Itching for a Reason: Understanding Mechanisms of Itch

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Itching for a Reason: Understanding Mechanisms of Itch

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Non-neuronal Cells Contributing to Itch:
- Keratinocytes
- Dendritic cells in the skin
- Macrophages
- Mast cells

What is an itch?
- Almost everyone has experienced itchiness, or the "unpleasant sensation that elicits the desire or reflex to scratch."
- Acute or chronic (e.g., psoriasis)
- Types include pruritogenous (heat, touch, pressure), neurogenic (painful), or psychogenic (psychiatric origin)

Two major and distinct neuronal pathways to transmit itch signals: histaminergic vs. non-histaminergic
- Both pathways activate itch-selective C-fibers but each activates a separate and distinct population
- Both pathways go through dorsal root ganglion to spinal cord and specifically to the trigeminal system
- Different tracts and different brain activation

Intensity Theory:
- Interprets itch as a form of pain
- Suggests that:  
  - Itch activates the same neurons
  - These neurons distinguish whether it is painful or itchy based on intensity
  - Weak activation of neuron = itch
  - Strong activation of neuron = pain
  - Depressed by studies showing that modifying intensity did not convert itch to pain or vice versa

Labeled Line Theory:
- Suggests that:  
  - Non-specific fibers transmit information to the spinal cord
  - Specific set of C-fibers in humans are histamine-sensitive and different from other known pain fibers
  - However, a later study showed that the itch sensation activated the C fibers that were hypothesized to be itch-specific
  - C fibers are also unrelated to histamine

Selectivity Theory:
- Suggests that:  
  - Large population of pain receptors and a smaller population of itch-sensitive receptors within it
  - Excitation of the smaller itch-sensitive population would generate itch
  - However, if a pain stimulus also activates the larger population, the sensation of pain would outweigh the itch-sensitve subset of receptors

Histaminergic Pathway:
- Histaminergic pathway is associated with acute itch
- Released by mast cells, basophils, and keratinocytes
- Histamine receptors on itch afferents
- When histamine is found
- Phospholipase C and other signal pathways are activated
- Neuropeptides like substance P and CGRP released which cause the inflammation associated with itch

Non-Histaminergic Pathway:
- Non-histaminergic pathway is associated with chronic itch
- Non-histaminergic afferents respond to pruritogens other than histamine whose receptors also activate a phospholipase signal pathway
- Cowhage (Mucous of cow)
- The plant's spicules contain a protease that induces sensation of itch
- Used in most research involving non-histaminergic pathway

In summary:
- There is still a lot about itching that we don't know.
- Newer models of itching are being developed as we learn more about the mechanisms.
- Itch sensation is a complex process involving multiple pathways.
- Future research is needed to better understand the mechanisms of itching.

Water Closet