TherapeuticAssociates
PHYSICAL THERAPY

LOOKING BEYOND THE TISSUE ISSUE
WHY WE STILL HURT

Kyle Bonin, PT DPT

Certified Therapeutic Pain Specialist

West Kennewick Physical Therapy

509-783-1962

Objectives

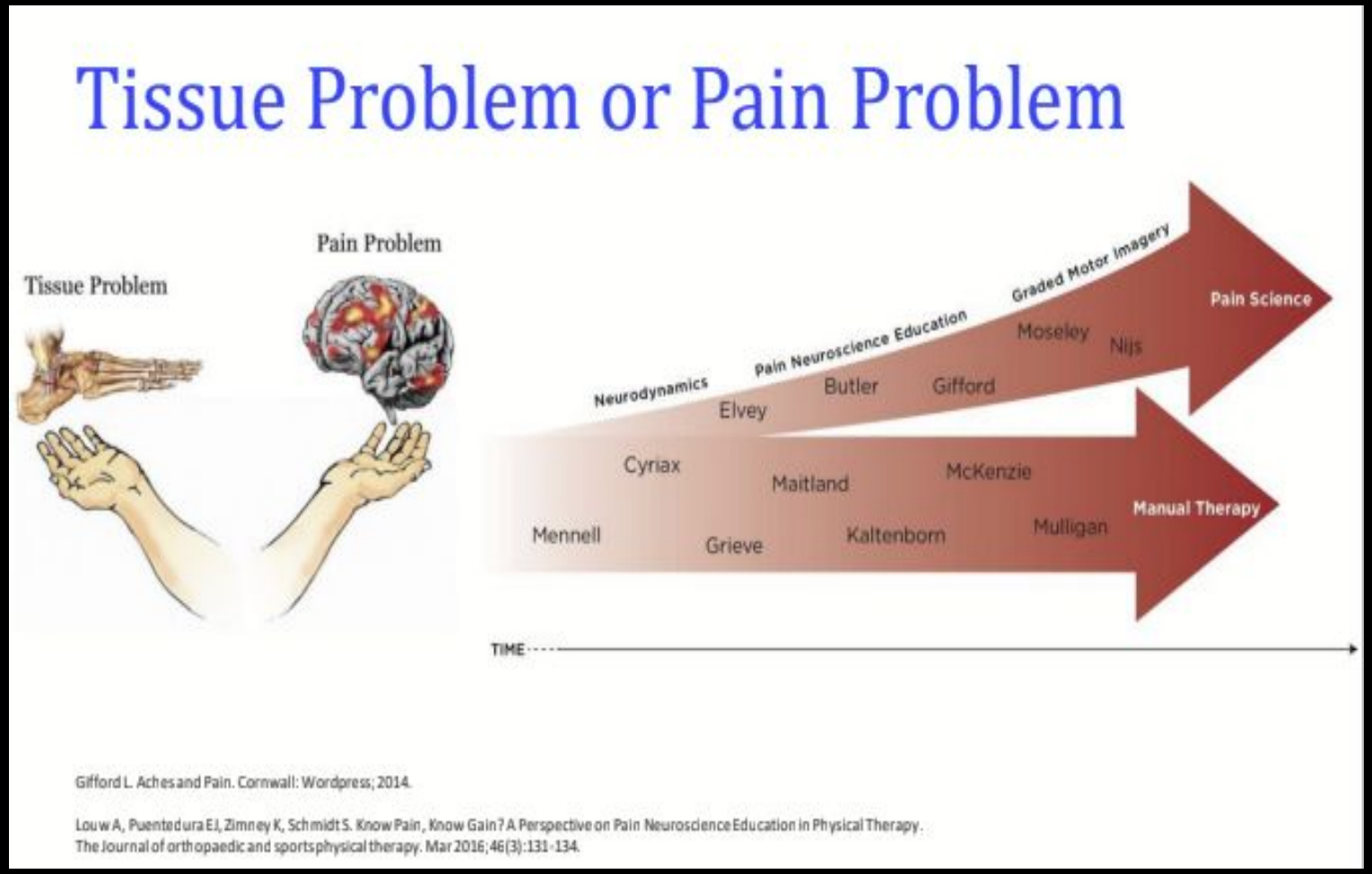
- Learners will be able to differentiate between the different pain theories
- Learners will attain knowledge of the anatomy of the nervous system
- Learners will be able to identify the brain's role in pain experience
  - Neuroplasticity and plastic maps
  - Inhibition and facilitation
- Learners will be able to educate patients on basic PNE concepts to:
  - Promote self-care
  - Decrease unnecessary fear of movement
  - Minimize treatment costs

Why Care About Pain

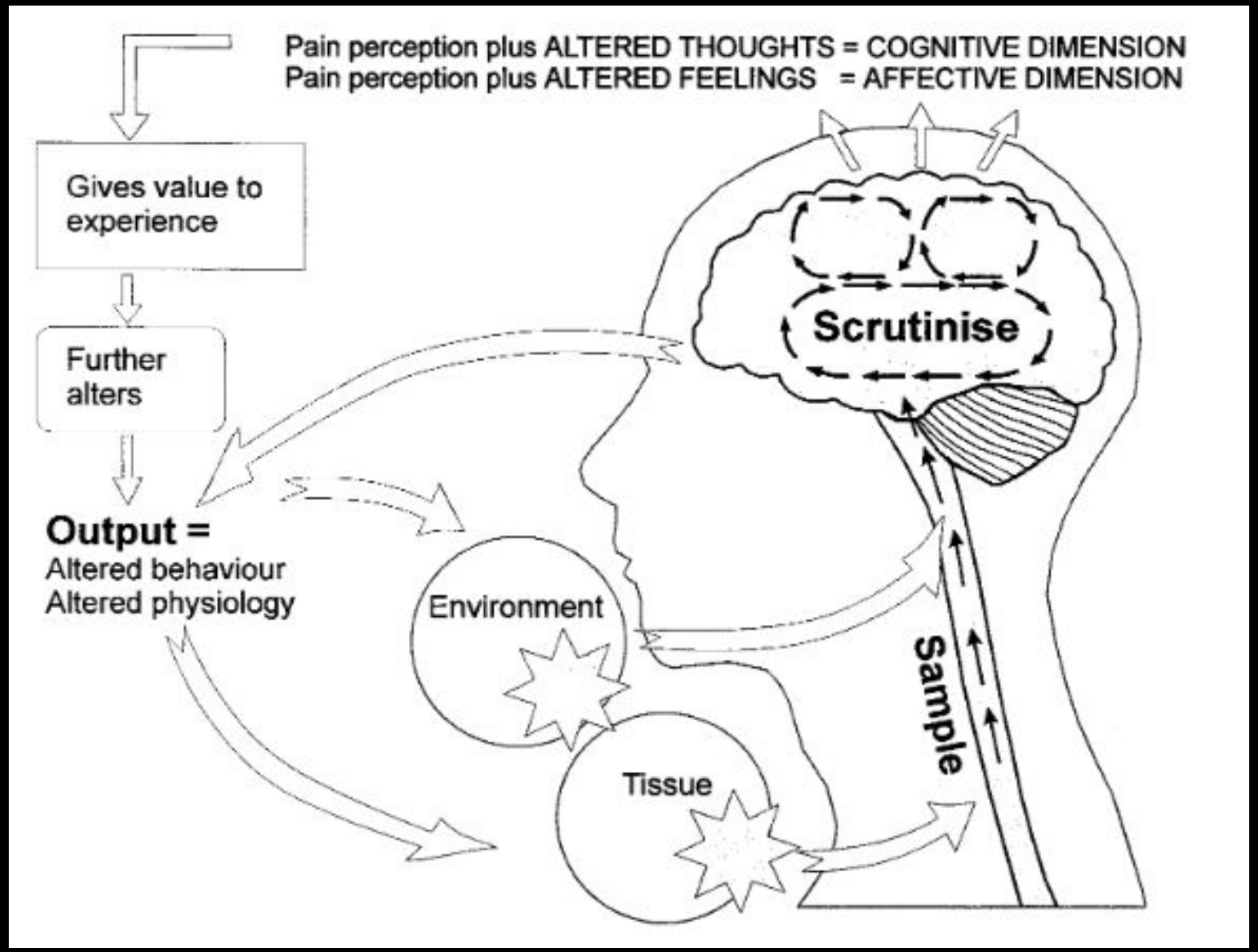
- Study of 2008 found the total cost of pain to society to be $560-$630 billion in 2010 dollars.[1]
- Rising healthcare costs with reduced reimbursement rates.[2]
- The Opioid Epidemic with rising number of Opioid related deaths.
- Pain Neuroscience Education has been shown to minimize the number of treatments and contacts with medical professionals.[3]

The Different Pain Theories

- Cartesian Model
- Gate Control Theory
- Neuromatrix Model
- Biomedical Model[5]
- Biopsychosocial Model
- Mature Organism Model[6]

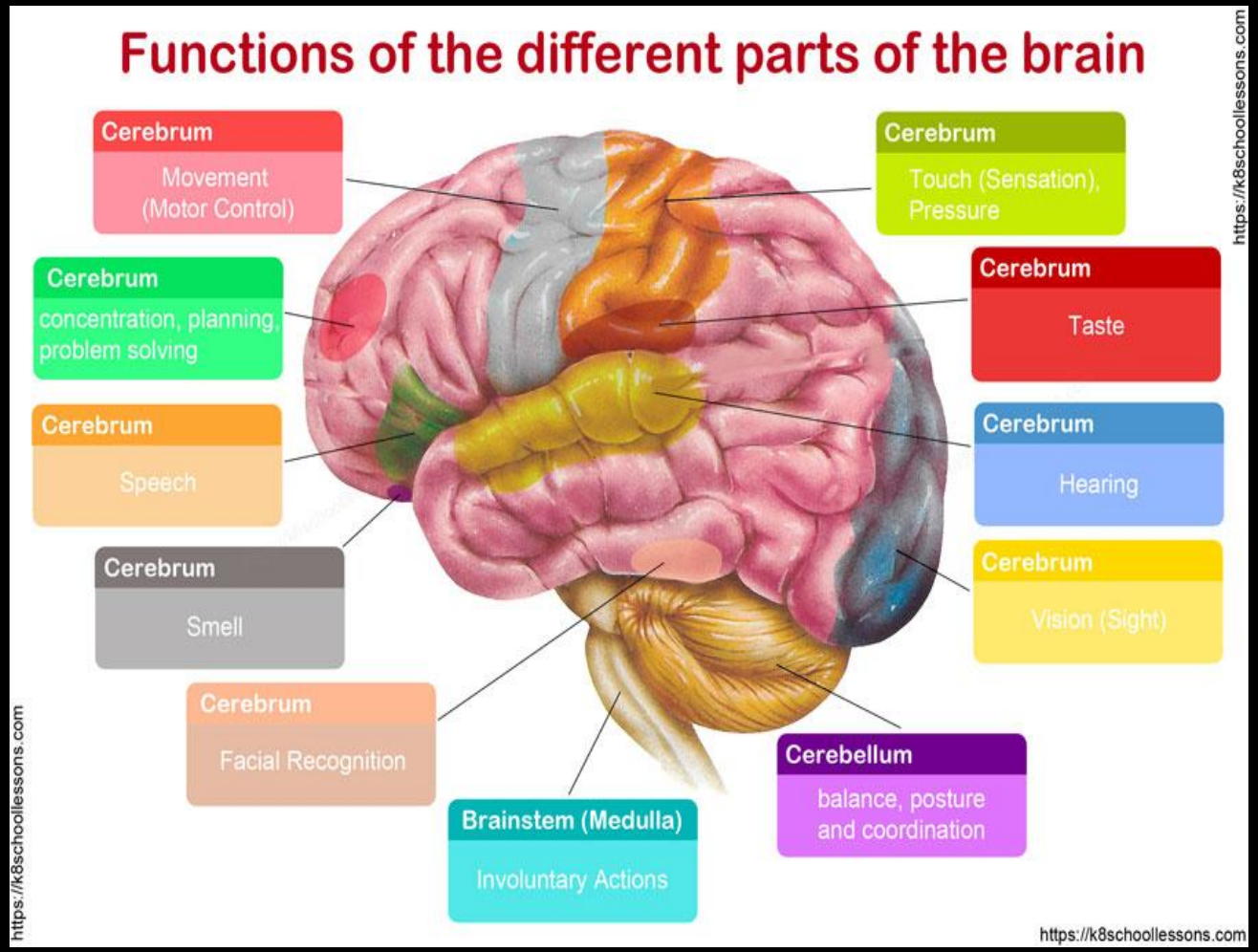


The Mature Organism Model



Where Does Pain Come From?

- Modern understanding is that pain is constructed by the brain
- We do not have pain receptors we have nociceptive nerve fibers
- It is the brain that constructs pain as a method of protection



Look at the Evidence

Age-specific prevalence estimates of degenerative spine imaging findings in asymptomatic patients[a]

	Age (yr)						
Imaging Finding	**20**	**30**	**40**	**50**	**60**	**70**	**80**
Disk degeneration	37%	52%	68%	80%	88%	93%	96%
Disk signal loss	17%	33%	54%	73%	86%	94%	97%
Disk height loss	24%	34%	45%	56%	67%	76%	84%
Disk bulge	30%	40%	50%	60%	69%	77%	84%
Disk protrusion	29%	31%	33%	36%	38%	40%	43%
Annular fissure	19%	20%	22%	23%	25%	27%	29%
Facet degeneration	4%	9%	18%	32%	50%	69%	83%
Spondylolisthesis	3%	5%	8%	14%	23%	35%	50%

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[a]Prevalence rates estimated with a generalized linear mixed-effects model for the age-specific prevalence estimate (binomial outcome) clustering on study and adjusting for the midpoint of each reported age interval of the study.

- We are more than the sum of our parts.
- True tissue damage doesn't explain chronic pain or varying levels of pain.[7]
- There is a high number of asymptomatic individuals with disc bulges, degeneration, or OA but no pain.[8]

The Nervous System: Ion Channels

- A key factor in a sensitive nervous system
- They regulate the flow of neurons across cell membranes
- Several hundred different ion channels have been identified
- Every 48 hours, ion channels are replaced
- The amount and type depends on:
  - Your DNA
  - **What your brain perceives is necessary**

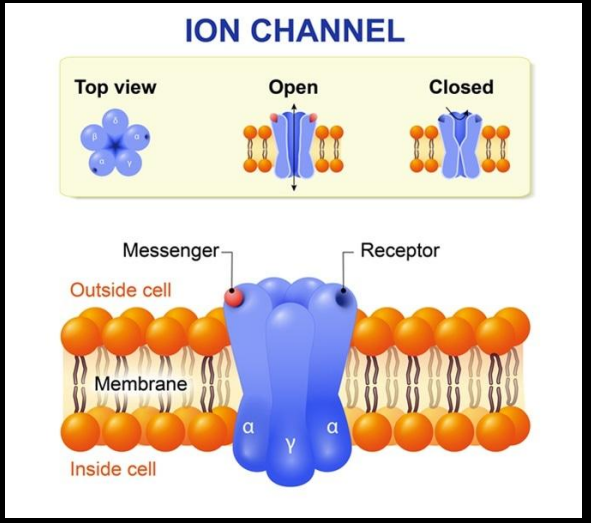
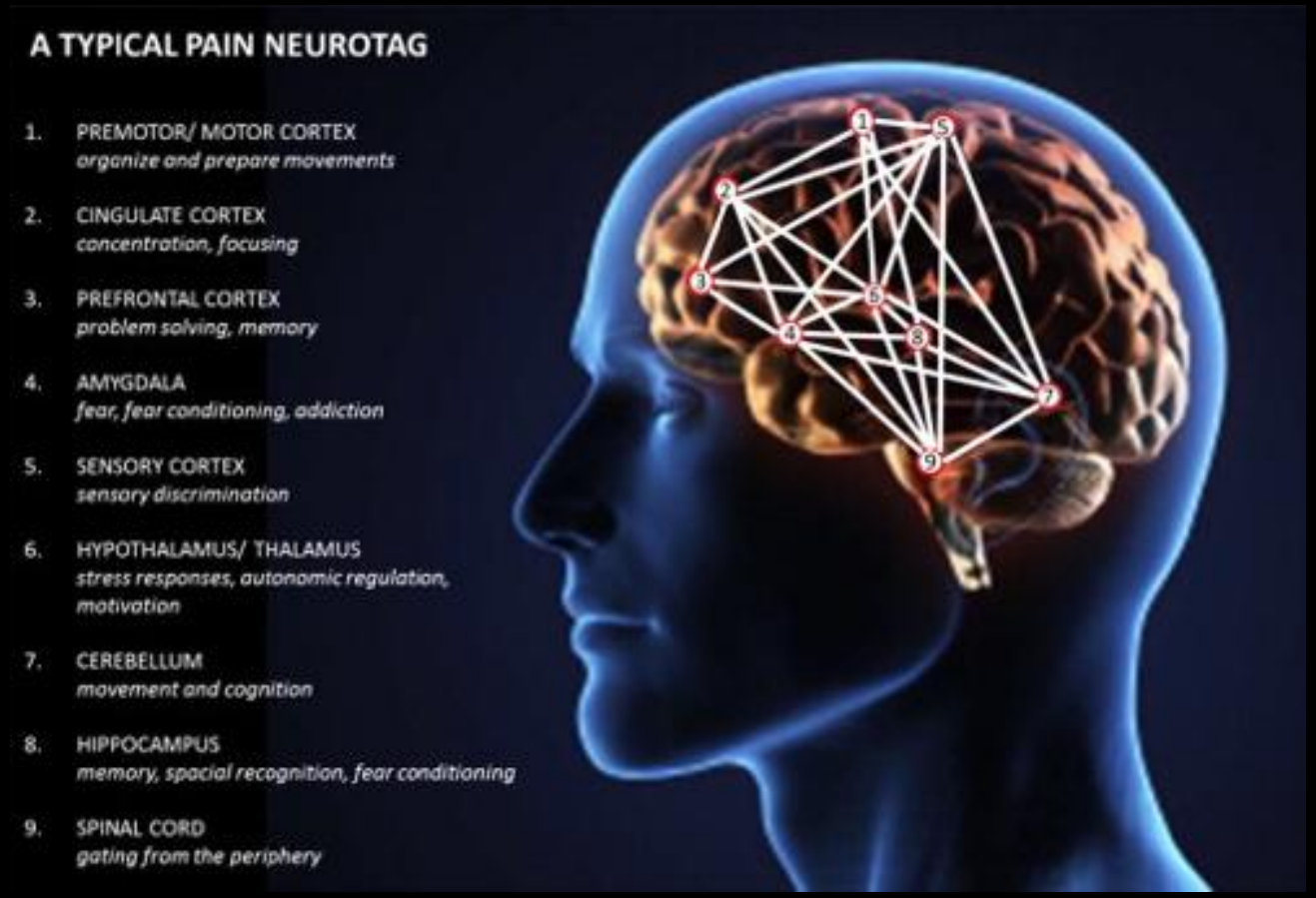


Image retrieved from Ratan-NM MP. Types of ion channels in the body. News Medical Life Sciences. October 26, 2018. Accessed December 2, 2023. https://www.news-medical.net/health/Types-of-Ion-Channels-in-the-Body.aspx.

The Nervous System: The Brain



- fMRI images of a person in pain show different areas of the brain activating
- Hebbian Theory - "Nerves that fire together, wire together"

Pain and the Brain

- The brain perceives a threat which results in the individual experiencing pain
- Pain is a perception
- We can affect perception via descending modulation
  - Facilitation - "Tell me more"
  - Inhibition - "Stop bothering me"
- We do this with words and images to change the brain's perceived level of threat

Neuroplasticity and Plastic Maps

- If you decrease the use of a body part, the representation for that area can diminish
- Affects motor and sensory
- Changes can occur in minutes[14]

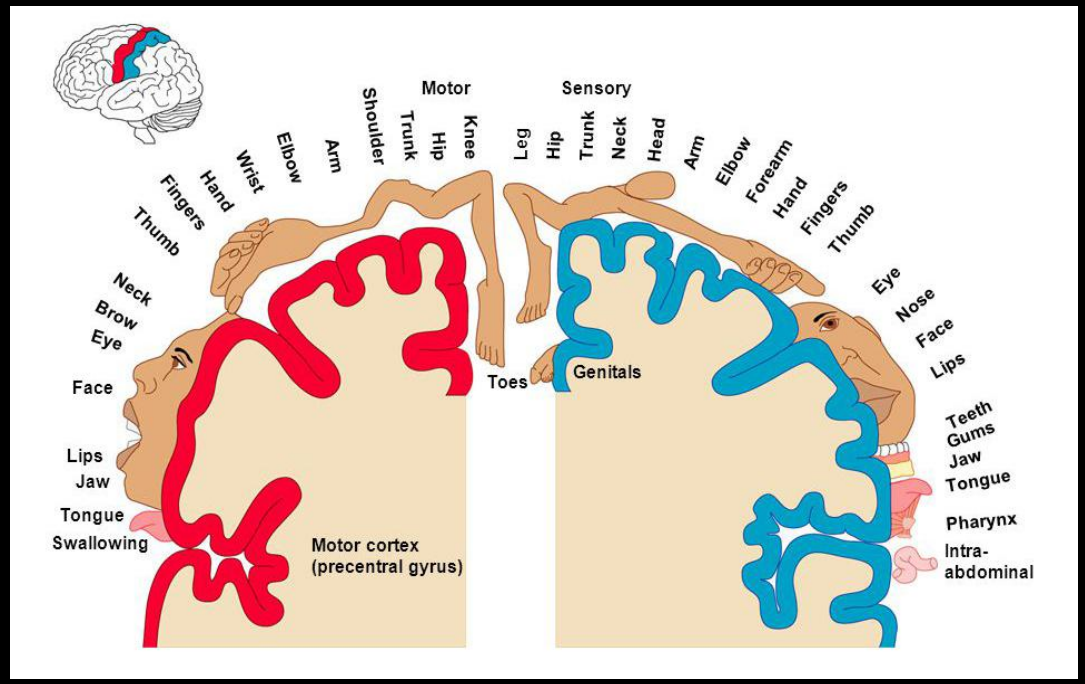


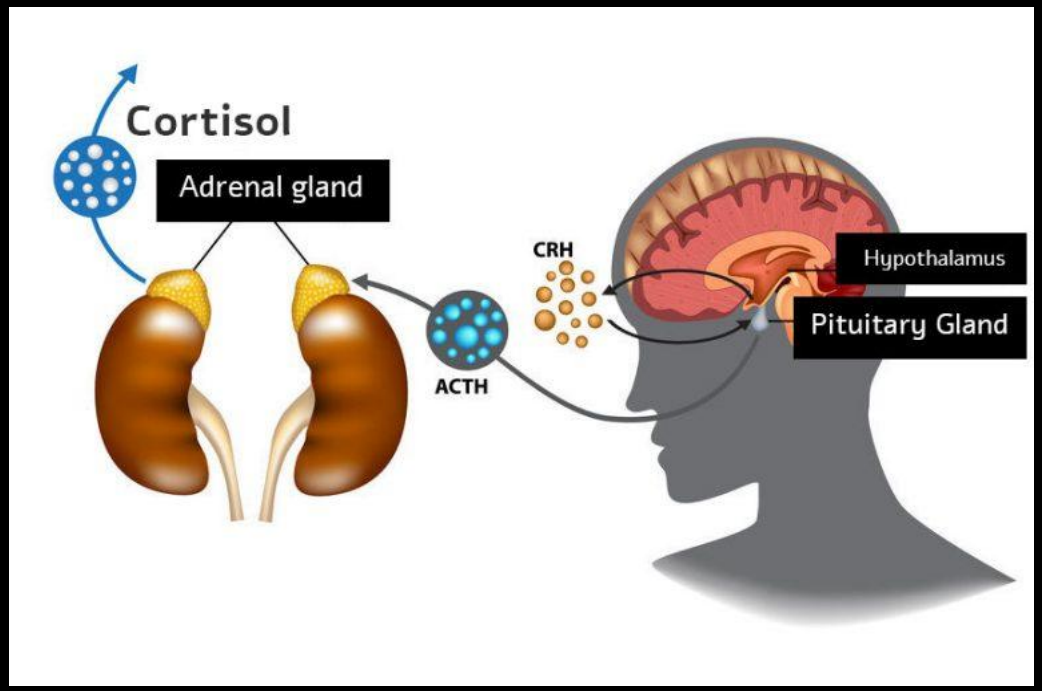
Image retrieved from How your Brain sees your Body - Learn Somatics. Published September 25, 2020. https://learnsomatics.ie/how-your-brain-sees-your-body/

Other Factors Affecting Pain: Stress

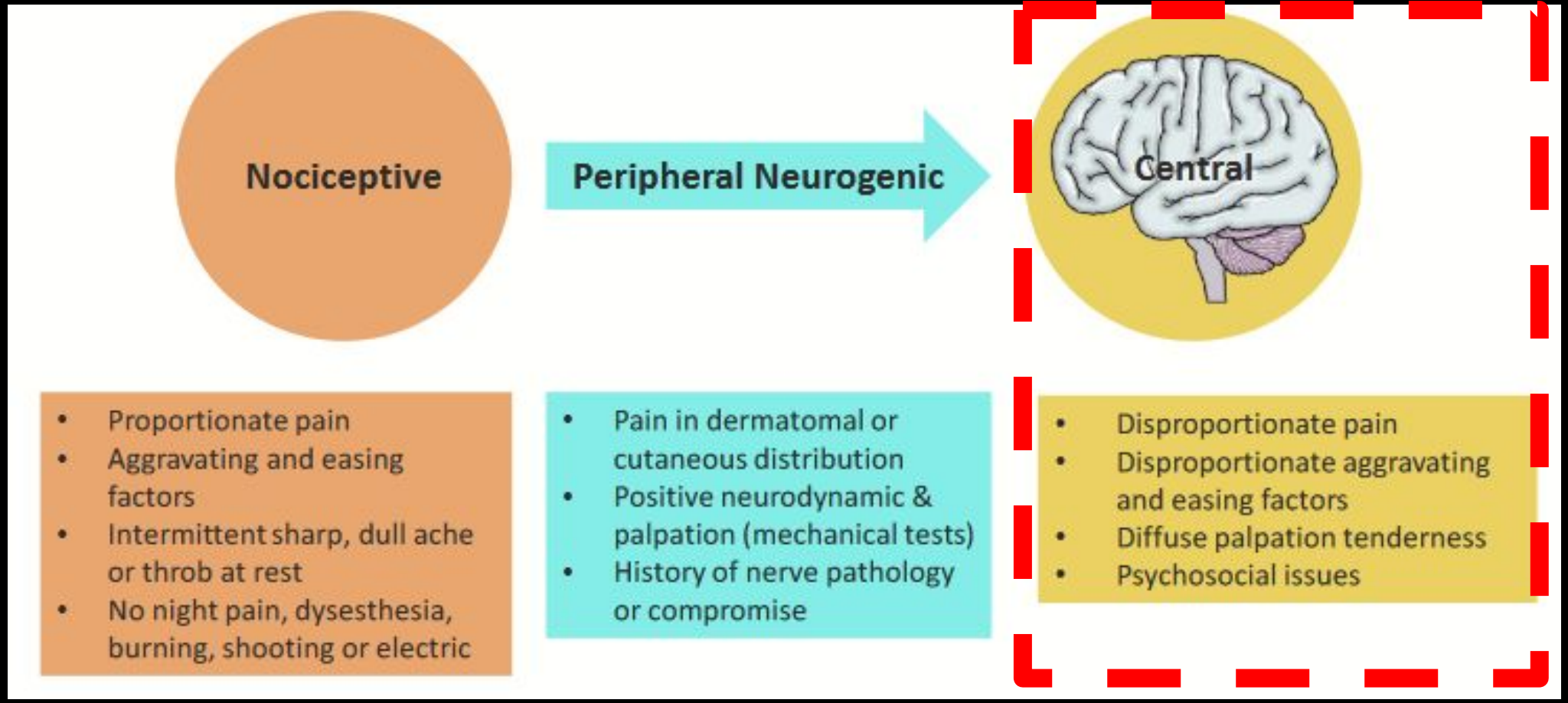
- Psychological factors influence immune function via endocrine system, health behaviors and other pathways[15]
- This leads to an abundance of pro-inflammatory cytokines
- Can increase the sensitivity of the nervous system

Stress and Cortisol

- Stress hormone created in the adrenal glands in response to tissues being sore, tired, sensitive, or fatigued
- Can affect memory, sleep, concentration, blood pressure, reproduction
- Can increase nerve sensitivity, persistent inflammation, and brain plasticity[16]



Sources of Pain



Looking at Widespread Pain and Fatigue

Symptoms	Fibromyalgia	Chronic Fatigue Syndrome	IBS	Chronic Lyme Disease
Widespread Pain	x	x	x	x
Fatigue	x	x	x	x
Joint Stiffness	x	x		x
Persistent Pain	x	x	x	x
Sleep Issues	x	x	x	x
Depression	x	x	x	
Mental Fog	x	x	x	x
Short term memory loss	x	x		x
Sensitized GI system	x		x	x
Social/functional impact	x	x	x	x
Headaches	x	x	x	x
Sexual Dysfunction	x	x	x	x
Dx with cluster of symptoms	x	x	x	x

Louw, A.; Schmidt, S; Zimney, K and Puentedura, E.J. Treat the Patient not the Label: A Pain Neuroscience Approach; Journal of Woman's Health; February 2019; pages 1 - 9
Louw, A.. Everything Hurts. Module 1 Session 2 Lecture presented: Therapeutic Pain Specialist Certification at Evidence in Motion; 2020; Online.

Labels: Good or Bad?

- Labels can be both beneficial or detrimental
- We treat the patient and not the label

Benefits of labels	Consequences of labels
Helps validate a patient	Can cause patient to over-identify with label
Can provide relief for the patient	Patients may fall for expensive and predatory "cures"
Provides a sense of community	Can provide a community of sufferes (motor neurons)
Can help guide certain elements of treatment	Diagnoses can overlap causing confusion for the patients
Helps cue clinician into thinking "big picture"	May erode institutional trust in provider
	Lack of definitive tests leads to uncertainty
	"Syndrome" still connotates uncertainty

What Does This Mean to Healthcare Providers?

- We need to do more than traditional treatment
- Pain has multiple factors that affects it
- Educating patients about pain and the nature of their problem can [9, 10, 11]
  - Improve pain levels
  - Reduce fear avoidance
  - Lower disability
  - Minimize healthcare utilization/costs
  - IMPROVE FUNCTION

What PTs Typically Do for Patients

- Manual Therapy
- Therapeutic Exercise
- Neuromuscular Reeducation
- Therapeutic Activities

What Traditional PT Treatment Misses

Figure 1
The fear avoidance model of musculoskeletal pain (adapted from: Vlaeyen JWS & Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: A state of the art. Pain 2000;85(3):317-332)

Focus on Function

- Treatment is aimed to achieving function and not specifically to reduce pain

- Objective measurements are best to help track progress
  - Provides patient with a sense of accomplishment

What Does This Mean to Us?

- Louis Gifford and Adriaan Louw give us these 5 questions that our patients want to know

1. What is wrong with me?
2. How long will it take to get better?
3. What can I, the patient, do to improve it?
4. What can you, the therapist, do to help it?
5. How much is this treatment going to cost?

Why We Need to Go Beyond Traditional Treatment

Treatment works best when closely linked to the biological nature of their problem. Therefore, we need to:

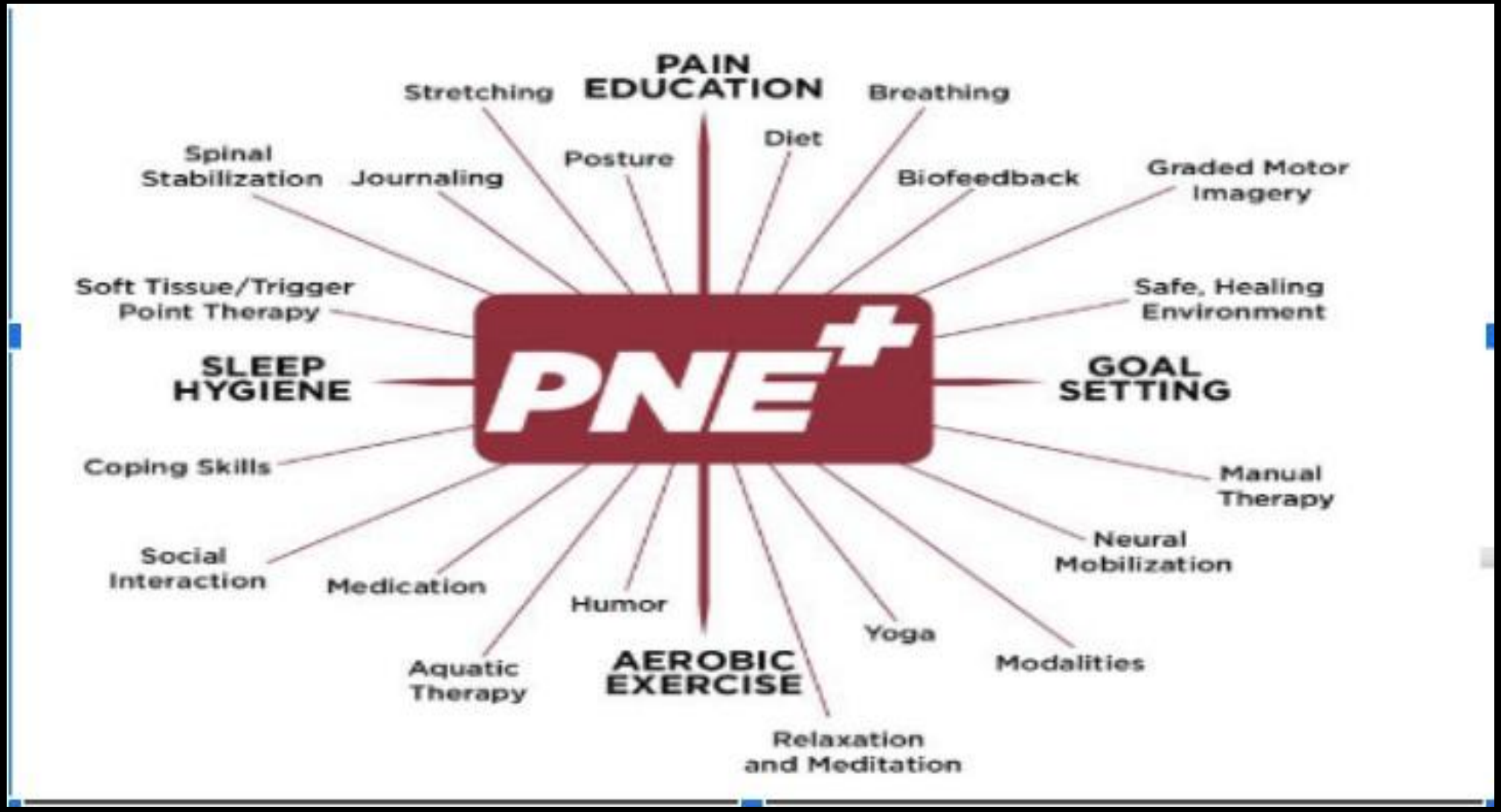
- Change the perception of pain to change the pain
  - Facilitation vs Inhibition
- Build a therapeutic alliance with the patient
- Utilize the concept of neuroplasticity
- Help the patient experience success
- Help provide prognostication for the patient

Tying It All Together: PNE

PNE content educates the patient on:

- The neurophysiology of pain
- Nociception and nociceptive pathways
- Neurons
- Synapses
- Action potentials
- Spinal inhibition and facilitation
- Peripheral sensitization
- Central sensitization
- Plasticity of the nervous system

For Best Results...



Getting Started with PNE: Assessment

- A good assessment is vital
- Screen out red and yellow flags[22,23]
- Utilize motivational interviewing[24]
  - Open ended questions
  - Active listening
  - Give Affirmation, Recognition, understanding
  - Summarize what the patient said
  - Encourage self-motivational statements

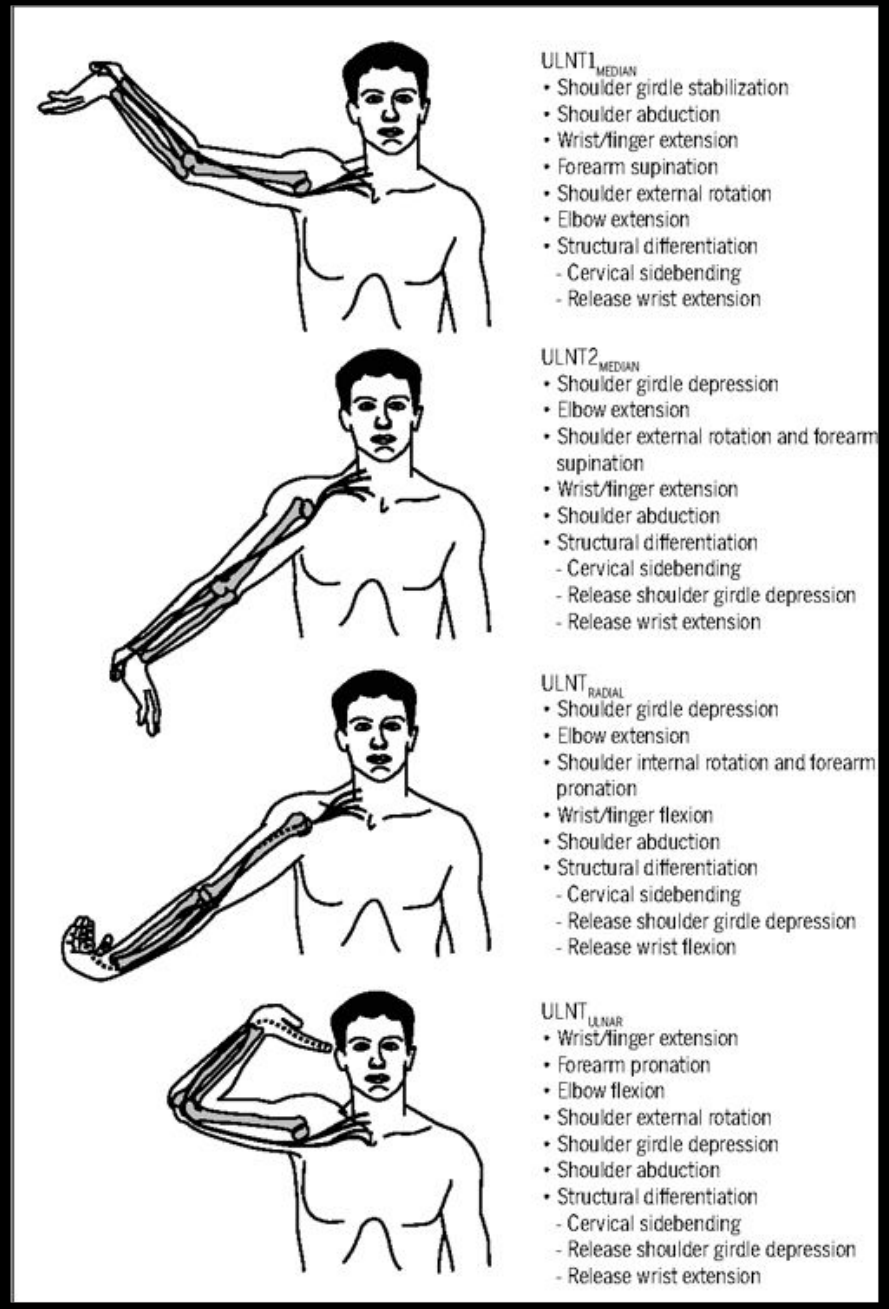
- Ask the patient what their goals are and what they want to accomplish with therapy

Assessment Continued

- Range of motion, strength testing, neural dynamics, sensory testing, functional mobility, special tests, etc.
- Shows what the patient can do
- Gives you physical dysfunctions to work on
- Evidence shows education with exercise is most effective
- Tell your patient how they did and what your findings from the evaluation are

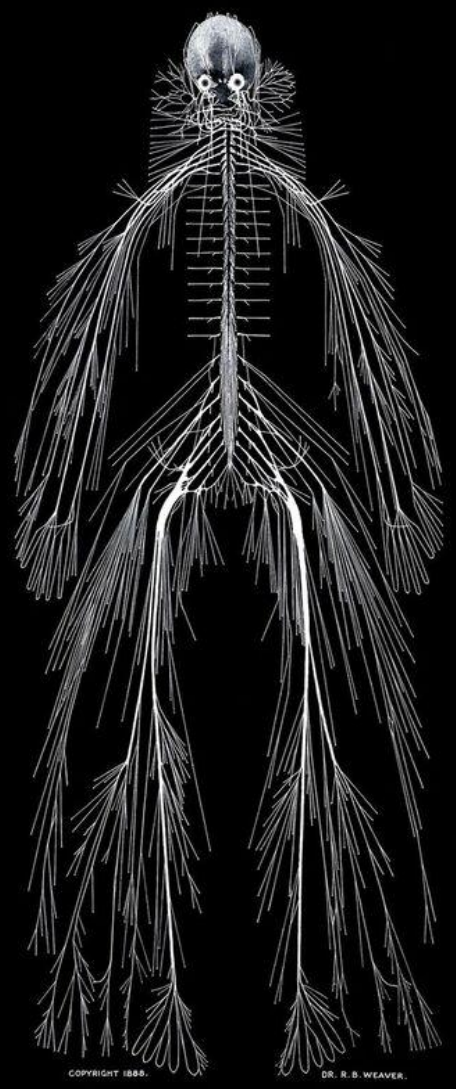
Neurodynamics

- Nerves like blood flow, movement, and space
  - 20-25% of available oxygen in the blood goes to the brain and spinal cord
- The nervous system wants information, let's give it some
- The test is the treatment
  - Palpation/neural massage
  - Active neurodynamic test
    - Sliders and tensioners
  - Passive neurodynamic tests

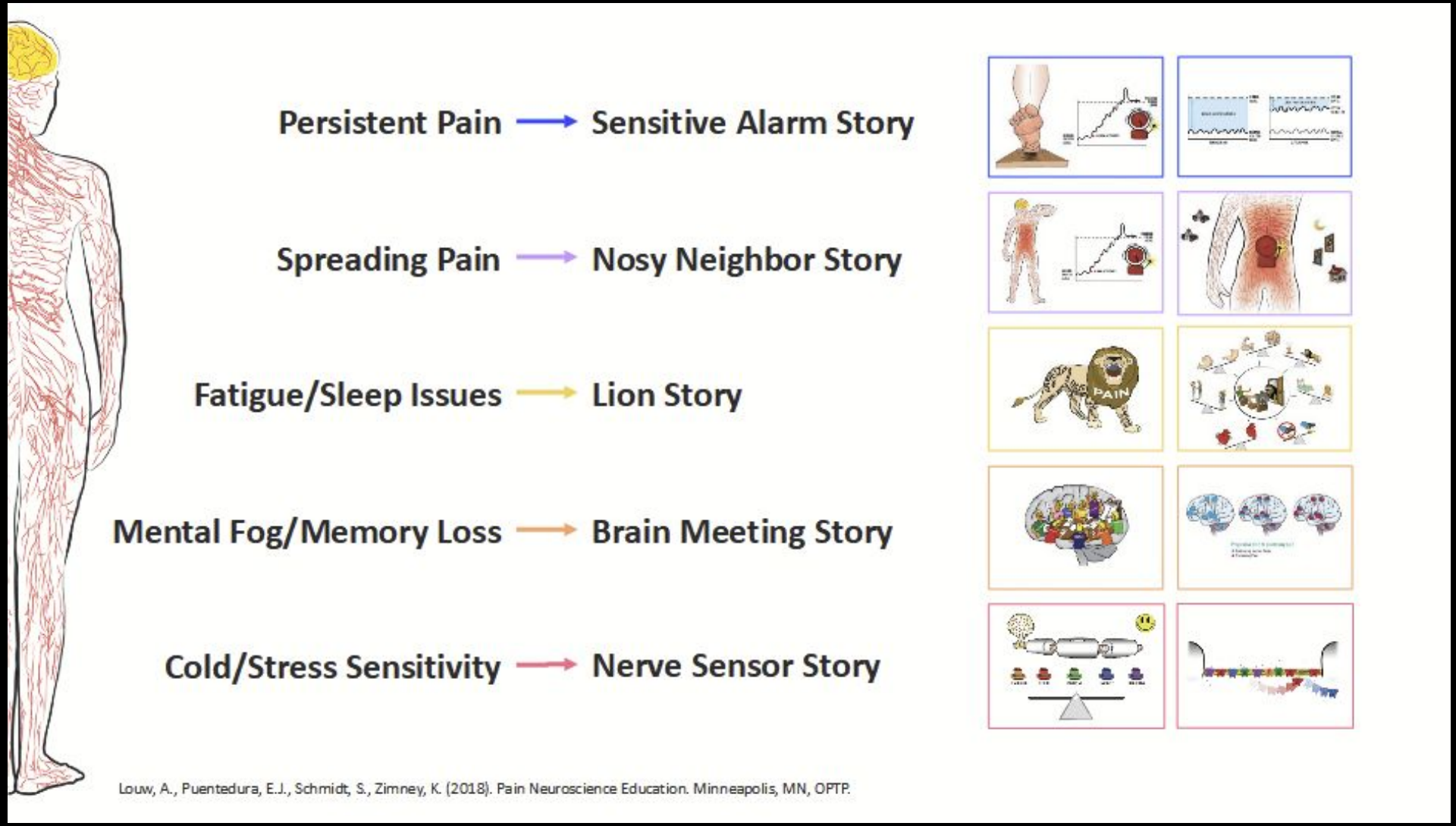


Neurodynamics Continued

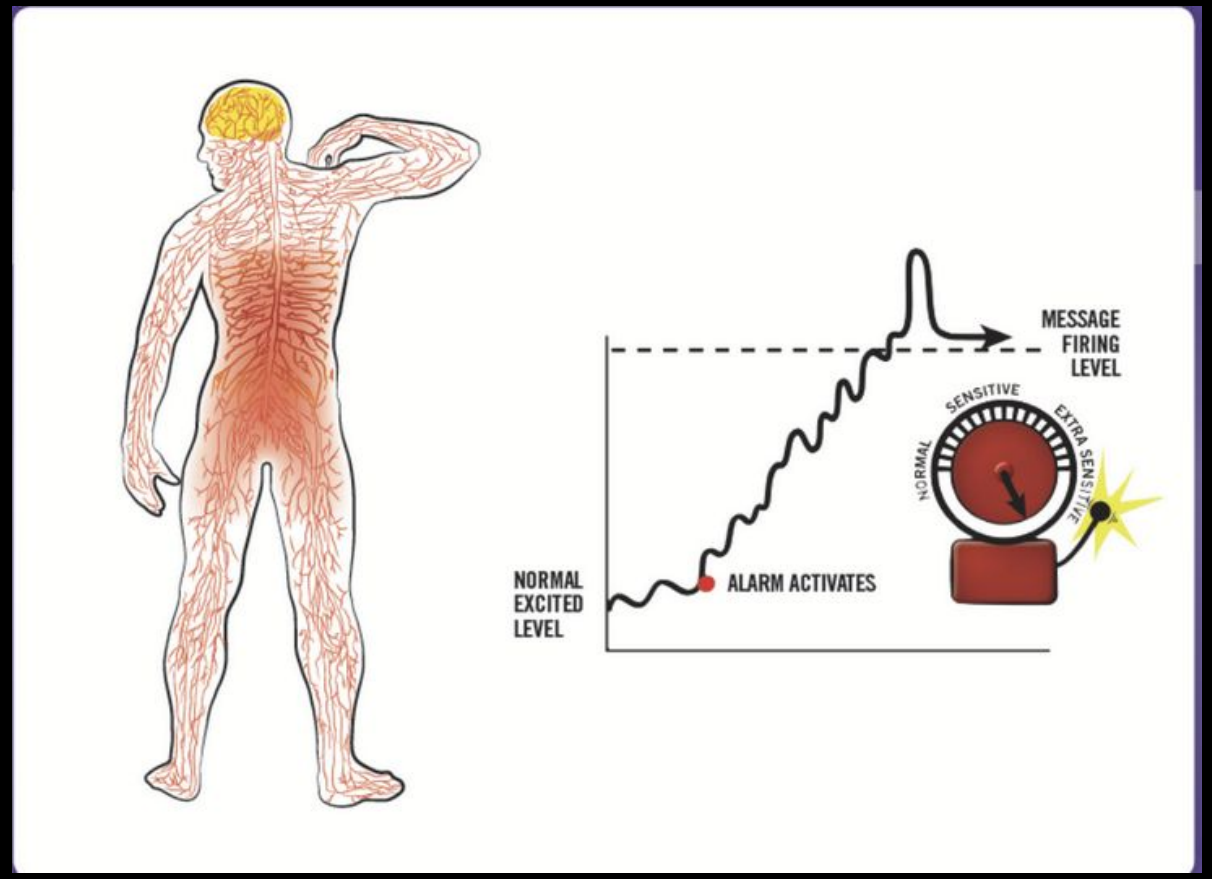
- DO NOT OVERSTRETCH NERVES[29]
  - 6-8% stretch will slow blood flow
  - 15% stretch will stop blood flow
  - 20% stretch will cause cells to die and demyelination
- Nerves do not have the same tension through their entire path
  - Spinal cord has most tension at T6

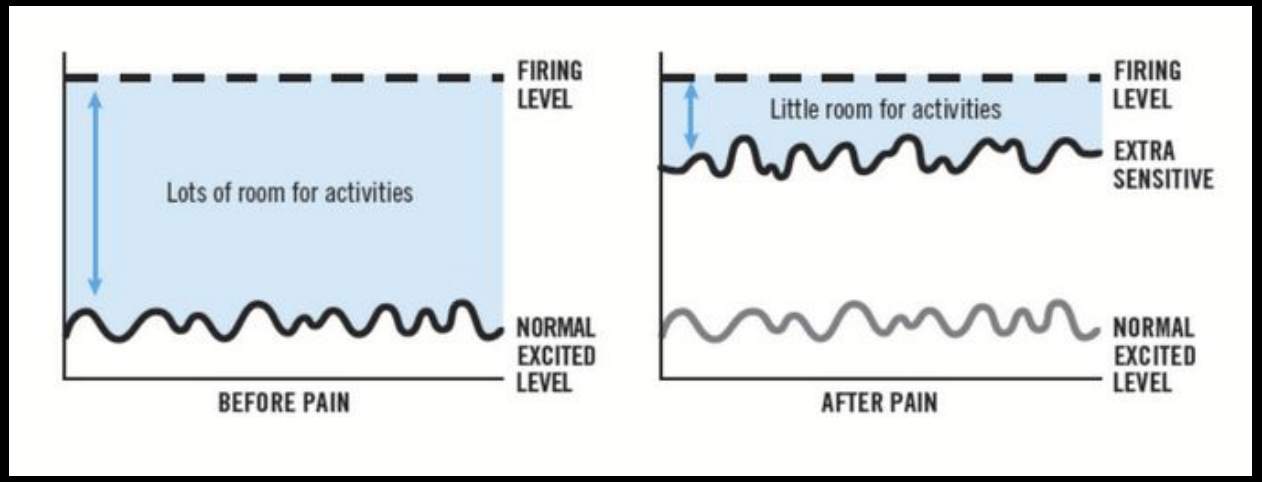


PNE: The Metaphors



The Sensitive Alarm System





How to Use the Metaphors

- Like exercise, education should be graded
- Keep it simple but do not dumb it down
- It should be individualized to the patient's environment and experiences
- Give homework to promote reception of the information
- Encourage movement
- Everyone is different

Putting It All Together

- Our goal is to plant the seed for change in the patient
- Like exercise, education should be graded
- First build their trust by asking their permission and by validating their pain
- Set meaningful goals for the patient

Putting It All Together

- Get the patient moving as soon as physically possible
- Use any means possible to reduce their pain
- Promote self-care
- Get them back to doing the things that they want to do; we are returning function not improving arbitrary ROM or strength measures

What's Next: Some Ideas

- Recommended books:
  - Explain Pain by David Butler and G. Lorimer Moseley
  - Why Do I Hurt by Adriaan Louw
- Whyyouhurt.com
- Retrainpain.org
- The Curable App
- Take a PNE course

- **Therapeutic Pain Specialist at our locations:**
  - Kyle Bonin, PT, DPT Ken Call, PT, DPT

- Contact information:
- Kyle Bonin, PT, DPT
- West Kennewick Physical Therapy
  - 1408 N Louisana Street Suite 104-A
  - 509-783-1962
  - kbonin@taipt.com

  - Pasco re-opening soon

Works Cited

1. Mayer S, Spickschen J, Stein KV, Crevenna R, Dorner TE, Simon J. The societal costs of chronic pain and its determinants: The case of Austria. *PLoS One*. 2019;14(3):e0213889. Published 2019 Mar 20. doi:10.1371/journal.pone.0213889
2. Gaskin DJ, Richard P. The Economic Costs of Pain in the United States. In: Institute of Medicine (US) Committee on Advancing Pain Research, Care, and Education. Relieving Pain in America: A Blueprint for Transforming Prevention, Care, Education, and Research. Washington (DC): National Academies Press (US); 2011. Appendix C. Available from: https://www.ncbi.nlm.nih.gov/books/NBK92521/
3. Louw A, Diener I, Butler DS, Puentedura EJ. The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. *Arch Phys Med Rehabil*. 2011;92(12):2041-2056. doi:10.1016/j.apmr.2011.07.198
4. Trachsel LA, Munakomi S, Cascella M. Pain Theory. [Updated 2023 Apr 17]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2023 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK545194/
5. Bendelow G. Chronic pain patients and the biomedical model of pain. AMA Journal of Ethics. 2013 May 1;15(5):455-9.
6. Gifford l s 1998 Pain the tissues and the nervous system: a conceptual model. Physiotherapy 84(1):27-36
7. Bedson J, Croft PR. The discordance between clinical and radiographic knee osteoarthritis: a systematic search and summary of the literature. *BMC Musculoskelet Disord*. 2008;9:116. Published 2008 Sep 2. doi:10.1186/1471-2474-9-116
8. Brinjikji W, Luetmer PH, Comstock B, et al. Systematic literature review of imaging features of spinal degeneration in asymptomatic populations. *AJNR Am J Neuroradiol*. 2015;36(4):811-816. doi:10.3174/ajnr.A4173
9. Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature. *Physiother Theory Pract*. 2016;32(5):332-355. doi:10.1080/09593985.2016.1194646
10. Quartana PJ, Campbell CM, Edwards RR. Pain catastrophizing: a critical review. *Expert Rev Neurother*. 2009;9(5):745-758. doi:10.1586/ern.09.34
11. Vlaeyen JWS, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain*. 2000;85(3):317-332. doi:10.1016/S0304-3959(99)00242-0
12. Woolf, C. J. (2007). “Central sensitization: uncovering the relation between pain and plasticity.” Anesthesiology 106(4): 864-867
13. Louw, A., Puentedura, E., Schmidt, S. and Zimney, K., 2018. *Pain neuroscience education: Teaching people about pain*. Orthopedic Physical Therapy Products
14. Louw A. Treating the brain in chronic pain. In: C FdlP, J C, Dommerholt J, eds. Manual Therapy for Musculoskeletal Pain Syndromes. Vol 1. London: Churchill Livingston; 2015

Works Cited

15. Kiecolt-Glaser JK, McGuire L, Robles TF, Glaser R. Psychoneuroimmunology: psychological influences on immune function and health. *J Consult Clin Psychol*. 2002;70(3):537-547. doi:10.1037//0022-006x.70.3.537

16. Chapman CR, Tuckett RP, Song CW. Pain and stress in a systems perspective: reciprocal neural, endocrine, and immune interactions. *J Pain*. 2008;9(2):122-145. doi:10.1016/j.jpain.2007.09.006

17. Doidge N. The Brain That Changes Itself. New York: Penguin Books; 2007.

18. Girault JA, Greengard P. The neurobiology of dopamine signaling. Arch Neurol. May 2004;61(5):641-644.

19. Amit DJ, Brunel N, Tsodyks MV. Correlations of cortical Hebbian reverberations: theory versus experiment. J Neurosci. Nov 1994;14(11 Pt 1):6435-6445.

20. Linton SJ, Nordin E. A 5-year follow-up evaluation of the health and economic consequences of an early cognitive behavioral intervention for back pain: a randomized, controlled trial. *Spine (Phila Pa 1976)*. 2006;31(8):853-858. doi:10.1097/01.brs.0000209258.42037.02

21. Ferreira PH, Ferreira ML, Maher CG, Refshauge KM, Latimer J, Adams RD. The therapeutic alliance between clinicians and patients predicts outcome in chronic low back pain. *Phys Ther*. 2013;93(4):470-478. doi:10.2522/ptj.20120137

22. Ramanayake RPJC, Basnayake BMTK. Evaluation of red flags minimizes missing serious diseases in primary care. *J Family Med Prim Care*. 2018;7(2):315-318. doi:10.4103/jfmpc.jfmpc_510_15.

23. Kendall NAS, Linton SJ, Main CJ. Guide to assessing psychosocial yellow flags in acute low back pain: risk factors for long term disability and work loss. Wellington: Accident Rehabilitation & Compensation Insurance Corporation of New Zealand and the National Health Committee; 1997.

24. Bischof G, Bischof A, Rumpf HJ. Motivational Interviewing: An Evidence-Based Approach for Use in Medical Practice. *Dtsch Arztebl Int*. 2021;118(7):109-115. doi:10.3238/arztebl.m2021.0014

25. Jones MA. Clinical reasoning in manual therapy. Physical Therapy. 1992;72:875-883.

26. Louw, A.; Schmidt, S; Zimney, K and Puentedura, E.J. Treat the Patient not the Label: A Pain Neuroscience Approach; Journal of Woman's Health; February 2019; pages 1 - 9

27. Louw A, Butler DS, DienerI, PuenteduraEJ. Development of a preoperative neuroscience educational program for patients with lumbar radiculopathy. American journal of physical medicine & rehabilitation / Association of Academic Physiatrists. May 2013;92(5):446-452.

28. Nee RJ, Yang CH, Liang CC, Tseng GF, Coppieters MW. Impact of order of movement on nerve strain and longitudinal excursion: a biomechanical study with implications for neurodynamic test sequencing. Manual therapy Aug 2010;15(4):376-381

29. Dommisse GF, ed The blood supply of the spinal cord and the consequences of failure. 2nd ed. Edinburgh: Churchill Livingstone; 1994. Boyling JD, Palastanga N, eds. Grieve's Modern Manual Therapy