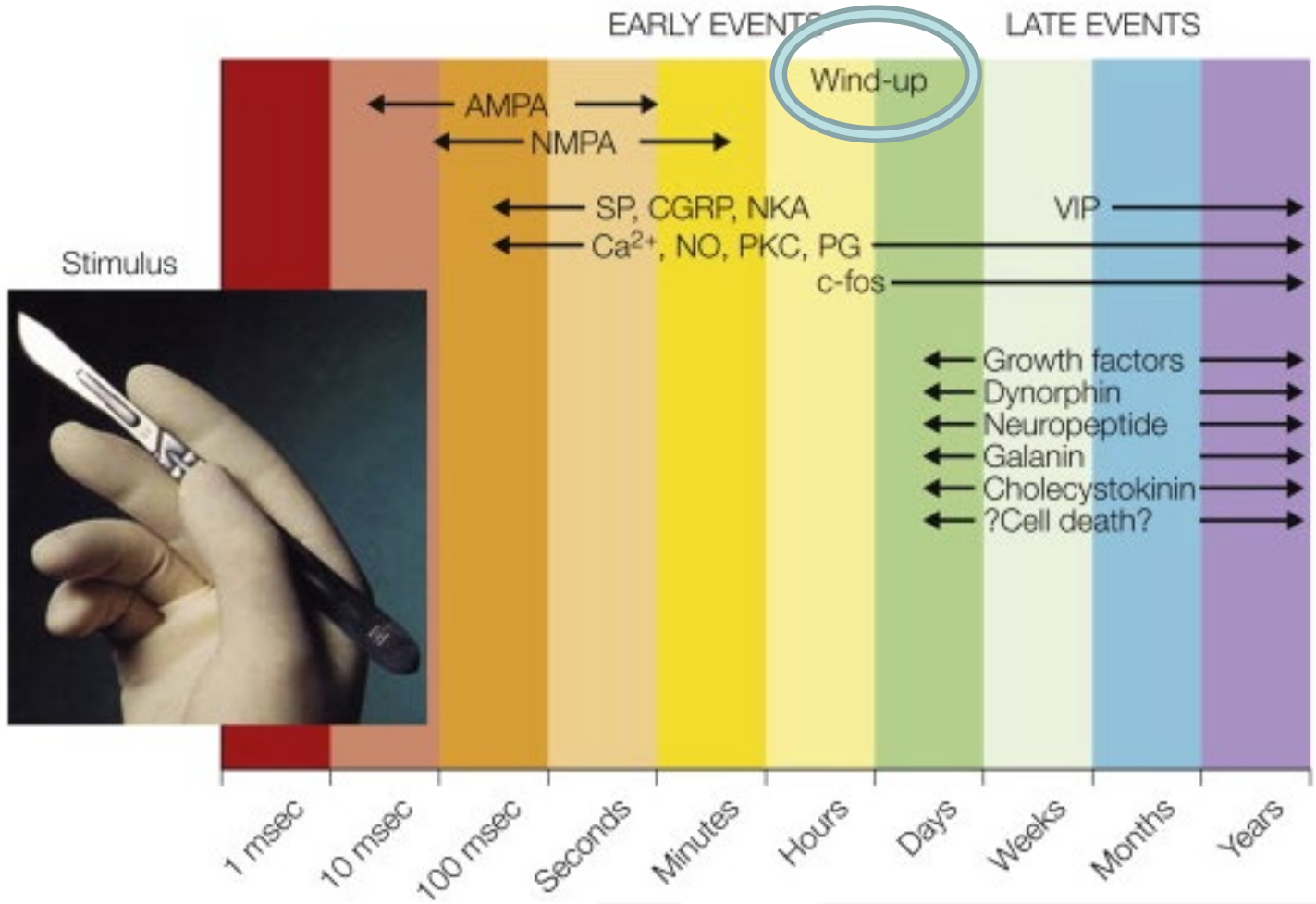
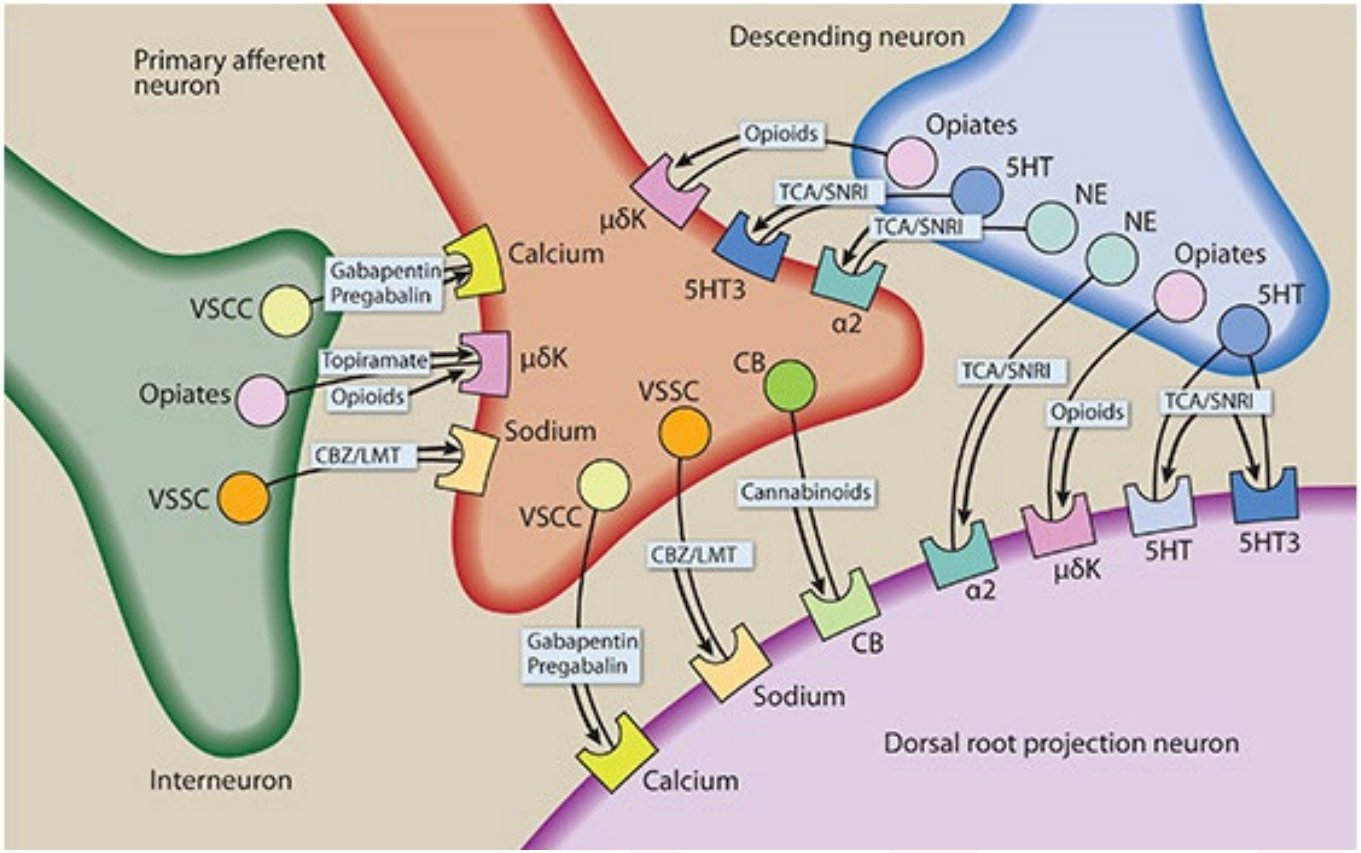
Dahl J and Kehlet H. Preventive Analgesia. *Current Opinion in Anesthesiology* 2011, 24:331-338.

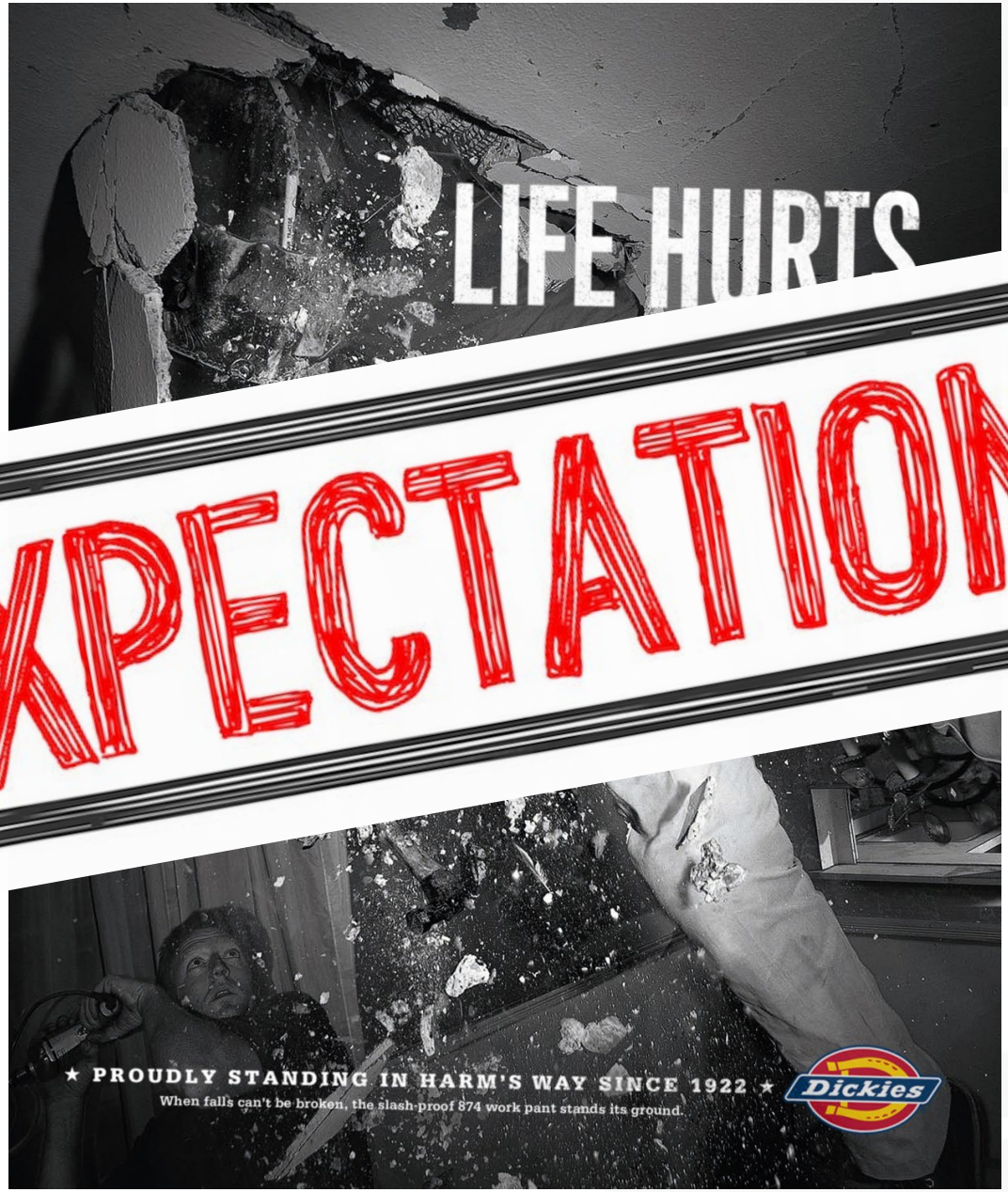
Persistent Pain After Surgery



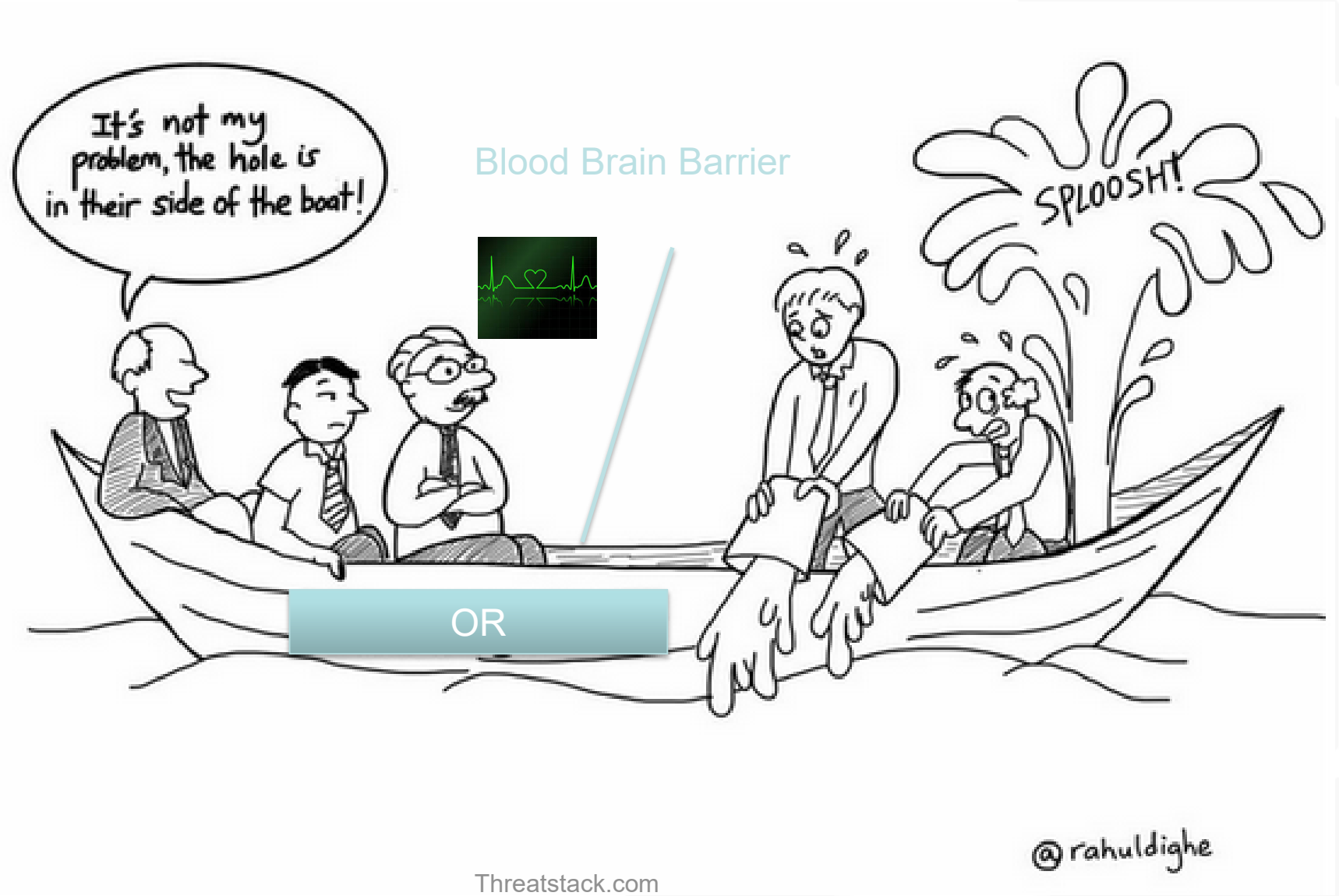
Buvanendran et al. Postoperative Pain And Its Management. Wall & Melzack's Textbook of Pain, Chapter 46, 629-644.

Preventive Analgesia





EXPECTATIONS



Threatstack.com