

Pruritus

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If you've seen one Type C neuron,
you've seen them all (1990's)

How quaintly 20th century.

A New Beginning: A Tale of Two Neurons



Capsaicin vs. Histamine
(Pain vs. Itch)

Subsets of Type C and Aδ Neurons

Neurotransmitters	
Peptidergic	Nonpeptidergic
-CGRP	-DRG cells bind lectin IB4
-CGRP + SP/NKA	-Excitatory amino acids?
-Other peptides -GRP, galanin, VIP?, CCK?	-glutamate? -aspartate? -Purinergetic?

Subsets of Type C and Aδ Neurons

Neurotransmitters		Receptors / Stimuli	
Peptidergic	Nonpeptidergic	Histamine H-1 Receptor	Capsaicin Receptor
-CGRP	-DRG cells bind lectin IB4	Gastrin Releasing Peptide (GRP)	Vanilloid Receptor VR1
-CGRP + SP/NKA	-Excitatory amino acids?	ITCH	Burning Pain
-Other peptides -GRP, galanin, VIP?, CCK?	-glutamate? -aspartate? -Purinergetic?	Distinct Sensations	

Subsets of Type C and Aδ Neurons

Receptors / Stimuli	
Type C Mechanosensitive Heat-insensitive Histamine-sensitive CM(his+) nerve endings	Capsaicin Receptor
Histamine H-1 R = 700 PGE2 = 130 Ach = 100 Serotonin (5HT) = 70 BK = 40 Gastrin Releasing Peptide (GRP)	Vanilloid Receptor VR1
THE ITCH	Burning Pain
Distinct Sensations	

Subsets of Type C and Aδ Neurons

Receptors / Stimuli	
Type C Cowhage spicule sensitive (<i>Mucuna pruriens</i>) Mucunain protease → cleaves PAR-4 on Mechanosensitive Heat sensitive CMH nerve endings THE "Stinging" ITCH	Type C Mechanosensitive Heat-insensitive Histamine-sensitive CMI(his+) nerve endings Histamine H-1 R = 700 PGE2 = 130 Ach = 100 Serotonin (5HT) = 70 BK = 40 Capsaicin = 10 Gastrin Releasing Peptide (GRP) THE "Burning" ITCH
Capsaicin Receptor Vanilloid Receptor VR1 TRPV1 Burning Pain	Distinct Sensations

Neurotransmitters:
 Histaminergic: GRP, CGRP + SPIN1A, Other proteases: GRP, galanin, VIP, CCK?
 Neuroendocrine: GRP, CGRP, SPIN1A, Other proteases: GRP, galanin, VIP, CCK?
 Excitatory amino acids: glutamate? GABAergic? Serotonergic?

Subsets of Type C and Aδ Neurons

Receptors / Stimuli	
Type C Cowhage spicule sensitive (<i>Mucuna pruriens</i>) Mucunain protease → cleaves PAR-4 on Mechanosensitive Heat sensitive CMH nerve endings THE "Stinging" ITCH	Type C Mechanosensitive Heat-insensitive Histamine-sensitive CMI(his+) nerve endings Histamine H-1 R = 700 PGE2 = 130 Ach = 100 Serotonin (5HT) = 70 BK = 40 Capsaicin = 10 Gastrin Releasing Peptide (GRP) THE "Burning" ITCH
Capsaicin Receptor Vanilloid Receptor VR1 TRPV1 BK PGE2 Ach 5HT ASIC-3 P2X4 Burning & Stinging Pain(s)	Distinct Sensations

Neurotransmitters:
 Histaminergic: GRP, CGRP + SPIN1A, Other proteases: GRP, galanin, VIP, CCK?
 Neuroendocrine: GRP, CGRP, SPIN1A, Other proteases: GRP, galanin, VIP, CCK?
 Excitatory amino acids: glutamate? GABAergic? Serotonergic?

Subsets of Type C and Aδ Neurons

Electric paresthesia? Uremia? Hepatic?

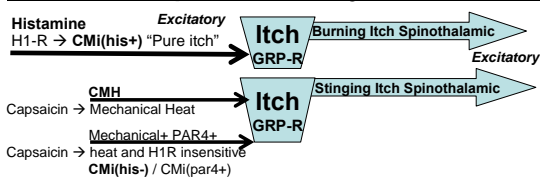
Receptors / Stimuli	
Type C Cowhage spicule sensitive itch (<i>Mucuna pruriens</i>) Mucunain protease → cleaves PAR-4 on (a) Mechanosensitive Heat sensitive CMH and, (b) heat and histamine-insensitive CMI(his-) / CMH(par4+) nerve endings THE "Stinging" ITCH	Type C Mechanosensitive Heat-insensitive Histamine-sensitive CMI(his+) nerve endings Histamine H-1R = 700 PGE2 = 130 Ach = 100 Serotonin (5HT) = 70 BK = 40 Capsaicin = 10 Gastrin Releasing Peptide (GRP) Glutamate THE "Burning" ITCH
Capsaicin Receptor Vanilloid Receptor VR1 TRPV1 BK PGE2 ASIC-3 P2X4 Ach (Nicotinic?) 5HT Burning & Stinging Pain(s)	Distinct Sensations

Neurotransmitters:
 Histaminergic: GRP, CGRP + SPIN1A, Other proteases: GRP, galanin, VIP, CCK?
 Neuroendocrine: GRP, CGRP, SPIN1A, Other proteases: GRP, galanin, VIP, CCK?
 Excitatory amino acids: glutamate? GABAergic? Serotonergic?

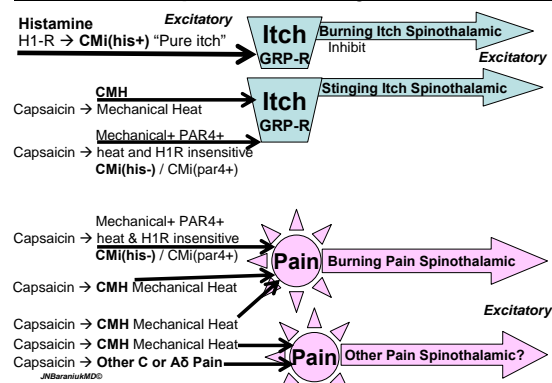
Dorsal Horn Spinal Selectivity of Itch vs. Pain



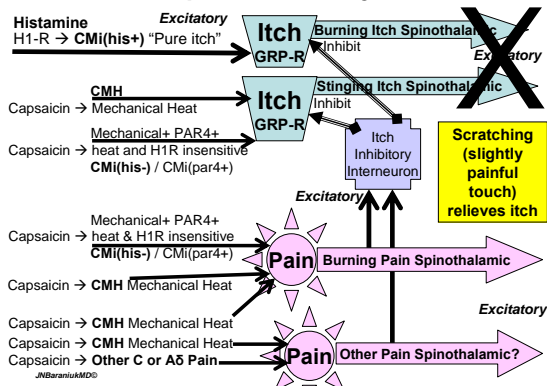
Dorsal Horn Spinal Selectivity of Itch vs. Pain



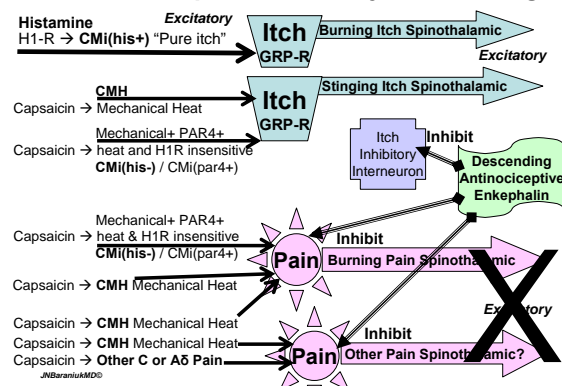
Dorsal Horn Spinal Selectivity of Itch vs. Pain



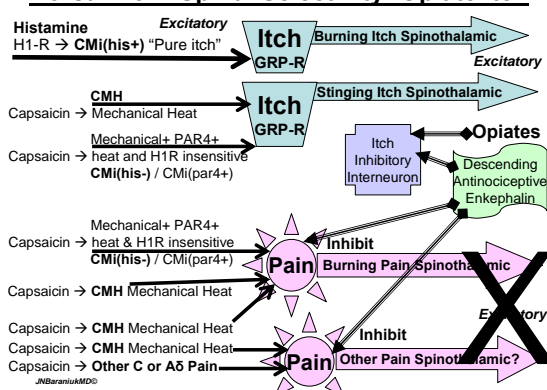
Dorsal Horn Spinal Selectivity of Pain > Itch



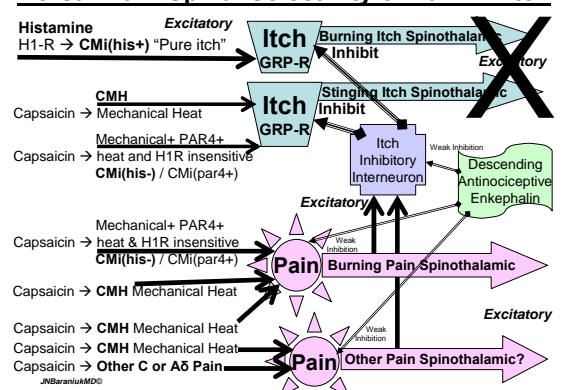
Dorsal Horn Spinal Selectivity: Descending



Dorsal Horn Spinal Selectivity: Opiate Itch



Dorsal Horn Spinal Selectivity of Pain >> Itch



Subsets of Type C and Aδ Neurons

Neurotransmitters		Receptors / Stimuli		
Peptidergic	Nonpeptidergic	PAR4+ Mechano-sensitive	Histamine H-1 Receptor	Capsaicin Receptor
-CGRP	-DRG cells bind lectin IB4	heat & histamine insensitive	Gastrin Releasing Peptide (GRP)	Vanilloid Receptor VR1 TPRV1
-CGRP + SP/NKA	-Excitatory amino acids?	?	Glutamate	Burning or Stinging Pain
-GRP	-glutamate?		Burning ITCH	
-Galanin	-aspartate?			
-VIP?	-Purinerbic?			
-CCK?				
-Glutamate		Stinging ITCH		

Distinct Regulation of Sensations and Perceptions

Neuroplasticity of receptor and neurotransmitter expression in inflammation mediated by LTB4, NGF (*TrkA*), BDNF & NT-4 (*TrkB*), and NT-3 (*TrkC*) (AR).

Home Remedies for Itch and Stinging Jelly Fish Prototypic Medications for Commercial Investment

Papain, also known as **papaya proteinase I**, is a cysteine protease (E.C. 3.4.22.2) present in papaya (*Carica papaya*) and mountain papaya (*Vasconcellea cundinamaricensis*). It is a home remedy treatment for jellyfish, bee, and yellow jacket (wasps) stings; mosquito bites; and possibly stingray wounds that may digest protein toxins in the venoms.

Acetic acid, found in vinegar, disables the box jelly's nematocysts that have not yet discharged into the bloodstream (though it will not alleviate the pain).

There is no scientific evidence that urine, fresh water, ammonia, papaya, meat tenderizer (papain), lemon juice, sodium bicarbonate, hydrogen peroxide, cold packs, steroid cream, methylated spirits, vodka or other alcohols will disable further stinging. These substances may even hasten the release of venom. Pressure immobilization bandages should never be used for jelly stings.