



Week 9. Pain: The Dark Side of Neuroplasticity

Presentation by Dr. Bialosky

What did you guys think of this?

I found it kind of alarming. It really gets to the idea that Neuroplasticity applies to ALL neurons.

Increasing sensitivity to pain with osteoarthritis in the knee

- Nociceptors (pain sensing neurons) loop to the spinal cord.
- Thanks to neuroplasticity ☹️, increased use of pain circuits leads to more nociceptor synapses in the knee.
 - Knees become more & more sensitive to pain
 - Eventually, even a relatively mild stimulus is perceived as pain.
 - What would the person do then?

What Neuroplasticity Principle Applies?

- Constant pain will increase the number of synapses from nociceptors and strengthen of pain circuits.
 - Repetition matters! Use it and Improve it.
- What would it lead to in terms of sensory maps?
 - Use it and "Improve" it.
- Pain leads to avoidance of whatever causes the pain (e.g., walking, sitting cross legged), so, what will happen?
 - Use it or Lose it.
- Motor maps being used less, so...?

As some of you pointed out...

- Because constant knee pain will increase the number of synapses from nociceptors and strengthen of pain circuits...
- People can develop maladaptive walking strategies
 - Neuroplasticity will reinforce these patterns the more they are used, making them difficult to unlearn.
 - These maladaptive strategies can have secondary effects on other parts of the body, like...?
 - Proprioception of how you are walking is impacted—
 - You don't realize you are doing something that is hurting yourself

Chronic pain

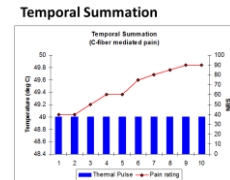
- Can be a neurological condition caused by damage or dysfunction in the CNS
 - Stroke, MS, tumor, epilepsy, trauma, spinal cord trauma, Parkinson's
- Chronic pain is caused by long-term peripheral pain setting up Neuroplasticity-reinforced CNS circuits
 - Pain is not associated with current peripheral damage
 - Chronic pain is a disease
 - Can affect whole body or parts of the body that are not being stimulated
- Pain is constant & moderate-severe in intensity
 - Everything makes it worse: touch, temp, movement
 - Character of the pain is variable: Burning + pins & needles are the most common types.
 - Fibromyalgia
- Chronic pain (and those suffering from it) are not respected by the health care community, though it can have a severe impact on quality of life
- Very hard to treat: drugs, anti-depressants,
 - Lowering stress seems to help?

Wearing new shoes...

- A type of immediate, short-term Neuroplasticity
- Initially, the discomfort is minimal, you likely don't even notice it (or you wouldn't have bought them!)
- Escalating pain is due to repeated stimulation of the same nociceptors
 - Repetition matters!
 - Those nociceptors quickly become very good at responding to the particular type of pain they are experiencing.
 - Use it and improve it! (unfortunately!)

Escalating Pain: Temporal Summation of Pain

- The perception of pain increases in intensity with the same level of stimulus.
- A type of Allodynia (*æ.lo.'dɪ.ni.ə*)
 - Other examples?



Another Example: Diabetic peripheral neuropathy

- Numbness in a foot & leg is how it begins
 - Then tingling, then pain. Just numbness first..
 - It also gets in the fingers and hands.
- No afferent signals to somatosensory cortex, so...
 - Impaired proprioception
 - Changes in sensory maps
 - How would this impact standing?
 - How would this impact walking?
- If you cannot feel what or whether your feet are touching the floor ... what will happen?
 - You are more likely to drag them, trip over obstacles
 - Watch the floor & your feet as you walk-this is dangerous!
 - Moving fast or abruptly could lead to falls (legs don't respond)

Impact on daily life?

- Diabetic Peripheral Neuropathy leads to Aberrant input from misfiring peripheral nerves (nociceptors).
 - What effect will this have in Somatosensory cortex?
 - What will be the behavioral effects?
- Not being able to feel the appropriate sensations in body parts can lead to severe injury, untreated infections, and even amputations.
 - Those of you going into PT, OT, and medicine are highly likely to have patients with Diabetic Peripheral Neuropathy and/or Osteoarthritis.

Great Job on This, Folks!

- The last couple topics have been kind of a stretch for the speech folks, but that is what this class is about!
 - You did great!
 - This will give you all increased awareness of people with mobility impairments, and conditions leading to chronic pain.

After Test 2, we will do speech-language topics for a little turn-about.

- Remember: Extra Credit should be submitted through CANVAS.

THANKS, Have a great Week!