

SESSION 4

The Neuroscience of Treating the Patient with Fibromyalgia (and Chronic Fatigue Syndrome)

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 OCS - Orthopaedic Certified Specialist
 Fellow - AAOMPT
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ALASKA
 PHYSICAL THERAPY ASSOCIATION

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SESSION 4

Objectives

Upon completion of this session, attendees will be able to:

- Be familiar with the latest neuroimmunology and neurobiology associated with FM
- Understand the clinical framework for testing and treating
- Practice clinical application of pain neuroscience education for FM
- Understand principles to adapt content to other patients struggling with persistent and widespread pain, cognitive deficits pertaining to focus and concentration, fatigue and hypersensitivity

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Too tired to move, too sore to care

- What's in a name? Words that hurt or heal?
 - Fibromyalgia (FM)
 - Chronic Fatigue Syndrome (CFS), Myalgic Encephalomyelitis (ME), Systemic Exertion Intolerance Disease (SEID)



“My pain is invisible, so is the pain you inflict when you don’t believe me.” – Anonymous



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Penny J Furness¹, Katharina Vogt², Simon Ashe¹,
Sophie Taylor¹, Sarah Haywood-Small¹ and Kim Lawson¹

Report of empirical study



What causes fibromyalgia? An online survey of patient perspectives

Health Psychology Open
July-December 2018: 1–11
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DOI: 10.1177/2055102918802683
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SAGE

- “Bodily assault, ill-health, and change”
- “Emotional trauma and distress”
- “Stress and vulnerability”
- “Explaining and authenticating fibromyalgia”

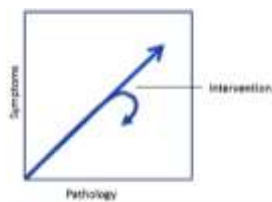
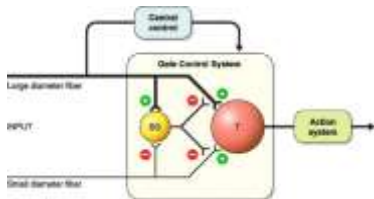
N = 596 respondents



4

Your PT training is useless...

(for helping patients like this)



Lou A, Puentedura EJ, Zimney K, Schmidt S. Know Pain, Know Gain? A Perspective on Pain Neuroscience Education in Physical Therapy. *The JOSPT*. Mar 2016;46(3):131-134.

Moseley GL, Butler DS. Fifteen Years of Explaining Pain: The Past, Present, and Future. *The Journal of Pain*. Jun 5 2015.

Hoeger Bement MK, Sluka KA. The current state of physical therapy pain curricula in the United States: a faculty survey. *The Journal of Pain*. Feb 2015;16(2):144-152.

Cox T, Puentedura E, Lou A. An Abbreviated Therapeutic Neuroscience Education Session Improves Pain Knowledge in First Year Physical Therapy Students But Does Not Change Attitudes or Beliefs. *JMMT* 2017; 25(1): 11-21.

Latimer J, Maher C, Refshauge K. The attitudes and beliefs of physiotherapy students to chronic back pain. *Clinical Journal of Pain*. 2004;20:45-50.

“The body has 45 miles of nerves, and fibromyalgia is on every inch of them” -



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*** Do not attempt this at home**



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Fibromyalgia

American College of Rheumatology Criteria (2016)*

1. Generalized pain, in at least 4 of 5 regions, is present
2. Symptoms present at a similar level for ≥ 3 months
3. Widespread Pain Index (WPI) ≥ 7 and Symptom Severity Scale (SSS) score ≥ 5 (or WPI of 4–6 and SSS score ≥ 9)
4. A diagnosis of FM is valid irrespective of other diagnoses and does not exclude presence of other illnesses

AAPT Diagnostic Criteria for Fibromyalgia (2018)

1. Multi-site pain (6 or more sites from a total of 9 possible)
2. Moderate to severe sleep problems OR fatigue
3. Multi-site pain + fatigue/sleep problems ≥ 3 months
 - Other domains: common features, medical/psychiatric comorbidities, psychosocial & functional impact, risk factors

Arnold LM et al. [AAPT Diagnostic Criteria for Fibromyalgia](#). J Pain. 2018 Nov 16. pii: S1526-5900(18)30832-0.

Wolfe F et al. [2016 Revisions to the 2010/2011 fibromyalgia diagnostic criteria](#). Seminars in Arthritis and Rheumatism. 2016; (46): 319–329. *Also see Wolfe F et al (1990) , (2010) and (2011) for earlier versions of the ACR FM Criteria

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Fibromyalgia

Symptoms:

- ✓ Widespread pain
- ✓ Joint stiffness
- ✓ Fatigue
- ✓ Persistent pain
- ✓ Sleep disturbance
- ✓ Depression
- ✓ Mental fatigue
- ✓ Short term memory loss

- ✓ Sensitized GI system
- ✓ Anxiety
- ✓ Social impact
- ✓ Functional impact
- ✓ Headaches
- ✓ Sexual dysfunction

Diagnosis:

- ✓ Process of elimination
- ✓ Cluster of symptoms
- ✓ Limited medical tests

“I’ll tell you what it is. It’s a syndrome that is essentially a cyclone of stress induced pain.”
Lady Gaga

Di Franco, M., C. Iannuccelli, et al. (2010). "Neuroendocrine immunology of fibromyalgia." *Annals of the New York Academy of Sciences* 1193: 84-90.

Izquierdo-Alvarez, S., J. P. Bocos-Terraz, et al. (2008). "Is there an association between fibromyalgia and below-normal levels of urinary cortisol?" *BMC research notes* 1: 134.

Menzies, V. and D. E. Lyon (2010). "Integrated review of the association of cytokines with fibromyalgia and fibromyalgia core symptoms." *Biological research for nursing* 11(4): 387-394.

Millea, P. J. and R. L. Holloway (2000). "Treating fibromyalgia." *American family physician* 62(7): 1575-1582, 1587.

Rodriguez-Pinto, I., N. Agmon-Levin, et al. (2014). "Fibromyalgia and cytokines." *Immunology letters* 161(2): 200-203.



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Fibromyalgia

- What do the diagnostic criteria tell you?
 - *Widespread and disproportionate pain with diffuse palpation findings (“illogical” distribution), disproportionate aggravating/easing factors, psychosocial comorbidities, no identifiable “lesion”... sound familiar???*



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Fibromyalgia

- What do the diagnostic criteria tell you?
 - *Widespread and disproportionate pain with diffuse palpation findings (“illogical” distribution), disproportionate aggravating/easing factors, psychosocial comorbidities, no identifiable “lesion”... sound familiar???*



Central Sensitivity

- Disproportionate pain
- Disproportionate aggravating and easing factors
- Diffuse palpation
- Psychosocial
 - Sensitivity 91.8%
 - Specificity 97.7%
 - Dx Odds Ratio 486.56

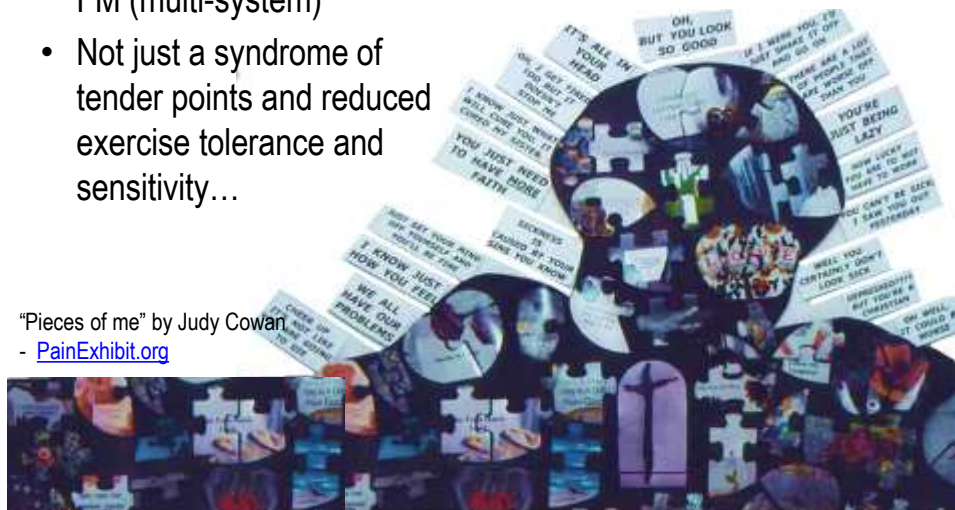
Smart KM, et al. Mechanisms-based classifications of musculoskeletal pain: parts 1, 2 & 3. *Man Ther.* 2012 Aug;17(4):336-357.



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Don't get too *neuro-centric*...

- Need a bigger picture of FM (multi-system)
- Not just a syndrome of tender points and reduced exercise tolerance and sensitivity...



"Pieces of me" by Judy Cowan
- PainExhibit.org

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The latest in FM research...

- Neuroplasticity
- Neuroimmunology
- Stress, hormones and the endocrine system
- Are there genetic factors?



"People think those with fibromyalgia are just faking it. Actually, they've got it backwards... we're faking being well." - Anonymous



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A fibromyalgia neurosignature?

Towards a neurophysiological signature for fibromyalgia

Marina López-Solà, PhD^{1,2*}, Choong-Wan Woo, MSc^{1,2}, Jesus Pujol, MD, PhD³, Joan Deus, PhD^{3,4}, Ben J. Harrison, PhD⁵, Jordi Monfort, MD, PhD⁵, and Tor D. Wager, PhD^{1,2}

- Subjects with FM demonstrated heightened neural responses to pressure pain **AND non-painful multisensory stimulation** (visual, auditory, tactile)
 - Enhanced pain signature responses related to mechanical hypersensitivity AND correlated to both depression and disability
 - Multisensory responses correlated to pain intensity

“Pain does not need to be seen to be felt.” Emm Roy – The First Step

Pain. 2017 January ; 158(1): 34–47

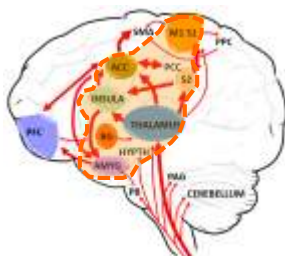


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Cortical reorganization

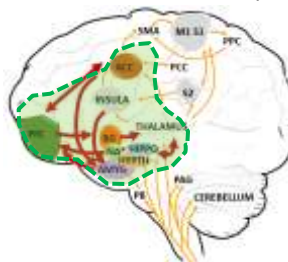
Acute/sub-acute pain

Sensory nociceptive pattern



Chronic pain

Limbic, reward & frontal pattern



Onset/acute pain → 3 months → 6 months → 12 months → and beyond

Chronic pain initiates a cascade of *emotionally-driven learning events* to reorganize the brain

Hashmi JA, Baliki MN, et al. Shape shifting pain: chronification of back pain shifts brain representation from nociceptive to emotional circuits. Brain. 2013;136(9):2751-68.



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Fibromyalgia and brain changes

- Similar to findings in other chronic pain populations, patients with FM demonstrate structural changes in “pain matrix areas” but also widespread changes to regions which consistent with non-pain characteristics of FM
 - Cognitive, affective and perceptual domains, comorbidities of fatigue, cognitive and emotional impairments

Diaz-Piedra C, et al. The impact of fibromyalgia symptoms on brain morphometry. *Brain Imaging Behav.* 2016 Dec;10(4):1184-1197.



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Fibromyalgia and neuroimmunology

- Cytokines (chemokines, interleukins, interferons, tumor necrosis factors, etc.) are small proteins important in cell signaling and are important in the immune system (play a role in messaging between neural systems, humoral and cell-based immune responses)
 - Produced by immune cells (macrophages, lymphocytes, mast cells) but also by many other nucleated cells

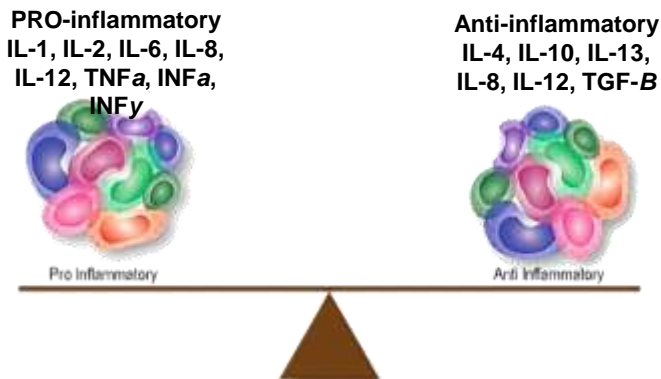
Rodriguez-Pinto I, Agmon-Levin N, Howard A, Shoenfeld Y. Fibromyalgia and cytokines. *Immunol Lett.* Oct 2014;161(2):200-203.



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Fibromyalgia and neuroimmunology

Simple version: Cytokines regulate inflammation



Menzies, V. and D. E. Lyon (2010). "Integrated review of the association of cytokines with fibromyalgia and fibromyalgia core symptoms." *Biological research for nursing* 11(4): 387-394.

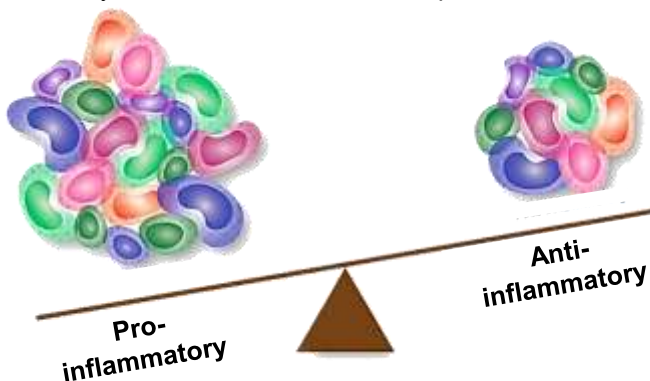
Sturgill, J., et al. (2014). "Unique cytokine signature in the plasma of patients with FM." *J of Immun Res* 2014: 938576.

Wallace, D. J. (2006). "Is there a role for cytokine based therapies in FM." *Current Pharm Design* 12(1): 17-22.

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Fibromyalgia and neuroimmunology

- FM: upregulation in pro-inflammatory cytokines, shifts the inflammatory balance and leads to widespread sensitization



Di Franco, M., C. Iannuccelli, et al. (2010). "Neuroendocrine immunology of fibromyalgia." *Annals of the New York Academy of Sciences* 1193: 84-90.

Izquierdo-Alvarez, S, et al. (2008). "Is there an association between FM and below-normal levels of urinary cortisol?" *BMC research notes* 1: 134.

Rodriguez-Pinto, I., N. Agmon-Levin, et al. (2014). "Fibromyalgia and cytokines." *Immunology letters* 161(2): 200-203.

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Fibromyalgia and neuroimmunology

Lab tests looking for biomarkers: ...not there...

- No accepted diagnostic biochemical markers or instrumental test on which to base the a FM Dx

Rodriguez-Pinto I, et al. (2014) FM and cytokines. *Immunol Lett.*

- Metabolic fingerprinting for diagnosis of fibromyalgia and other rheumatologic disorders (vibrational spectroscopy) Hackshaw KV et al (2019) *J Biol Chem*

- Cerebrospinal fluid proteome (identified CSF proteins associated with inflammatory signaling, energy metabolism and neuropeptide signaling) Khoonsari PE et al (2019) *J Proteomics*

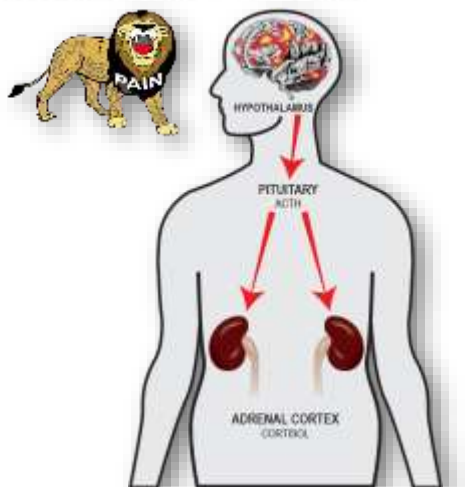
"It's raining, its pouring, my pain levels soaring! I took some meds, went to bed, and hope it's tolerable by morning." - Anonymous



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FM, stress and the endocrine system

- **Pain is a stress event:**
"through a common chemical language comprising neurotransmitters, peptides, endocannabinoids, cytokines, and hormones, an ensemble of interdependent nervous, endocrine, and immune processes operates in concert to cope with the injury."

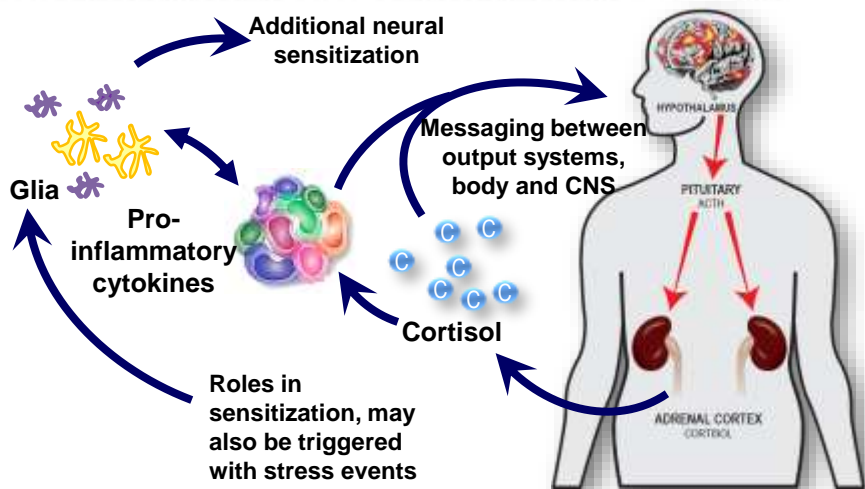


Chapman R, Tuckett R, Song C. Pain and Stress in a Systems Perspective: Reciprocal Neural, Endocrine, and Immune Interactions. *The Journal of Pain*, 2008;9(2):122-145.



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Stress, immune and endocrine systems



Albrecht DS et al Brain Glial activation in FM *Brain Behavior and Immunity* 2019 75:72-83
 Littlejohn G, Guymer E Neurogenic Inflammation in FM *Semin Immunopathology* 2018 40:291-300.
 Nijis J et al Sleep disturbances and severe stress as glial activators. *Exp Opin Ther Targets* 2017 21(8): 817-826.
 Bote ME et al Inflammatory/stress feedback dysfunction in women with FM *Neuroimmunomodulation* 2012 19(6):343-51

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What about sex? It's complex...



- Females: ↑ FM prevalence
- Estrogen, pain & inflammation
 - Hormonal replacement increased oestradiol levels, but no differences in pain between treatment and placebo or with QST (Stening KD et al 2011)
 - TMD pain, depressive sx, somatization are highest when estrogen is lowest (Ivković N, R et al 2018)

Watt FE Musculoskeletal pain and menopause. *Post Reprod Health* 2018 24(1): 34-43.
 Ivković N, R et al Relationship Between Symptoms of Temporomandibular Disorders and Estrogen Levels in Women With Different Menstrual Status. *J Oral Facial Pain Headache*. 2018 Mar 21;32(2):151-158.
 Stening KD et al. Hormone replacement therapy does not affect self estimated pain or pain responses in post menopausal women with FM: double blind randomized, placebo controlled trial. *Rheumatology* 2011 50:544-551.
 Straub RH. The complex role of estrogens in inflammation. *Endocr Rev*. 2007;28(5):521-574.

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What about sex?

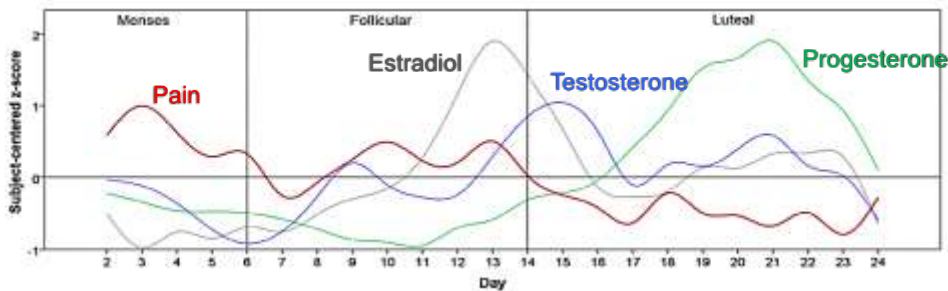
It's complex...

Testosterone & progesterone

- Progesterone ($P = .002$) & testosterone ($P = .015$) inversely correlated with pain severity.
- No relationship between estradiol ($P = .551$) or cortisol and pain ($P = .633$)

Other hormones with possible links: growth hormone, DHEA-S, cortisol, insulin, melatonin, etc...

White HD et al.
Treatment of pain in FM with testosterone gel
Intern Immunopharmacology 2015 27:249-256.
Schertinger M et al.
Daily fluctuations of progesterone and testosterone are associated with FM pain severity. J Pain 2018 19(4):410-417.



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FM, genetics and epigenetics

- Biosignatures get more complex...
 - Genetics: risk of FM is 8x higher for 1st degree relatives
 - Epigenetics: variable expression of genes (what you do, environment, stress, sleep, what you eat, aging, etc.
 - e.g. early life stressors (pain exposure, premature, maternal separation, child abuse/trauma, early opioid or substance exposure) may prompt epigenetic changes
 - Genes related to: stress systems, nociception, DNA repair, axonal development



Park DJ, Lee SS. New insights into the genetics of fibromyalgia. Korean J Intern Med. 2017 Nov;32(6):984-995.
Low LA, Schweinhardt P. Early Life Adversity as a Risk Factor for Fibromyalgia in Later Life. Pain Res Treat. 2012: 140832.
Ciampi de Andrade D, et al. Epigenetics insights into chronic pain: DNA hypomethylation in fibromyalgia—a controlled pilot-study. Pain. 2017 Aug;158(8):1473-1480.
Tour J, et al. Gene-to-gene interactions regulate endogenous pain modulation in fibromyalgia patients and healthy controls—antagonistic effects between opioid and serotonin-related genes. Pain. 2017 Jul;158(7):1194-1203.
Jones KD, et al. [Genome-wide expression profiling in the peripheral blood of patients with fibromyalgia](#). Clin Exp Rheumatol. 2016 Mar-Apr;34(2 Suppl 96):S89-98.

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FM, genetics and epigenetics

Biosignatures get more complex...

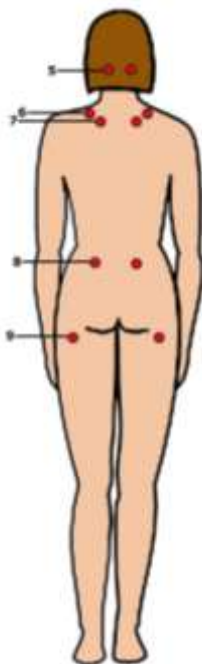
- Genome-wide association studies investigated potential genes involved in FM → genetic factors may be responsible for up to 50% of disease susceptibility
- Genes implicated relate to: *stress response, DNA repair, autonomic response, subcortical neuronal abnormalities*
- Beware of \$\$\$: www.forbes.com, www.sciencebasedmedicine.org



From professor
Wikipedia

Kerr JI, Burri A. [Genetic and epigenetic epidemiology of chronic widespread pain](#). J Pain Res. 2017 Aug 24;10:2021-2029.
D'Agnelli A et al. Fibromyalgia: Genetics and epigenetics insights may provide the basis for the development of diagnostic biomarkers. Mol Pain. 2019 Jan-Dec;15:1744806918819944.
Iacob E, et al. Gene Expression Factor Analysis to Differentiate Pathways Linked to Fibromyalgia, Chronic Fatigue Syndrome, and Depression in a Diverse Patient Sample Arthritis Care & Research 2016 68(1): 132-140.
Lukkahatai N, et al. A predictive algorithm to identify genes that discriminate individuals with fibromyalgia syndrome diagnosis from healthy controls. Journal of Pain Research 2018;11 2981–2990.
Trescot AM, Faynboym S. A Review of the Role of Genetic Testing in Pain Medicine. Pain Physician 2014; 17

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Fibromyalgia in review

- **The idea of thinking about tender points and exercise tolerance is....**
- **Multi-system involvement:** cortical reorganization, central sensitivity, neuroimmunology, stress systems, endocrine/hormones, genetic/epigenetic factors
- **Patient perspectives:** *bodily assault or change, emotional trauma, stress & vulnerability, explaining/authenticating FM*
- **What's to be done?**
 - Complex, multi-system problem needs a complex, multi-system solution
 - **Hope is plastic too!**



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Meanings of ME: Interpersonal and Social Dimensions of Chronic Fatigue pp 177-197 | James Griffith, Nancy Ryan

Stigma, Unspeakable Dilemmas, and Somatic Symptoms — a Legacy of Suffering in CFS/ME and Fibromyalgia

- Question moral character: perceived as characterologically lazy or unwilling to accept responsibilities
- Provider empathy fatigue (patient's sx require too much 'emotional work')
- Internalized stigma, pt learned from society to view oneself through a judgmental, contemptuous, and dismissive lens
- Felt like providers saw problems as fictitious or related to psychological reasons (dismissive of physical problem, not real)
- Felt providers thought their Dx lacked legitimacy

Armentor JL. Living With a Contested, Stigmatized Illness: Experiences of Managing Relationships Among Women With Fibromyalgia. *Qual Health Res.* 2017 Mar;27(4):462-473.

Griffith J., Ryan N. (2015) Stigma, Unspeakable Dilemmas, and Somatic Symptoms — a Legacy of Suffering in CFS/ME and Fibromyalgia. In: Ward C.D. (eds) *Meanings of ME: Interpersonal and Social Dimensions of CF.* Palgrave Macmillan, London.

Åsbring P, Närvänen AL. Women's Experiences of Stigma in Relation to Chronic Fatigue Syndrome and Fibromyalgia. *Qual Health Res* 2002; 12(2): 148-160.

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Chronic fatigue...

What's in a name?

- Chronic Fatigue Syndrome (CFS)
- Myalgic Encephalomyelitis (ME)
- Systemic Exertion Intolerance Disease (SEID)



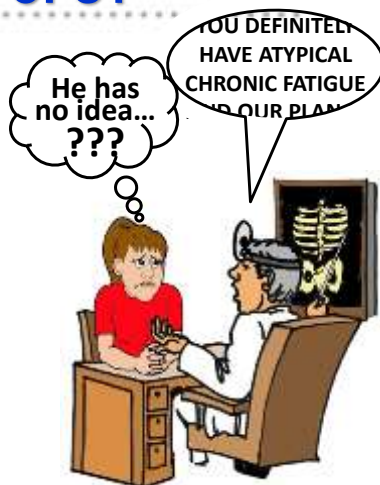
"When I do any activity that goes beyond what I can do—I literally collapse—my body is in major pain. It hurts to lay in bed, it hurts to think, I can't hardly talk—I can't find the words. I feel my insides are at war."

—Patient communication to IOM committee

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Experts: What causes CFS?

- “We do not know the cause of CFS”
- “Despite many years of research the diagnosis stays one of exclusion”
- “CFS does not have one cause”
- “Medical practitioners still view the diagnosis of CFS with great uncertainty and sometimes with outright denial”



Holgate ST, Komaroff AL, Mangan D, Wessely S. Chronic fatigue syndrome: understanding a complex illness. *Nat Rev Neurosci.* Sep 2011;12(9):539-544.

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CFS/ME/SEID Criteria

Unfortunately, differing Dx opinions:

- [Holmes et al](#)
- [Fukuda criteria](#)
- [Canadian Consensus Criteria](#)
- [Reeves empirical criteria](#)
- [NICE Clinical Guidelines for CFS/ME](#)
- [International Consensus Criteria](#)
- [Institutes of Medicine Criteria](#)



“My personal experience of having ME/CFS feels like permanently having the flu, a hangover, and jet lag while being continually electrocuted (which means that pain plays at least as much of a role in my condition as fatigue).”
 —Patient communication to IOM committee

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CFS/ME/SEID Criteria

- Key features/themes in the various criteria:
 - New onset (not lifelong), >6mo in adults, >3mo in kids
 - Post-exertional malaise (not relieved by rest)
 - Fatigue (not relieved by rest)
 - Unrefreshing sleep
 - Widespread pain (muscle, joint, HA)
 - Reduced function
 - Cognitive problems (memory, concentration)
 - Other (immune, tender lymph nodes, neuroendocrine, orthostatic, autonomic, gastro-intestinal, genitourinary impairments, etc.)

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CFS/ME/SEID & FM similarities

- Overlapping Sx profiles
- No definitive lab/blood/imaging test
- Diagnosis of exclusion
- Multi-system involvement is likely: immune, endocrine, genetic/epigenetic factors, etc.

Symptoms	FM	CFS
• Widespread pain	✓	✓
• Joint stiffness	✓	✓
• Fatigue	✓	✓
• Persistent pain	✓	✓
• Sleep disturbance	✓	✓
• Depression	✓	✓
• Mental fatigue (fog)	✓	✓
• Short term memory loss	✓	✓
• Sensitized GI system	✓	✓
• Anxiety	✓	✓
• Significant social and functional impact	✓	✓
• Headaches	✓	✓
• Sexual dysfunction	✓	✓
• Diagnosis via cluster of symptoms	✓	✓

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CFS/ME/SEID: What's different?

- Possible viral trigger? Often with a flu-like onset: *Epstein–Barr, herpes virus, Chlamydia, cytomegalovirus, parvovirus, c. burnetti* and others...

Carruthers BM, et al. Myalgic encephalomyelitis: International Consensus Criteria. *J Int Med* 2011; 270: 327–338.

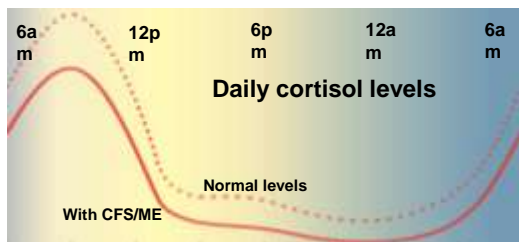
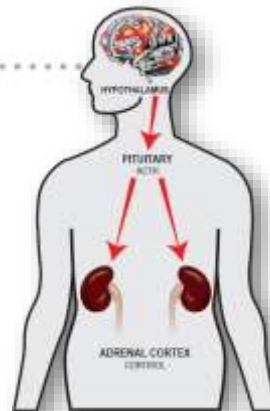


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HPA Axis Dysregulation

HPA axis: Controls levels of cortisol, circadian rhythm

- Energy metabolism, immune function & inflammation, stress responses
- Chronic stress leads to HPA hypoactivity, evidence for lowered cortisol levels in CFS, blunted HPA axis responsiveness



Papadopoulos AS, Cleare AJ. HPA-axis dysfunction in CFS. *Nat Rev Endocrinol.* Jan 2012;8(1):22-32.
 Van Den Eede F, et al. HPA-axis function in CFS. *Neuropsychobiology.* 2007;55(2):112-120.
 Jerjes WK, et al. Diurnal excretion of urinary cortisol, cortisone, and cortisol metabolites in CFS. *J Psychosom Res.* 2006;60(2):145-153.

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CFS/ME/SEID physiology

- Postexertional neuroimmune exhaustion (a heightened part of the body's global protection response): ↓pain threshold, ↓O₂ to CNS & muscles, ↑cytokines, ↑recovery time
- Cellular issues with energy transport: mitochondrial dysfunction, channelopathy, oxidative stress and increasing nitric oxide levels
- Autonomic regulation: HR, blood flow, BP (esp. orthostatic intolerance)

De Becker P, McGregor N, De Meirleir K. A definition-based analysis of symptoms in a large cohort of patients with chronic fatigue syndrome. *J Intern Med* 2001;250:234–40.

Nijs J, et al Tired of being inactive: a systematic literature review of physical activity, physiological exercise capacity and muscle strength in patients CFS. *Disabil Rehabil*. 2011;33(17-18):1493-1500.

Suárez A, et al. Nitric oxide metabolite production during exercise in CFS. *J Womens Health* 2010; 19(6):1073-7.

“The disabling weakness and exhaustion a person with ME/CFS experiences is so profound that “fatigue” is ...probably an insult.”
 — Jane Cuozzo

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CFS/ME/SEID in review

- Like FM, CFS/ME/SEID is associated with stigma and has multiple diagnostic challenges
- Possibly viral onset
- Multiple system involvement, but esp. physiologic responses to exercise and recovery
- Fatigue, like pain, is an extension of a bodily protective response
- FM and CFS/ME/SEID share a profound need for biopsychosocial interventions



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Take 30 seconds...

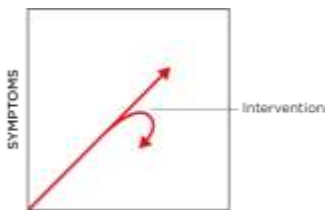
- Write down at least 3 reflections, thoughts or questions you now have about FM and/or CFS/ME/SEID
- Take one of the above, and write down how you could apply it with these patients (or others with chronic widespread pain)



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Your training is limited...

(for helping patients like this)



Low A, Puentedura EJ, Zimney K, Schmidt S. Know Pain, Know Gain? A Perspective on Pain Neuroscience Education in Physical Therapy. *The Journal of orthopaedic and sports physical therapy.* Mar 2016;46(3):131-134.

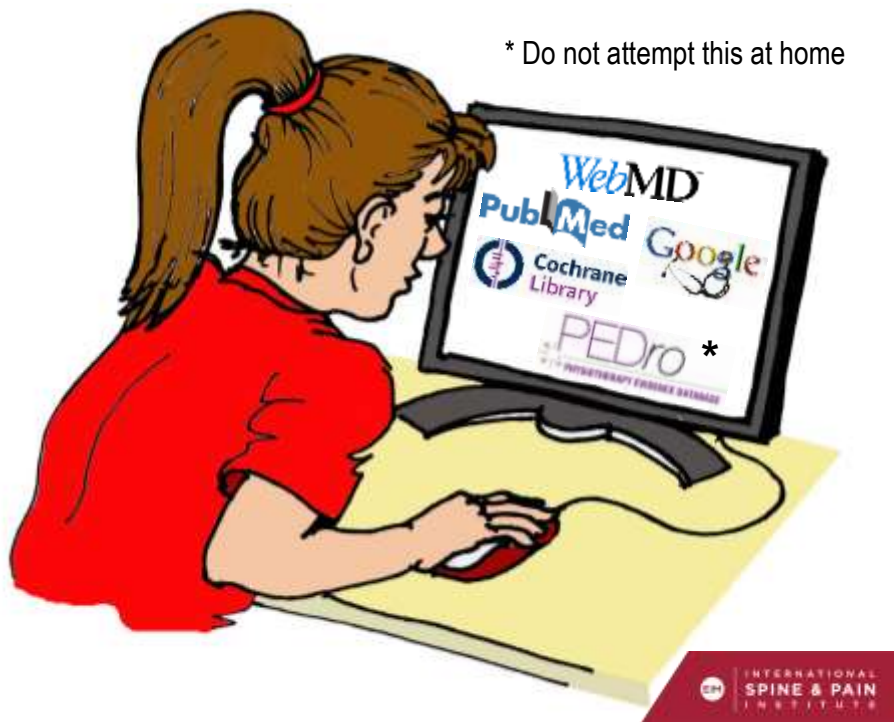
Moseley GL, Butler DS. Fifteen Years of Explaining Pain: The Past, Present, and Future. *The journal of pain : official journal of the American Pain Society.* Jun 5 2015. Hoeger Bement MK, Sluka KA. The current state of physical therapy pain curricula in the United States: a faculty survey. *The journal of pain : official journal of the American Pain Society.* Feb 2015;16(2):144-152.

Cox T, Puentedura E, Low A. An Abbreviated Therapeutic Neuroscience Education Session Improves Pain Knowledge in First Year Physical Therapy Students But Does Not Change Attitudes or Beliefs *Journal of Manual & Manipulative Therapy.* 2015; Accepted for Publication - Nov 2015.

Latimer J, Maher C, Refshauge K. The attitudes and beliefs of physiotherapy students to chronic back pain. *Clinical Journal of Pain.* 2004;20:45-50.



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Fibromyalgia

Symptoms:

- ✓ Widespread pain
- ✓ Joint stiffness
- ✓ Fatigue
- ✓ Persistent pain
- ✓ Sleep disturbance
- ✓ Depression
- ✓ Mental fatigue (fog)
- ✓ Short term memory loss

- ✓ Sensitized GI system
- ✓ Anxiety
- ✓ Social impact
- ✓ Functional impact
- ✓ Headaches
- ✓ Sexual dysfunction

Diagnosis:

- ✓ Process of elimination
- ✓ Cluster of symptoms
- ✓ Limited medical tests

Di Franco, M., C. Iannuccelli, et al. (2010). "Neuroendocrine immunology of fibromyalgia." *Annals of the New York Academy of Sciences* 1193: 84-90.

Izquierdo-Alvarez, S., J. P. Bocos-Terraz, et al. (2008). "Is there an association between fibromyalgia and below-normal levels of urinary cortisol?" *BMC research notes* 1: 134.

Menzies, V. and D. E. Lyon (2010). "Integrated review of the association of cytokines with fibromyalgia and fibromyalgia core symptoms." *Biological research for nursing* 11(4): 387-394.

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40



Chronic Fatigue Syndrome

Symptoms:

- ✓ Widespread pain
- ✓ Joint stiffness
- ✓ Fatigue
- ✓ Persistent pain
- ✓ Sleep disturbance
- ✓ Depression
- ✓ Mental fatigue (fog)
- ✓ Short term memory loss

- ✓ Social impact
- ✓ Functional impact
- ✓ Headaches
- ✓ Sexual dysfunction

Diagnosis:

- ✓ Process of elimination
- ✓ Cluster of symptoms
- ✓ Limited medical tests

Appel S, Chapman J, Shoenfeld Y. Infection and vaccination in chronic fatigue syndrome: myth or reality? *Autoimmunity*. Feb 2007;40(1):48-53.

Nijs J, Nees A, Paul L, et al. Altered immune response to exercise in patients with chronic fatigue syndrome/myalgic encephalomyelitis: a systematic literature review. *Exerc Immunol Rev*. 2014;20:94-116.

Logan AC, Wong C. Chronic fatigue syndrome: oxidative stress and dietary modifications. *Altern Med Rev*. Oct 2001;6(5):450-459.

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41

Your "aha" moment...

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

Symptoms	FM	CFB	IBS	CLD
• Widespread pain	✓	✓	✓	✓
• Joint stiffness	✓	✓	✓	✓
• Fatigue	✓	✓	✓	✓
• Persistent pain	✓	✓	✓	✓
• Sleep disturbance	✓	✓	✓	✓
• Depression	✓	✓	✓	✓
• Mental fatigue (fog)	✓	✓	✓	✓
• Short term memory loss	✓	✓	✓	✓
• Sensitized GI system	✓	✓	✓	✓
• Anxiously	✓	✓	✓	✓
• Significant social and functional impact	✓	✓	✓	✓
• Headaches	✓	✓	✓	✓
• Sexual dysfunction	✓	✓	✓	✓
• Diagnosis via cluster of symptoms	✓	✓	✓	✓



42

Today's talk

3

1. Pain, threat, biology and physiology...
2. Conceptual model of "similarity"
3. Clinical so what?

43



If we're so good, then why are our patients so bad?



Wall PD, Melzack R. Textbook of Pain. 5th edn ed. London: Elsevier; 2005.
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44



1

Pain, threat, biology and physiology...



45

Pain is 100% produced by the brain...

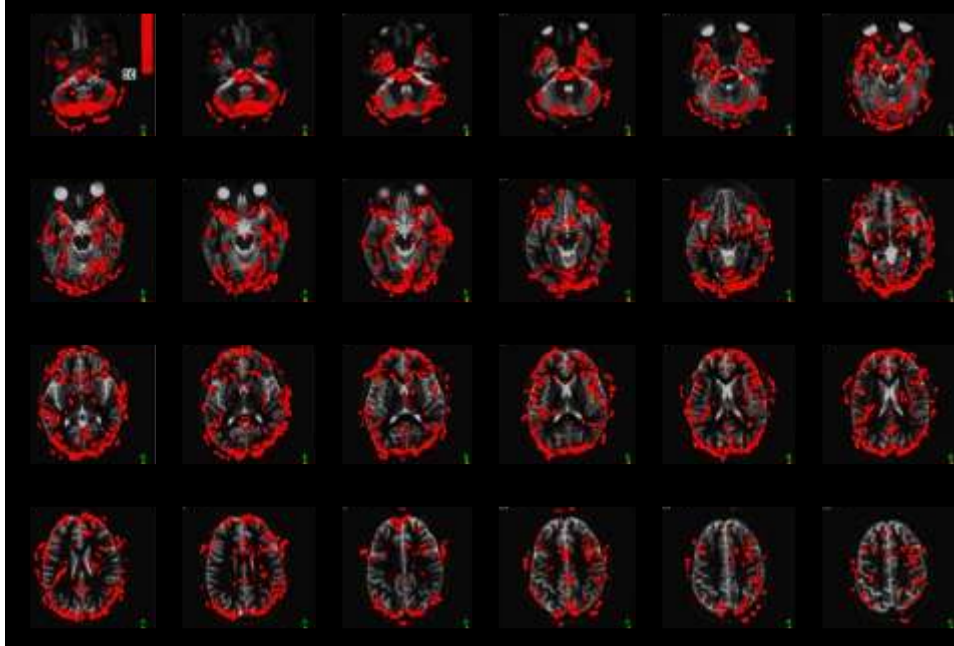
Pain is produced by the brain based on perception of **threat**



Moseley, G.L., A pain neuromatrix approach to patients with chronic pain. Man Ther. 2003. 8(3): p. 130-40.
Melzack, R., Pain and the neuromatrix in the brain Journal of Dental Education, 2001. 65: p. 1378-1382.

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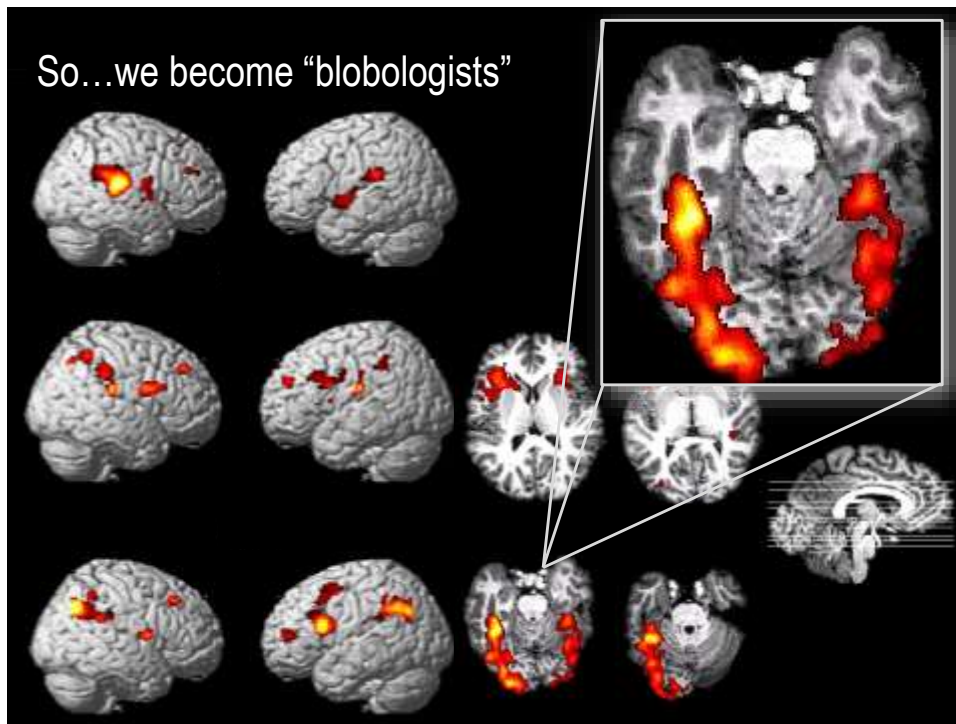
47

1. PREMOTOR/ MOTOR CORTEX
organize and prepare movements
2. CINGULATE CORTEX
concentration, focusing
3. PREFRONTAL CORTEX
problem solving, memory
4. AMYGDALA
fear, fear conditioning, addiction
5. SENSORY CORTEX
sensory discrimination
6. HYPOTHALAMUS/ THALAMUS
stress responses, autonomic regulation, motivation
7. CEREBELLUM
movement and cognition
8. HIPPOCAMPUS
memory, spacial recognition, fear conditioning
9. SPINAL CORD
gating from the periphery

A TYPICAL PAIN NEUROMATRIX

Puentedura EJ, Louw A. A neuroscience approach to managing athletes with low back pain. *Phys Ther Sport*. Aug 2012;13(3):123-133.

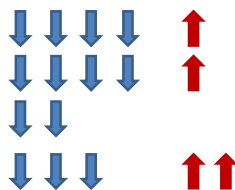
48



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Differences: Gray Matter

- Dorsolateral prefrontal cortex
- Temporal lobes
- Insula
- Primary somatosensory cortex



- Higher activation in:
 - S1, S2, posterior cingulate cortex, insula, medial prefrontal cortex
- Lower activation in:
 - Periaqueductal gray



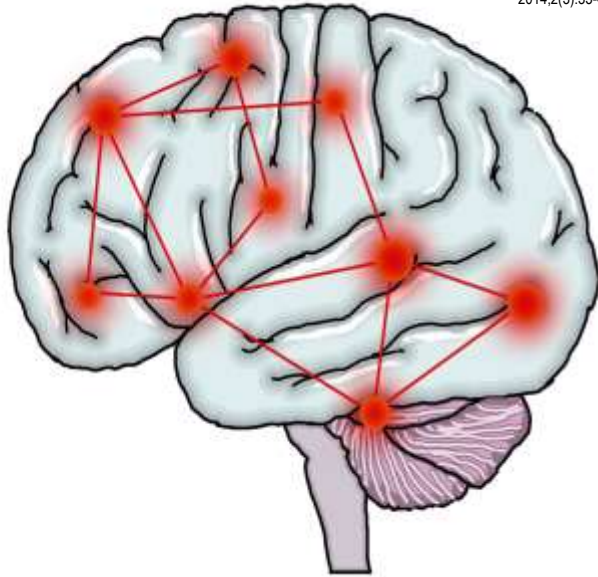
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Puentedura EJ, Louw A. A neuroscience approach to managing athletes with low back pain. *Phys Ther Sport.* Aug 2012;13(3):123-133.
Louw A, Puentedura E. Therapeutic Neuroscience Education, Pain, Physiotherapy and the Pain Neuromatrix. *International Journal of Health Sciences.* 2014;2(3):33-45.

Nociception



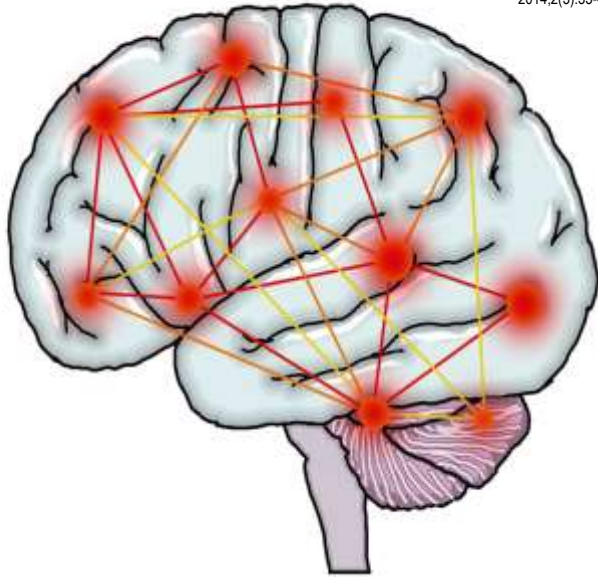
51

Puentedura EJ, Louw A. A neuroscience approach to managing athletes with low back pain. *Phys Ther Sport.* Aug 2012;13(3):123-133.
Louw A, Puentedura E. Therapeutic Neuroscience Education, Pain, Physiotherapy and the Pain Neuromatrix. *International Journal of Health Sciences.* 2014;2(3):33-45.

Nociception

Beliefs

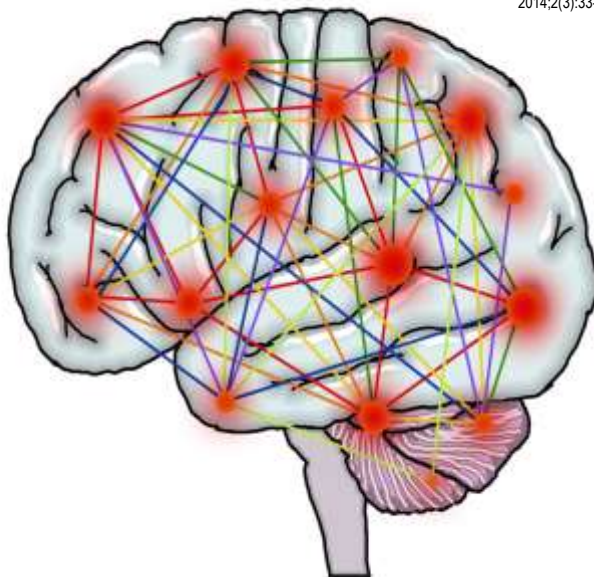
Knowledge & Logic



52

Puentedura EJ, Louw A. A neuroscience approach to managing athletes with low back pain. *Phys Ther Sport.* Aug 2012;13(3):123-133.
Louw A, Puentedura E. Therapeutic Neuroscience Education, Pain, Physiotherapy and the Pain Neuromatrix. *International Journal of Health Sciences.* 2014;2(3):33-45.

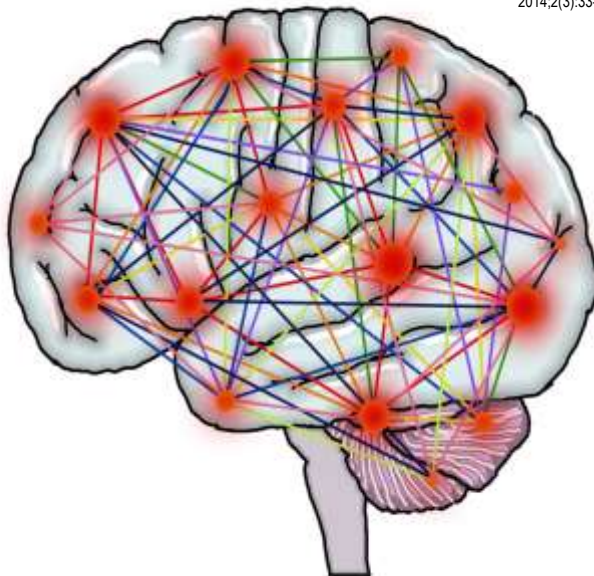
- Nociception
- Beliefs
- Knowledge & Logic
- Social Context
- Sensory Cues
- Physical Therapy
- Internet



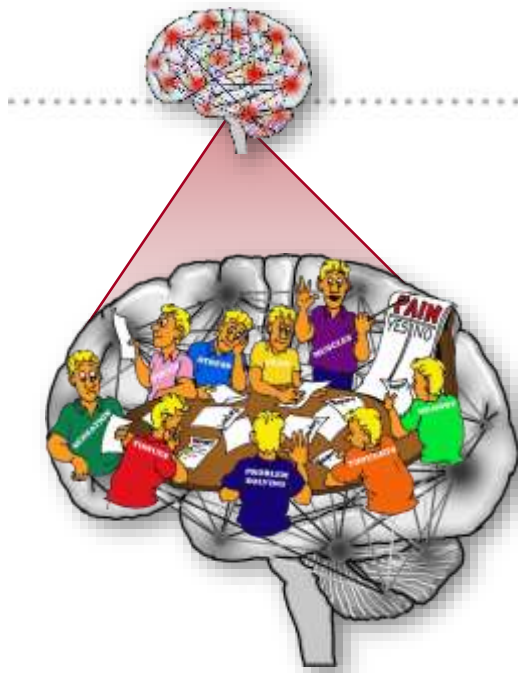
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Puentedura EJ, Louw A. A neuroscience approach to managing athletes with low back pain. *Phys Ther Sport.* Aug 2012;13(3):123-133.
Louw A, Puentedura E. Therapeutic Neuroscience Education, Pain, Physiotherapy and the Pain Neuromatrix. *International Journal of Health Sciences.* 2014;2(3):33-45.

- Nociception
- Beliefs
- Knowledge & Logic
- Social Context
- Sensory Cues
- Physical Therapy
- Internet
- Memories
- Fear & Anxiety



54



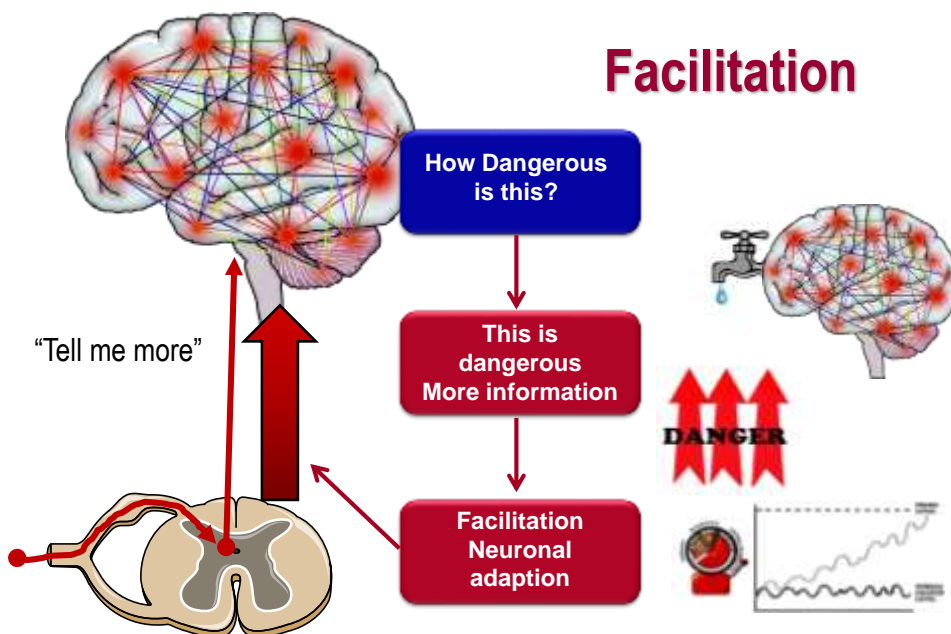
Threat Value...

Pain is a multiple system output, activated by an individual's specific pain neural signature. The neural signature is activated whenever the brain concludes that the body tissues are in danger and action is required

Moseley, G.L., *A pain neuromatrix approach to patients with chronic pain*. *Man Ther*, 2003, 8(3): p. 130-40.
 Melzack, R., *Pain and the neuromatrix in the brain* *Journal of Dental Education*, 2001, 65: p. 1378-1382.



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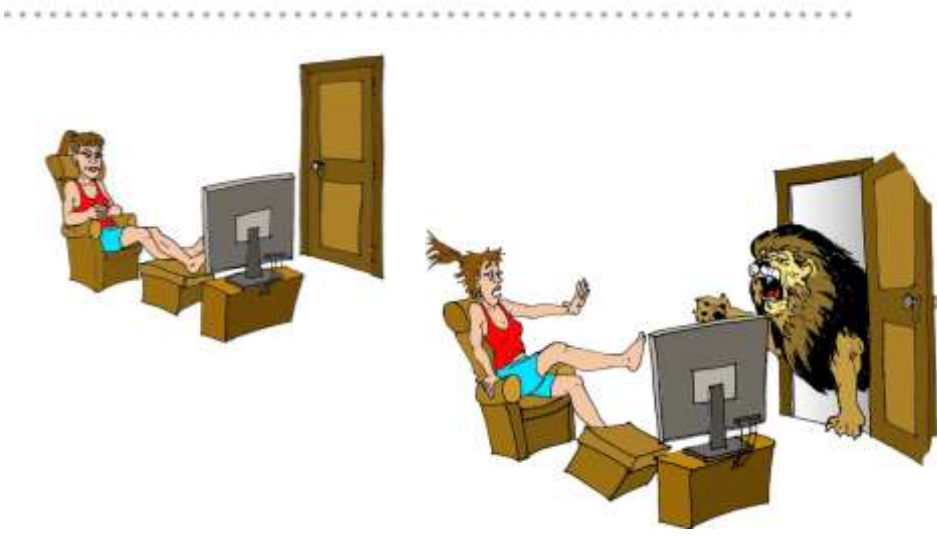


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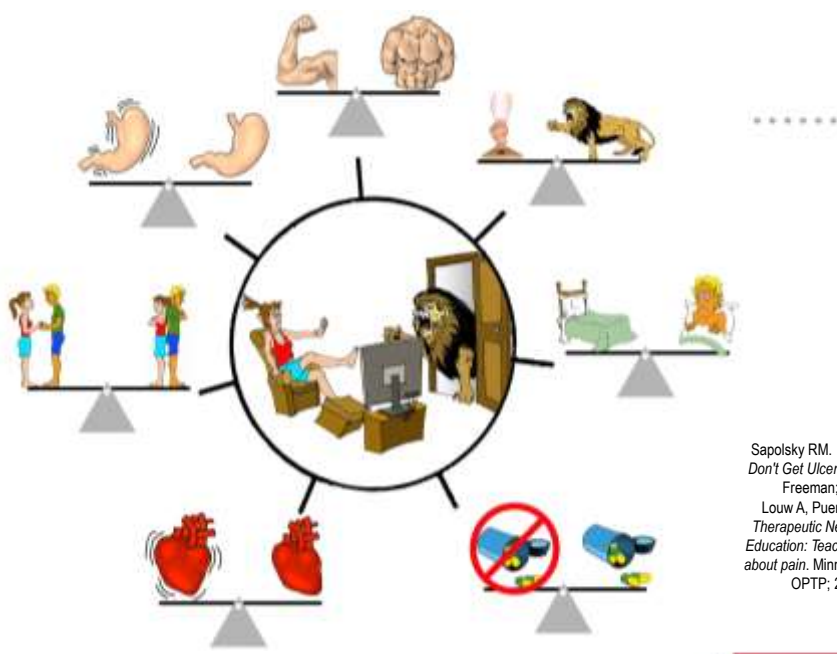


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Stress Responses...



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 Louw A, Puentedura E. *Therapeutic Neuroscience Education: Teaching patients about pain*. Minneapolis, MN: OPTP; 2013.

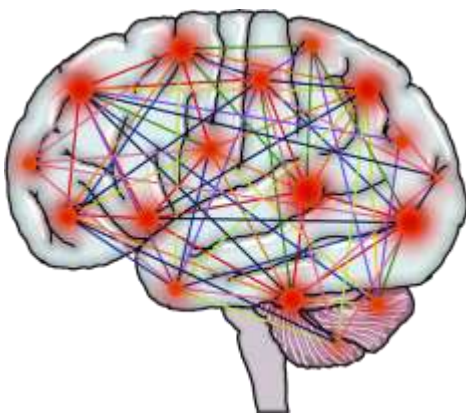




* What you see in the clinic

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Response to...Threat

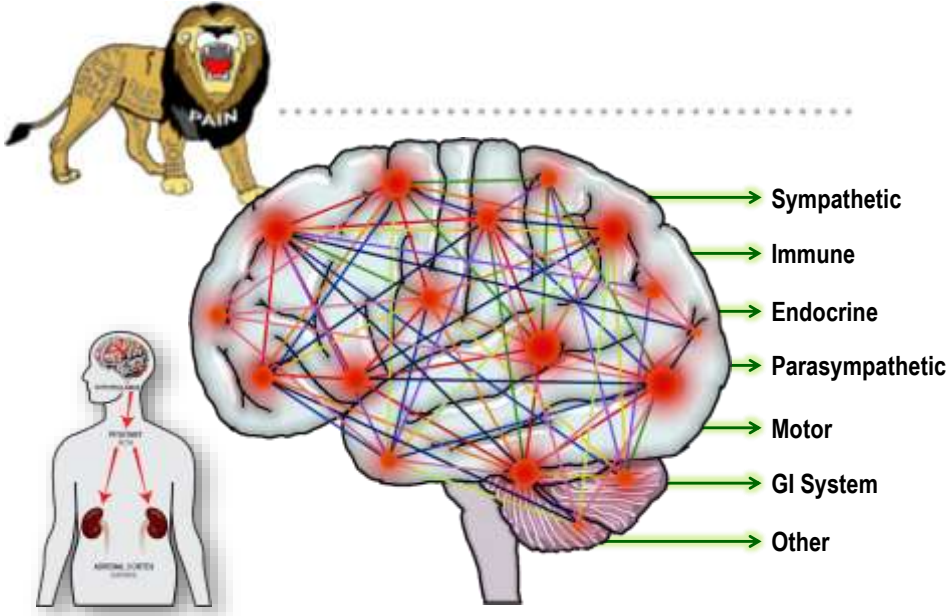


Pain is a **multiple system** output, activated by an individual's specific pain neural signature. The neural signature is activated whenever the brain concludes that the body tissues are in danger and action is required

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62

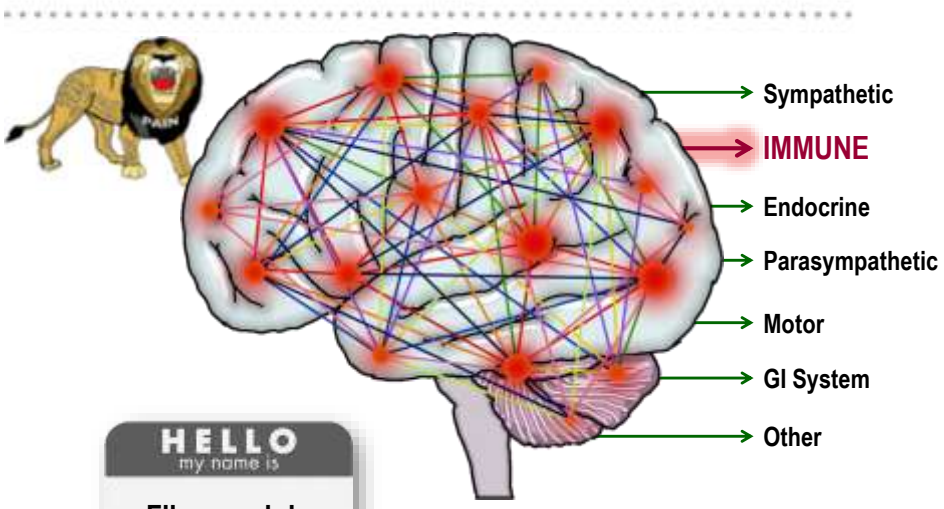


Gifford LS. Pain, the tissues and the nervous system. *Physiotherapy*. 1998;84:27-33.
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 Sapolsky RM. *Why Zebras Don't Get Ulcers*. New York: Freeman; 1994.

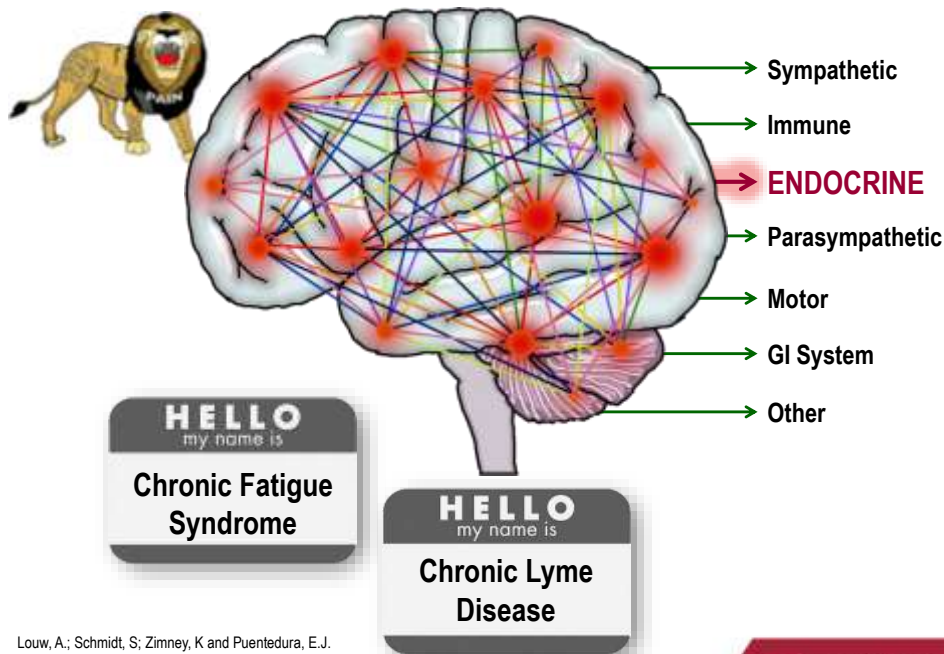


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Louw, A.; Schmidt, S; Zimney, K and Puentedura, E.J.
 Treat the Patient not the Label: A Pain Neuroscience Approach; *Journal of Woman's Health*; February 2019; pages 1 - 9



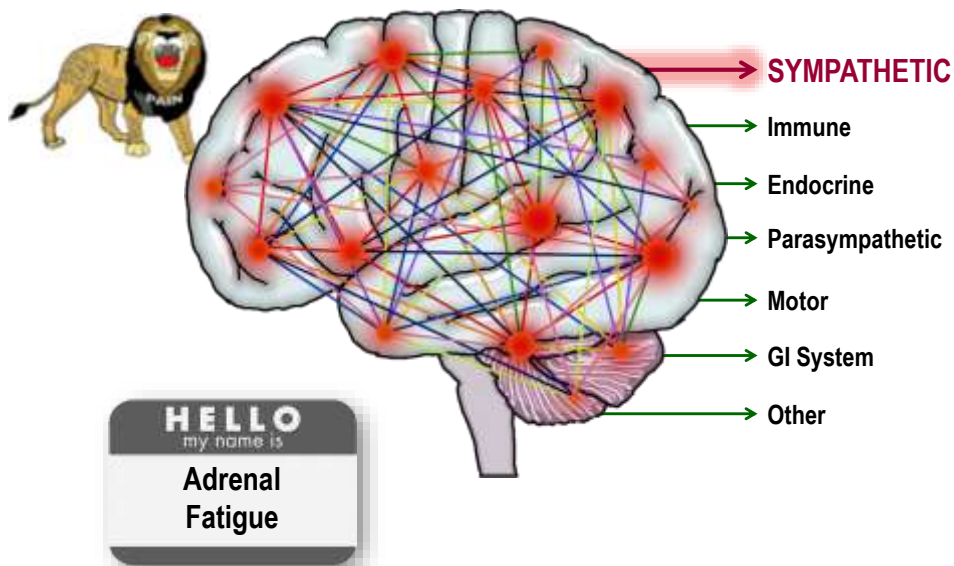
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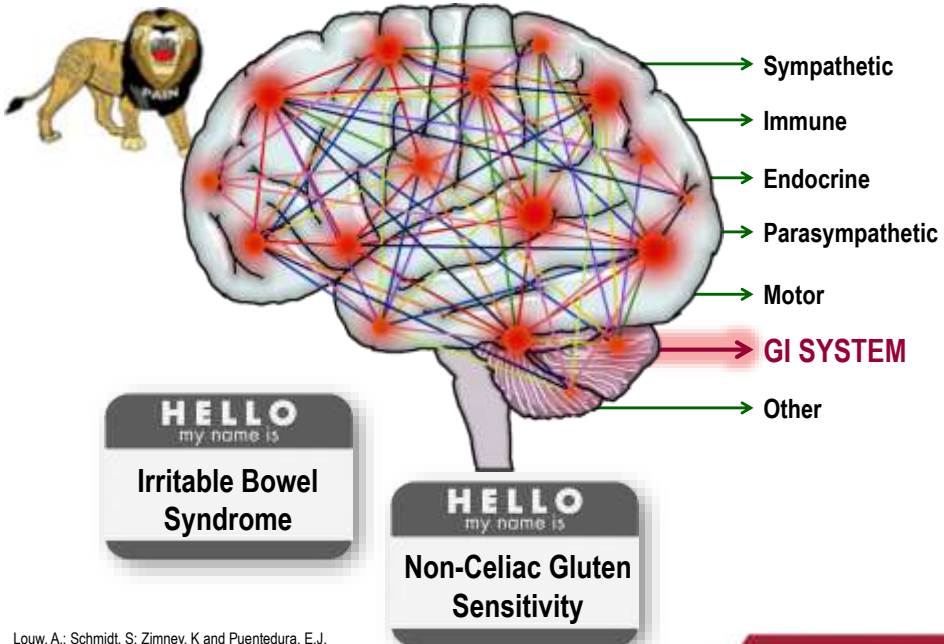
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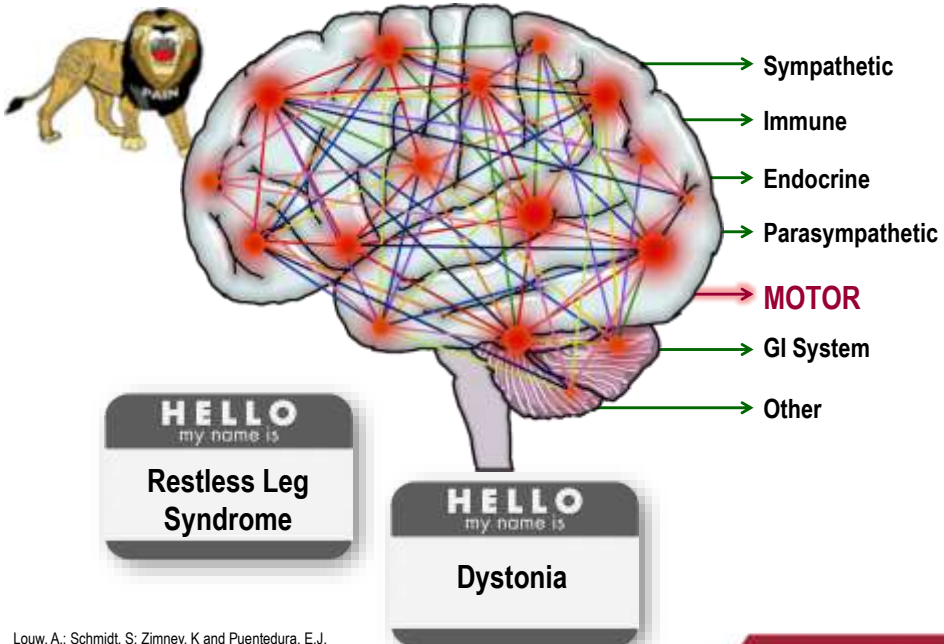
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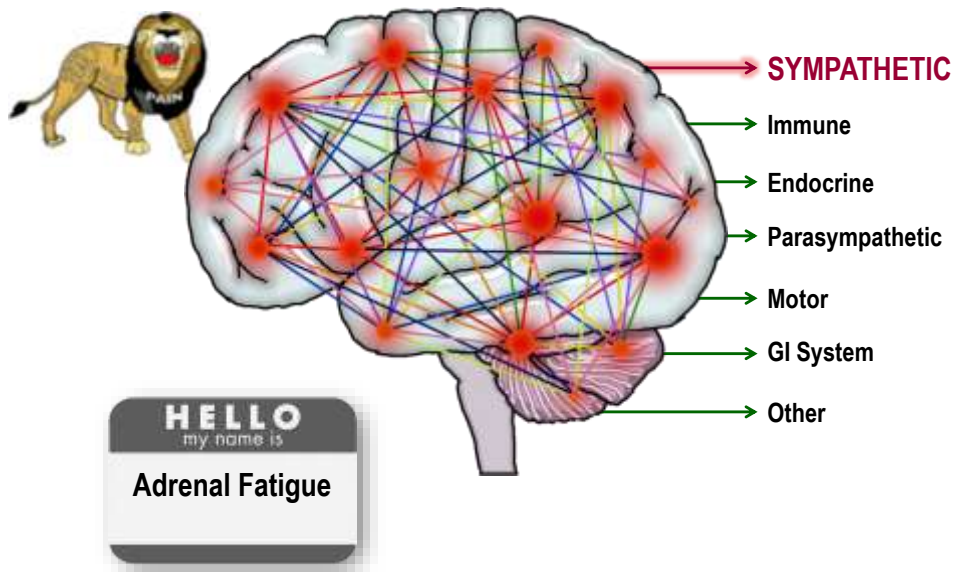
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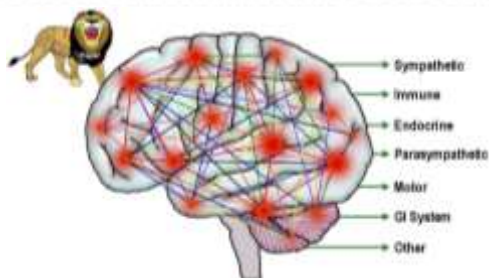


Louw, A.; Schmidt, S; Zimney, K and Puentedura, E.J.
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Approach; Journal of Woman's Health; February 2019;
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Why one system over the other?



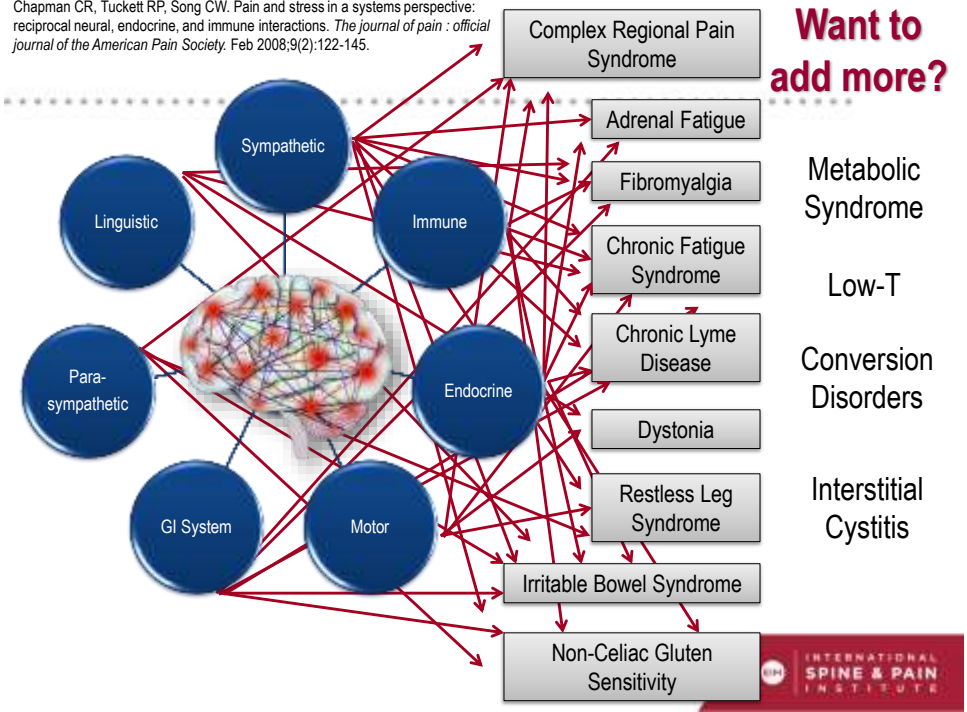
- Genetics?
- Memory?
- Weakest link
- Neurotransmitters
- Or...specialist you're sent to:
 - Endocrinologist
 - Rheumatologist
 - Internal Medicine
 - Gastroenterologist
 - Etc.

Louw, A.; Schmidt, S; Zimney, K and Puentedura, E.J.
Treat the Patient not the Label: A Pain Neuroscience
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72

Chapman CR, Tuckett RP, Song CW. Pain and stress in a systems perspective: reciprocal neural, endocrine, and immune interactions. *The journal of pain : official journal of the American Pain Society*. Feb 2008;9(2):122-145.



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Brain, Behavior, and Immunity 46 (2015) 1–16

Contents lists available at ScienceDirect

Brain, Behavior, and Immunity

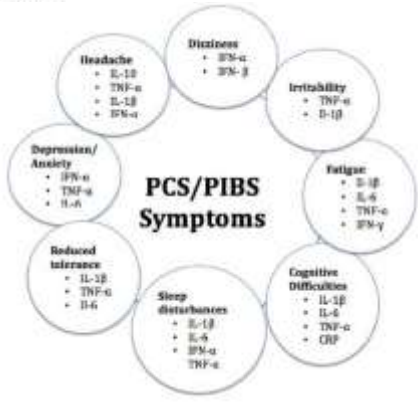
Journal homepage: www.elsevier.com/locate/ybrbi




A review of the neuro- and systemic inflammatory responses in post concussion symptoms: Introduction of the "post-inflammatory brain syndrome" PIBS



Alasdair Timothy Llewelyn Rathbone^a, Surejini Tharmaradinam^b, Shucui Jiang^c, Michel P. Rathbone^{a,c,*,1}, Dinesh A. Kumbhare^{a,1}



Rathbone AT, Tharmaradinam S, Jiang S, Rathbone MP, Kumbhare DA. A review of the neuro- and systemic inflammatory responses in post concussion symptoms: Introduction of the "post-inflammatory brain syndrome" PIBS. *Brain Behav Immun*. May 2015;46:1-16.



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Louw, A.; Schmidt, S; Zimney, K and Puentedura, E.J.
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Approach; Journal of Woman's Health; February 2019;
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Immune System
• Fibromyalgia

Sympathetic Nervous System
• Adrenal Fatigue

Gastrointestinal System
• Irritable Bowel Syndrome
• Non-Celiac Gluten Sensitivity

Endocrine System
• Chronic Fatigue Syndrome
• Chronic Lyme Disease

Clinical Commentary
Treat the Patient, Not the Label: A Pain Neuroscience Education Update
Adrian Louw, PT, PhD¹
Stephen Schmidt, PT²
Kory Zimney, PT, DPT³
Emilia J. Puentedura, PT, DPT, PhD⁴

INTERNATIONAL SPINE & PAIN INSTITUTE

75

One more...before actual treatment

A hallmark of all these widespread conditions: Central Sensitization

	FM	CFS	IBS	CLD
Central Sensitization	✓	✓	✓	✓

Meeus M, Nijls J. Central sensitization: a biopsychosocial explanation for chronic widespread pain in patients with fibromyalgia and chronic fatigue syndrome. *Clin Rheumatol.* Apr 2007;26(4):465-473.

Nijls J, Crombez G, Meeus M, et al. Pain in patients with chronic fatigue syndrome: time for specific pain treatment? *Pain Physician.* Sep-Oct 2012;15(5):E677-686.

Bennett RM, Goldenberg DL. Fibromyalgia, myofascial pain, tender points and trigger points: splitting or lumping? *Arthritis Res Ther.* 2011;13(3):117.

Bruehl S. Complex regional pain syndrome. *BMJ.* 2015;351:h2730.

Di Franco M, Iannuccelli C, Valesini G. Neuroendocrine immunology of fibromyalgia. *Ann N Y Acad Sci.* Apr 2010;1193:84-90.

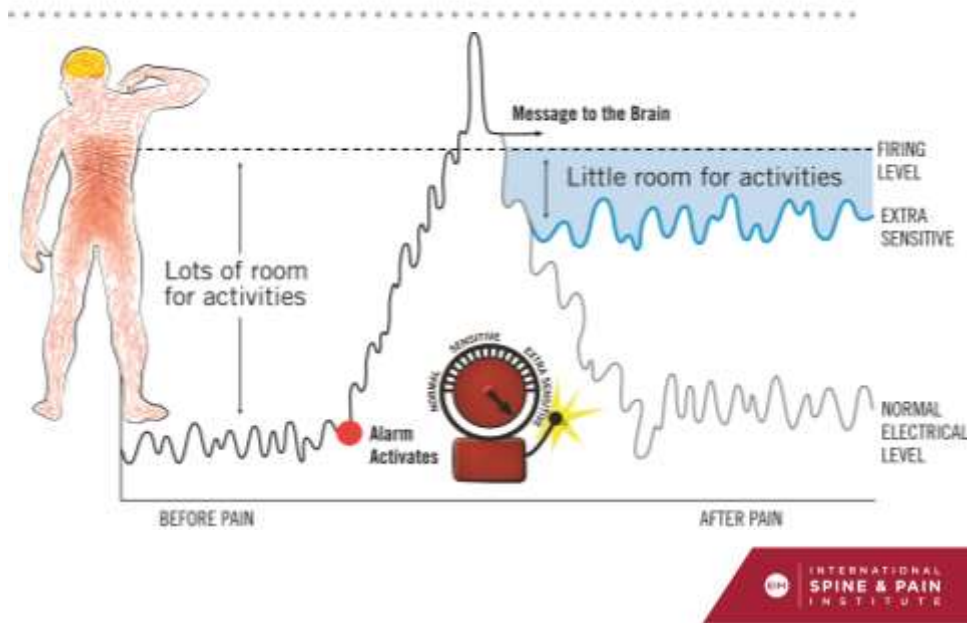
Nijls J, Paul van Wilgen C, Van Oosterwijk J, van Ittersum M, Meeus M. How to explain central sensitization to patients with 'unexplained' chronic musculoskeletal pain: practice guidelines. *Manual therapy.* Oct 2011;16(5):413-418.

Wijma AJ, van Wilgen CP, Meeus M, Nijls J. Clinical biopsychosocial physiotherapy assessment of patients with chronic pain: The first step in pain neuroscience education. *Physiotherapy Theory and Practice.* Jul 2016;32(5):368-384.

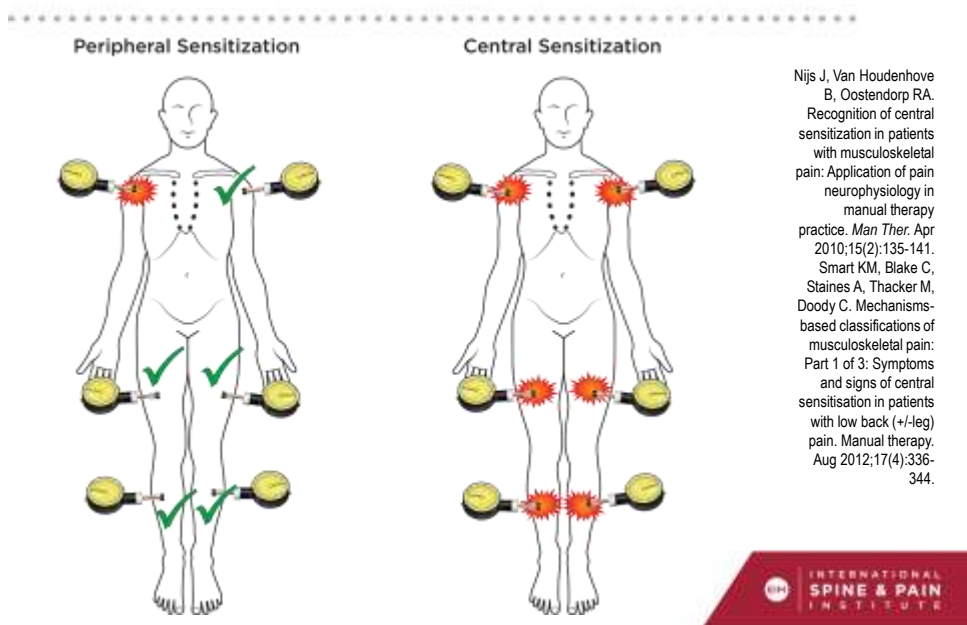


76

Nijs J, Van Houdenhove B, Oostendorp RA. Recognition of central sensitization in patients with musculoskeletal pain: Application of pain neurophysiology in manual therapy practice. *Man Ther.* Apr 2010;15(2):135-141.
 Smart KM, Blake C, Staines A, Thacker M, Doody C. Mechanisms-based classifications of musculoskeletal pain: Part 1 of 3: Symptoms and signs of central sensitisation in patients with low back (+/-leg) pain. *Manual therapy.* Aug 2012;17(4):336-344.



77



Nijs J, Van Houdenhove B, Oostendorp RA. Recognition of central sensitization in patients with musculoskeletal pain: Application of pain neurophysiology in manual therapy practice. *Man Ther.* Apr 2010;15(2):135-141.
 Smart KM, Blake C, Staines A, Thacker M, Doody C. Mechanisms-based classifications of musculoskeletal pain: Part 1 of 3: Symptoms and signs of central sensitisation in patients with low back (+/-leg) pain. *Manual therapy.* Aug 2012;17(4):336-344.

78

3

Clinical so what?



79

You still have to treat these patients...



Before we go through treatments, some **FUNDEMENTAL** principles



80

Fundamentals

- ✓ Treat the patient, not the label
- ✓ New/other labels are on their way
- ✓ Call it whatever the patient wants to call it
- ✓ Don't try and remove the label
- ✓ Treat them with respect, dignity and compassion
- ✓ All you need to know:
 - ✓ They hurt
 - ✓ They are tired
 - ✓ They have trouble sleeping
 - ✓ They have been let down by the medical community
- ✓ Biology is plastic and can change...HOPE

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



81

Current Best Evidence

Gold Level Evidence Cochrane Reviews

1. Cognitive Therapy
2. Movement/exercise
3. Medication to “calm” the nervous system

Bernardy K, Klose P, Busch AJ, Choy EH, Hauser W. Cognitive behavioural therapies for fibromyalgia. *The Cochrane database of systematic reviews*. 2013;9:CD009796.

Busch A, Schachter CL, Peloso PM, Bombardier C. Exercise for treating fibromyalgia syndrome. *The Cochrane database of systematic reviews*. 2002(3):CD003786.

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Larun L, Brurberg KG, Odgaard-Jensen J, Price JR. Exercise therapy for chronic fatigue syndrome. *The Cochrane database of systematic reviews*. 2015;2:CD003200.

Halperin JJ. Chronic Lyme disease: misconceptions and challenges for patient management. *Infect Drug Resist*. 2015;8:119-128.

Huertas-Ceballos A, Logan S, Bennett C, Macarthur C. Psychosocial interventions for recurrent abdominal pain (RAP) and irritable bowel syndrome (IBS) in childhood. *The Cochrane database of systematic reviews*. 2008(1):CD003014.

Price JR, Mitchell E, Tidy E, Hunot V. Cognitive behaviour therapy for chronic fatigue syndrome in adults. *The Cochrane database of systematic reviews*. 2008(3):CD001027.

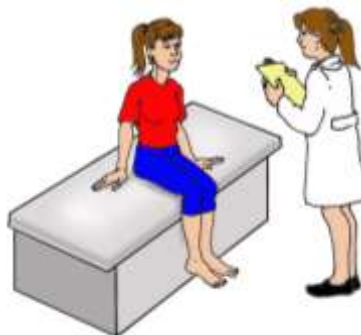


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1. Cognitive Therapy

What do patients want from us?

- Clear **diagnosis**
- **Education** about their problem
- Personalized and individualized care
- **Prognosis** and plan of care
- **Explanation** of treatment
- Pain relief and improved function
- Thorough physical examination



Verbeek J, Sengers MJ, Riemens L, Haafkens J. Patient expectations of treatment for back pain: a systematic review of qualitative and quantitative studies. *Spine*. Oct 15 2004;29(20):2309-2318.
 Puentedura EJ, Cleland JA, Landers MR, Mintken PE, Louw A, Fernandez-de-Las-Penas C. Development of a clinical prediction rule to identify patients with neck pain likely to benefit from thrust joint manipulation to the cervical spine. *The Journal of orthopaedic and sports physical therapy*. 2012;42(7):577-592.
 Hopayian K, Ntley C. A systematic review of low back pain and sciatica patients' expectations and experiences of health care. *The spine journal : official journal of the North American Spine Society*. Aug 1 2014;14(8):1769-1780.
 McRae M, Hancock MJ. Adults attending private physiotherapy practices seek diagnosis, pain relief, improved function, education and prevention: a survey. *J Physiother*. Oct 2017;63(4):250-256.



83

Seeking answers...



WebMD®

80 million visits/month



55 million visits/month

YAHOO! HEALTH

51 million visits/month

Morr S, Shanti N, Carrer A, Kubeck J, Gerling MC. Quality of information concerning cervical disc herniation on the Internet. *The spine journal : official journal of the North American Spine Society*. Apr 2010;10(4):350-354.
 Garcia RM, Messerschmitt PJ, Ahn NU. An evaluation of information on the Internet of a new device: the lumbar artificial disc replacement. *J Spinal Disord Tech*. Feb 2009;22(1):52-57.
 Greene DL, Appel AJ, Reinert SE, Palumbo MA. Lumbar disc herniation: evaluation of information on the internet. *Spine (Phila Pa 1976)*. Apr 1 2005;30(7):826-829.



84

Fibromyalgia (FM)

WebMD



Fibromyalgia is the second most common condition affecting your bones and muscles. Yet it's often misdiagnosed and misunderstood.

Its classic symptoms are widespread muscle and joint pain and fatigue. There's no cure. Doctors aren't sure what causes it, but some think it's a problem with how your brain and spinal cord process pain signals from your nerves.



85

Chronic Fatigue Syndrome (CFS)

NIH



CFS is a serious, long-term illness that affects many body systems. Another name for it is myalgic encephalomyelitis (ME). CFS can often make you unable to do your usual activities. Sometimes you may not even be able to get out of bed. Scientists don't know what causes CFS.



86

Let's play a little game...

Chronic Fatigue Syndrome (CFS)

NIH



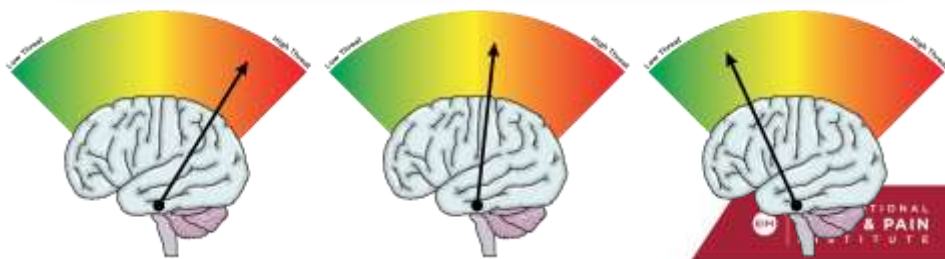
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Fibromyalgia (FM)

WebMD



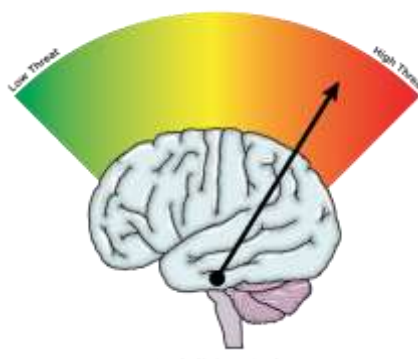
Fibromyalgia is the second-most common condition affecting your bones and muscles. Yet it's often misunderstood and misdiagnosed. Its classic symptoms are widespread muscle and joint pain and fatigue. There's no cure. Doctors aren't sure what causes it but some think it's a problem with how your brain and spinal cord process pain signals from your nerves.



87

Pain is 100% produced by the brain...

Pain is a multiple system output, activated by an individual's specific pain neural signature. The neural signature is activated whenever the brain perceives a threat

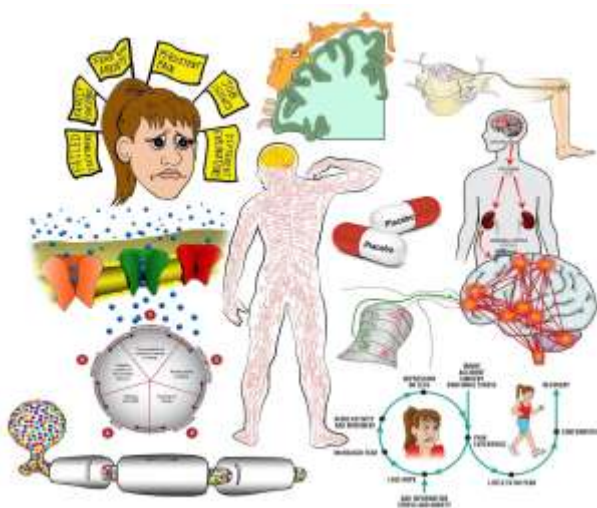


Moseley, G.L., A pain neuromatrix approach to patients with chronic pain. *Man Ther.* 2003. 8(3): p. 130-40.
 Melzack, R., Pain and the neuromatrix in the brain *Journal of Dental Education*, 2001. 65: p. 1378-1382.



88

Pain Science

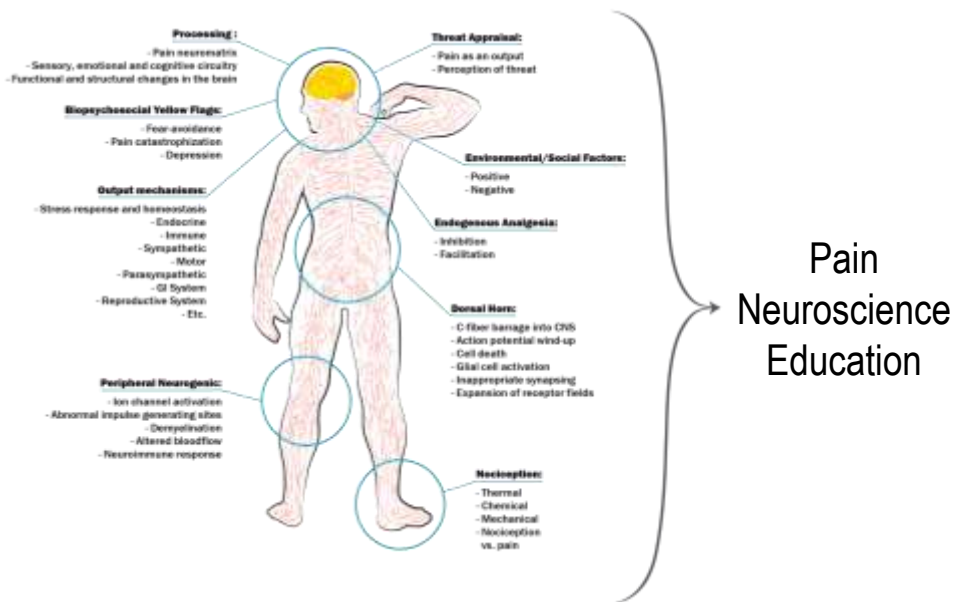


- Ion channel expression
- Demyelination
- Glial cell activation
- Action potential windup
- Inappropriate synapsing
- Cell death
- Neuroplasticity
- Endogenous hypo/hyperalgesia

Woolf CJ, Salter MW. Neuronal plasticity: increasing the gain in pain. *Science*. Jun 9 2000;288(5472):1765-1769.
 Woolf CJ. Central sensitization: uncovering the relation between pain and plasticity. *Anesthesiology*. Apr 2007;106(4):864-867.
 Devor M. Sodium channels and mechanisms of neuropathic pain. *The journal of pain : official journal of the American Pain Society*. Jan 2006;7(1 Suppl 1):S3-S12.
 Moseley GL. Reconceptualising pain according to modern pain sciences. *Physical Therapy Reviews*. 2007;12:169-178.
 Melzack R. From the gate to the neuromatrix. *Pain*. Aug 1999;Suppl 6:S121-126.



89



Pain Neuroscience Education



90

Pain Neuroscience Education

Educational tools

- Prepared pictures
- Metaphors
- Hand drawings



Script for PNE
• Neurophysiology of pain
• Nociception
• Nociceptive pathways
• Neurons
• Synapses
• Action potential
• Spinal inhibition and facilitation
• Peripheral sensitization
• Central sensitization
• Plasticity of the nervous system

Formats

- One-on-one
- Groups
- We already have the script

Louw A, Butler DS, Diener I, Puentedura EJ. 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.

Moseley L. Combined physiotherapy and education is efficacious for chronic low back pain. *Aust J Physiother*. 2002;48(4):297-302.

Louw A, Diener I, Butler DS, Puentedura EJ. The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. *Archives of physical medicine and rehabilitation*. Dec 2011;92(12):2041-2056.



91

Who needs PNE?

	FM	CFS	IBS	CLD
Central Sensitization	✓	✓	✓	✓

- ✓ Central sensitization
- ✓ Chronic pain
- ✓ Patients with high levels of fear-avoidance
- ✓ Patients displaying various pain catastrophization characteristics
- ✓ Patients ready to change

Louw A, Zimney K, O'Hotto C, Hilton S. The clinical application of teaching people about pain. *Physiotherapy Theory and Practice*. Jul 2016;32(5):385-395.

Louw A, Puentedura E, Zimney K, Cox T, Rico D. The Clinical Implementation of Pain Neuroscience Education: A Survey Study. *Physiotherapy Theory and Practice*. 2017 - accepted for publication.

Prochaska JO, DiClemente CC. Stages of change in the modification of problem behaviors. *Progress in Behavioral Modification*. 1992;28:183-218.



92

Pain Neuroscience Education CFS & FM



Mees M, Nijls J, Van Oosterwijk J, Van Alsenoy V, Truijen S. Pain Physiology Education Improves Pain Beliefs in Patients With Chronic Fatigue Syndrome Compared With Pacing and Self-Management Education: A Double-Blind Randomized Controlled Trial. *Arch Phys Med Rehabil.* Aug 2010;91(8):1153-1159.

van Ittersum MW, van Wilgen CP, van der Schans CP, Lambrecht L, Groothoff JW, Nijls J. Written pain neuroscience education in fibromyalgia: a multicenter randomized controlled trial. *Pain Pract.* Nov 2014;14(8):689-700.



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Symptoms	FM	CFS
• Widespread pain	✓	✓
• Joint stiffness	✓	✓
• Fatigue	✓	✓
• Persistent pain	✓	✓
• Sleep disturbance	✓	✓
• Depression	✓	✓
• Mental fatigue (fog)	✓	✓
• Short term memory loss	✓	✓
• Sensitized GI system	✓	
• Anxiety	✓	
• Significant social and functional impact	✓	✓
• Headaches	✓	✓
• Sexual dysfunction	✓	✓
• Diagnosis via cluster of symptoms	✓	✓



94



1. Persistent Pain

2. Widespread Pain

3. Fatigue

4. Sleep

5. Mental Fog

6. Memory Loss

Section 2: Sensory Nerves

- Peripheral neuropathic pain
- Peripheral nerve sensitization
- Central sensitization
- Hyperalgesia
- Allodynia

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Lou A. Why You Hurt Therapeutic Neuroscience Education System. Minneapolis, MN: OPTP; 2014.



1. Persistent Pain

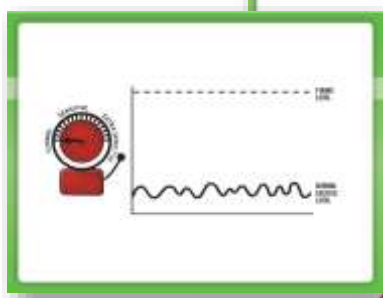
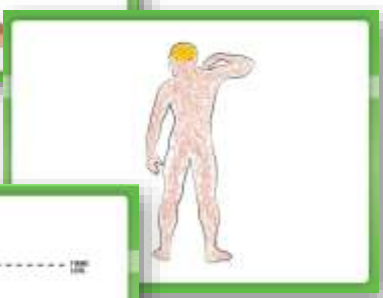
2. Widespread Pain

3. Fatigue

4. Sleep

5. Mental Fog

6. Memory Loss



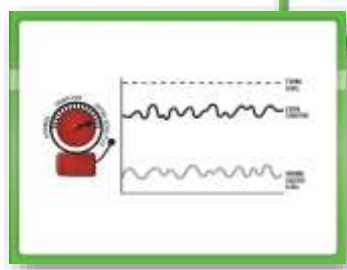
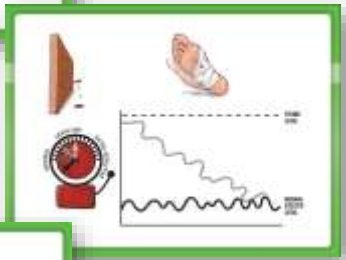
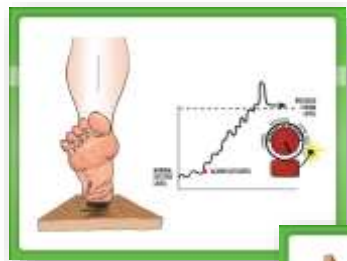
Lou A. Why You Hurt Therapeutic Neuroscience Education System. Minneapolis, MN: OPTP; 2014.





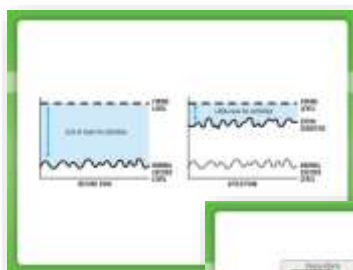
- 1. Persistent Pain
- 2. Widespread Pain
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- 4. Sleep
- 5. Mental Fog
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- 6. Memory Loss

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1. Persistent Pain
- 2. Widespread Pain**
3. Fatigue
4. Sleep
5. Mental Fog
6. Memory Loss

Section 4, New Neighbors

- Spreading pain
- Neuroplasticity
- Peripheral neuropathic pain
- Peripheral nerve sensitization
- Central sensitization
- Hyperalgesia
- Allodynia
- Irritable responses

Low A. (2014). (2014). The Clinical Implications of Pain Neuroscience Education. *Physical Therapy*, 34(1), 1-10. doi:10.1093/ptj/34.1.1

Low A. (2014). (2014). The Clinical Implications of Pain Neuroscience Education. *Physical Therapy*, 34(1), 1-10. doi:10.1093/ptj/34.1.1

Low A. (2014). (2014). The Clinical Implications of Pain Neuroscience Education. *Physical Therapy*, 34(1), 1-10. doi:10.1093/ptj/34.1.1

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1. Persistent Pain
2. Widespread Pain
3. Fatigue
4. Sleep
- 5. Mental Fog**
- 6. Memory Loss**

Section 1. Brain's Pain Map

- Pain neurons
- Neuronal activation
- Threat
- Pain uses other areas
- Neuroplasticity
- Chronic pain enslaves those areas
- Functional MRI's

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1. Persistent Pain
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- 5. Mental Fog**
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2. Widespread Pain
3. Fatigue
4. Sleep
- 5. Mental Fog**
- 6. Memory Loss**

Louw A. *Why You Hurt* Therapeutic Neuroscience Education System. Minneapolis, MN: OPTP; 2014.



Cognitive Homework



If a big, roaring African lion jumped into your room right now, what would you do? Take a nap? Focus on your posture or conserve energy? Here are some specific questions. Go ahead, answer them.

A lion has jumped into the room!

- Is your heart rate up or down? Why?
- Is it time for a nap? Why or why not?
- Is your posture important right now?
- Which are the important muscles to use?
- If you have food in your belly, do you want to spend time digesting it?
- Are you interested in sex at this time? (If you are, you have some serious issues...)
- Are you wanting to store energy for winter?




Louw A. *Why Do I Hurt Workbook*. Minneapolis, MN: OPTP; 2016.

.....

If a big, roaring African lion jumped into your room right now, what would you do? Take a nap? Focus on your posture or conserve energy? Here are some specific questions. Go ahead, answer them.

A lion has jumped into the room!

- Is your heart rate up or down? Why?
Up → Mobilize energy
- Is it time for a nap? Why or why not?
No → alert
- Is your posture important right now?
No → get to run away
- Which are the important muscles to use?
Legs and arms → run/fight
- If you have food in your belly, do you want to spend time digesting it?
No → more important things to do
- Are you interested in sex at this time? (If you are, you have some serious issues...)
No
- Are you wanting to store energy for winter?
No → may not see the winter



Low A. *Why Do I Hurt Workbook*. Minneapolis, MN: OPTP; 2016.


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.....

If a big, roaring African lion jumped into your room right now, what would you do? Take a nap? Focus on your posture or conserve energy? Here are some specific questions. Go ahead, answer them.

A lion has jumped into the room!

- Is your heart rate up or down? Why?
Up → Mobilize energy; TIRED
- Is it time for a nap? Why or why not?
No → alert; TIRED/STRESSED/MOODY
- Is your posture important right now?
No → get to run away; SORE/SENSITIVE MUSCLES
- Which are the important muscles to use?
Legs and arms → run/fight; TENSE MUSCLES
- If you have food in your belly, do you want to spend time digesting it?
No → more important things to do; SENSITIVE TO FOODS
- Are you interested in sex at this time? (If you are, you have some serious issues...)
No; MOOD; PAIN; LOW LIBIDO; MOTOR CONTROL
- Are you wanting to store energy for winter?
No → may not see the winter; RUN OUT OF STEAM



Low A. *Why Do I Hurt Workbook*. Minneapolis, MN: OPTP; 2016.

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Current Best Evidence

Gold Level Evidence Cochrane Reviews

1. ~~Cognitive Therapy~~
2. Movement/exercise
3. Medication to “calm” the nervous system

Bernardy K, Klose P, Busch AJ, Choy EH, Hauser W. Cognitive behavioural therapies for fibromyalgia. *The Cochrane database of systematic reviews*. 2013;9:CD009796.

Busch A, Schachter CL, Peloso PM, Bombardier C. Exercise for treating fibromyalgia syndrome. *The Cochrane database of systematic reviews*. 2002(3):CD003786.

Lunn MP, Hughes RA, Wiffen PJ. Duloxetine for treating painful neuropathy, chronic pain or fibromyalgia. *The Cochrane database of systematic reviews*. 2014;1:CD007115.

Larun L, Brurberg KG, Odgaard-Jensen J, Price JR. Exercise therapy for chronic fatigue syndrome. *The Cochrane database of systematic reviews*. 2015;2:CD003200.

Halperin JJ. Chronic Lyme disease: misconceptions and challenges for patient management. *Infect Drug Resist*. 2015;8:119-128.

Huertas-Ceballos A, Logan S, Bennett C, Macarthur C. Psychosocial interventions for recurrent abdominal pain (RAP) and irritable bowel syndrome (IBS) in childhood. *The Cochrane database of systematic reviews*. 2008(1):CD003014.

Price JR, Mitchell E, Tidy E, Hunot V. Cognitive behaviour therapy for chronic fatigue syndrome in adults. *The Cochrane database of systematic reviews*. 2008(3):CD001027.



111

Dallas Bed Rest and Training Study



McGavock JM, Hastings JL, Snell PG, et al. A forty-year follow-up of the Dallas Bed Rest and Training study: the effect of age on the cardiovascular response to exercise in men. *J Gerontol A Biol Sci Med Sci*. Feb 2009;64(2):293-299.



112

Dallas Bed Rest and Training Study

- Researchers recruited 6 college students to literally spend their **summer in bed**.
- After just three weeks in bed, the subjects experienced a deterioration in cardiovascular fitness that was equivalent to **twenty years of aging**.

McGuire DK, Levine BD, Williamson JW, et al. A 30-year follow-up of the Dallas Bedrest and Training Study: I. Effect of age on the cardiovascular response to exercise. *Circulation*. Sep 18 2001;104(12):1350-1357.
 McGavock JM, Hastings JL, Snell PG, et al. A forty-year follow-up of the Dallas Bed Rest and Training study: the effect of age on the cardiovascular response to exercise in men. *J Gerontol A Biol Sci Med Sci*. Feb 2009;64(2):293-299.



113

Movement Eases Pain...

A six mile run stimulates endorphin release that is equivalent to 10mg of morphine

Janal MN, Colt EW, Clark WC, Glusman M. Pain sensitivity, mood and plasma endocrine levels in man following long-distance running: effects of naloxone. *Pain*. May 1984;19(1):13-25.



114

Movement Thresholds and Pain...



There are thresholds for both the intensity (>50% Vo(2)max) and duration (>10 min) of exercise required to elicit exercise analgesia

Hoffman MD, Shepanski MA, Mackenzie SP, Clifford PS. Experimentally induced pain perception is acutely reduced by aerobic exercise in people with chronic low back pain. J Rehabil Res Dev. Mar-Apr 2005;42(2):183-190.



115

Example: 40 year old lady with FM

Movement Thresholds and Pain...

211-.64 x patient age = Max Heart rate

Age	Max HR	Exercise threshold (70% Max HR)
20	198.2	139
30	191.8	135
40	185.4	130
50	179	126
60	172.6	122
70	166.2	117
80	159.8	112

Heart Rate Norms

WOMEN'S RESTING HEART RATE CHART

AGE	18-19	20-29	30-39	40-49	50-59	60-69	70+
ATHLETE	54-62	55-59	54-58	55-60	54-59	54-59	54-59
EXCELLENT	61-65	60-64	62-64	61-63	60-64	63-64	63-64
GOOD	66-69	65-69	67-69	66-69	65-69	65-69	65-69
ABOVE AV	70-73	69-73	72-73	70-73	69-72	69-72	69-72
AVERAGE	74-76	73-76	74-76	74-77	74-77	73-76	73-76
BELOW AV	75-84	77-82	78-84	79-83	79-83	77-84	77-84
POOR	85+	83+	83+	84+	84+	84+	84+

NEW'S RESTING HEART RATE CHART

AGE	18-19	20-29	30-39	40-49	50-59	60-69	70+
ATHLETE	49-53	54	50-56	50-57	51-55	50-55	50-55
EXCELLENT	55-61	55-61	57-62	58-63	57-61	56-61	56-61
GOOD	62-66	62-66	63-66	64-67	62-67	62-67	62-67
ABOVE AV	66-71	66-70	67-70	68-71	66-71	66-70	66-70
AVERAGE	71-74	71-74	71-75	72-75	72-75	72-75	72-75
BELOW AV	74-81	75-81	75-82	77-83	76-81	74-79	74-79
POOR	82+	82+	83+	84+	82+	80+	80+

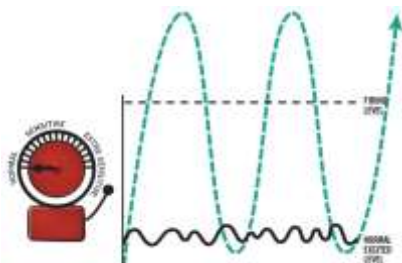
Increase resting HR from ~80 beats/minute to 130 beats per minute



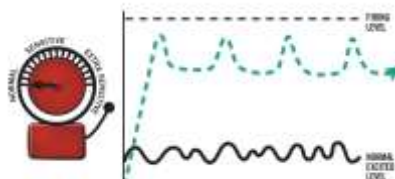
116

Exercise and activity mistakes

“No pain; no gain”



“If it hurts; don’t do it”

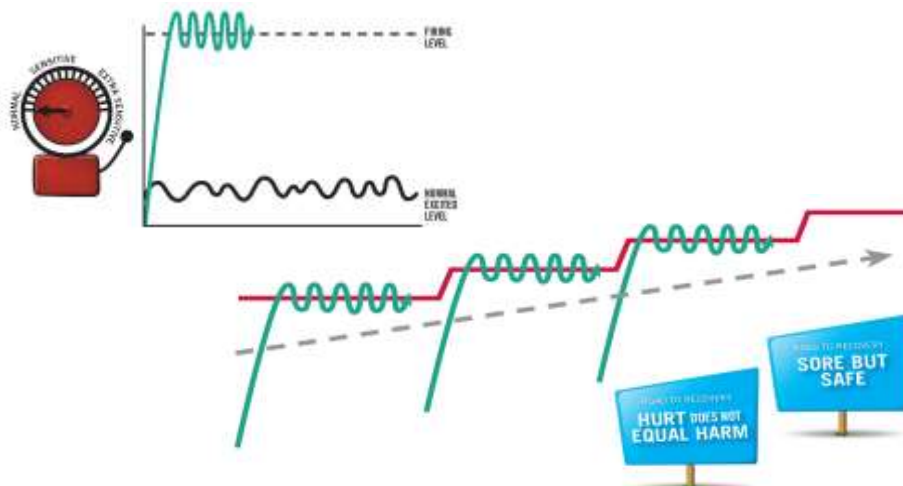


Louw A, Puentedura E. *Therapeutic Neuroscience Education: Teaching patients about pain.* Minneapolis, MN: OPTP; 2013.



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Pacing



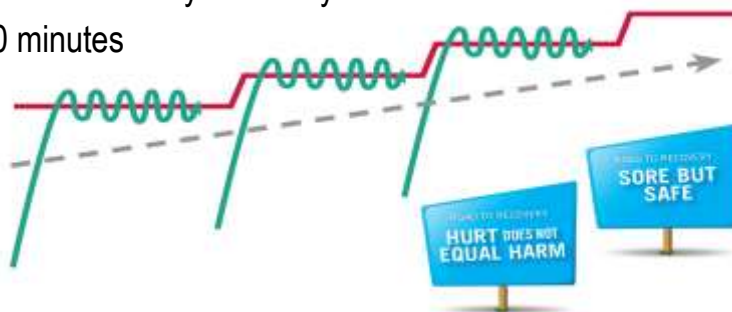
Louw A, Puentedura E. *Therapeutic Neuroscience Education: Teaching patients about pain.* Minneapolis, MN: OPTP; 2013.



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It does not take much...

- Start with 3-5 minutes
- 50% max heart rate
- Add 1-2 minutes every other day
- Goal: 30 minutes



Fulcher KY, White PD. Randomized controlled trial of graded exercise in patients with the chronic fatigue syndrome. *BMJ*. Jun 7 1997;314(7095):1647-1652.



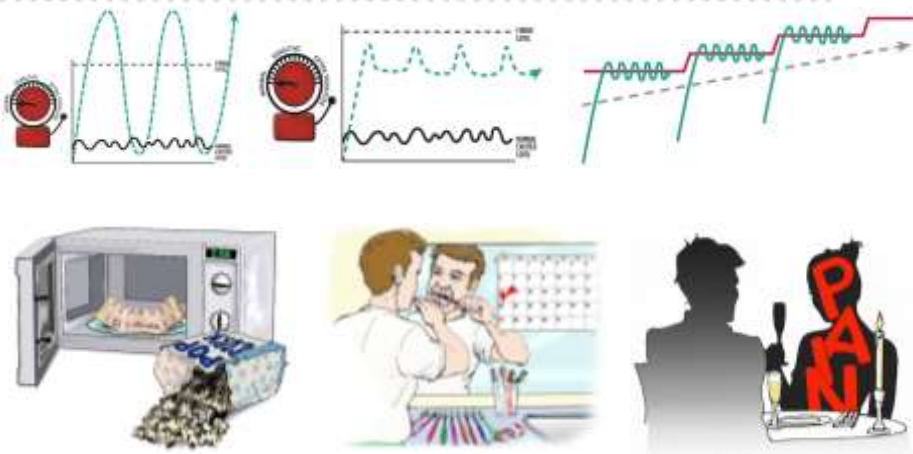
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PNE, Metaphors and Exercise



120

PNE, Metaphors and Exercise



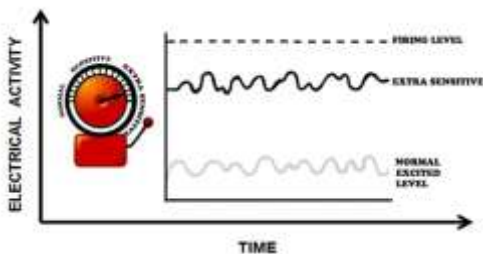
Louw A, Zimney K, O'Hotto C, Hilton S. The clinical application of teaching people about pain. *Physiotherapy Theory and Practice*. Jul 2016;32(5):385-395.



121

“But Exercise is Painful”

PNE



Louw A. *Why Do I Hurt? A Neuroscience Approach to Pain*. Minneapolis: OPTP; 2013.



122

Pain Acknowledgement Scale



Louw A, Puentedura E, Schmidt S, Zimney K. *Pain Neuroscience Education*. Vol 2. Minneapolis, MN: OPTP; 2018.



123

Other forms of Movement/Exercise

Strengthening-Conditioning

- Light weight; High Reps...
- Very little evidence people with chronic pain become weak
- You have to lose 70% muscle mass to become structurally weak



Valkeinen H, Hakkinen A, Alen M, Hannonen P, Kukkonen-Harjula K, Hakkinen K. Physical Fitness in Postmenopausal Women with Fibromyalgia. *Int J Sports Med*. Oct 24 2007.

Brosseau L, Wells GA, Tugwell P, et al. Ottawa Panel Evidence-Based Clinical Practice Guidelines for Aerobic Fitness Exercises in the Management of Fibromyalgia: Part 1. *Phys Ther*. 2008;07/01/2008;88(7):857-871.

Marcell TJ. Sarcopenia: causes, consequences, and preventions. *J Gerontol A Biol Sci Med Sci*. Oct 2003;58(10):M911-916.

Narici MV, Maganaris CN. Adaptability of elderly human muscles and tendons to increased loading. *Journal of anatomy*. Apr 2006;208(4):433-443.

Lederman E. The Myth of Core Stability. *CPDO Online Journal*. June 2007:1-17.

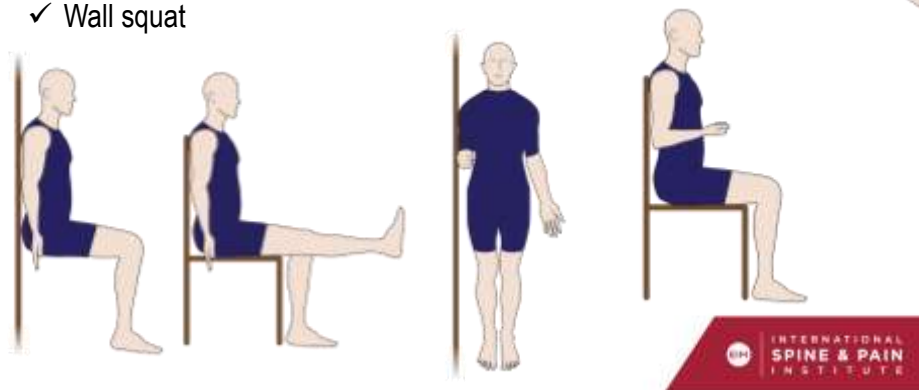


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Isometric Exercises

- ✓ Hand grip
- ✓ Knee extension
- ✓ Elbow flexion
- ✓ Shoulder external rotation
- ✓ Wall squat

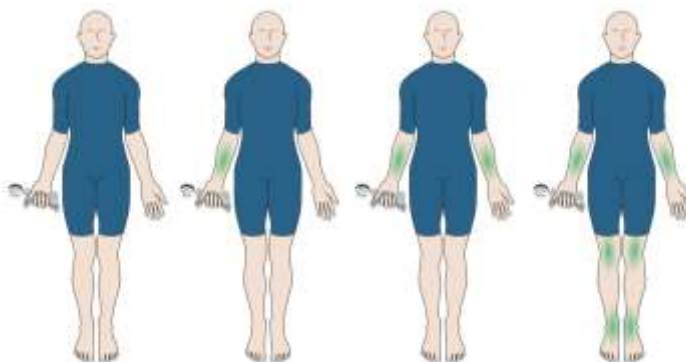
Naugle KM, Fillingim RB, Riley JL, 3rd. A meta-analytic review of the hypoalgesic effects of exercise. The journal of pain : official journal of the American Pain Society. Dec 2012;13(12):1139-1150.



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Isometric: Mechanism?

The hypoalgesic effect is multisegmental and not isolated to the contracting muscle. Various studies have shown that pain-reducing effects of isometric exercise on the contralateral and distant body parts are similar in magnitude to the local body part.

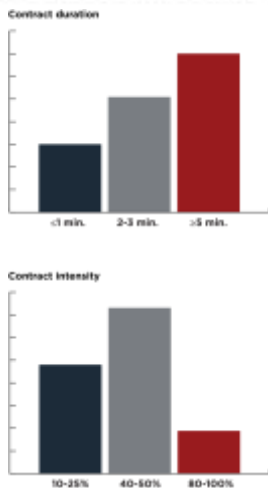


Naugle KM, Fillingim RB, Riley JL, 3rd. A meta-analytic review of the hypoalgesic effects of exercise. The journal of pain : official journal of the American Pain Society. Dec 2012;13(12):1139-1150.

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Isometric: Dosage



Name _____ Date _____

R_x

- Longer duration
- 40-50% MVC

MD _____

Signature _____

Smith, A., C. Ritchie, A. Pedler, K. McCamley, K. Roberts and M. Sterling (2017). "Exercise induced hypoalgesia is elicited by isometric, but not aerobic exercise in individuals with chronic whiplash associated disorders." *Scand J Pain* 15: 14-21.



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Movement as Antigen?

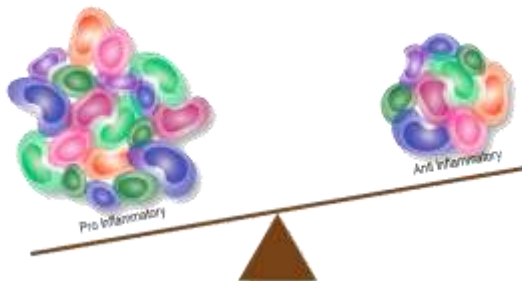
- Antigens stimulate immune responses
- Synapses are influenced by glial cells
- Vigorous movement/exercise – pro-inflammatory
- Moderate movement/exercise – anti-inflammatory

Pedersen BK, Toft AD. Effects of exercise on lymphocytes and cytokines. *British journal of sports medicine*. Aug 2000;34(4):246-251.
 Thacker MA, Clark AK, Marchand F, McMahon SB. Pathophysiology of peripheral neuropathic pain: immune cells and molecules. *Anesth Analg*. 2007;105:838-847.

IL-1, IL-2, IL-6, IL-8, IL-12, TNF- α , INF- α , IFN- γ

IL-4, IL-10, IL-13, TGF- β

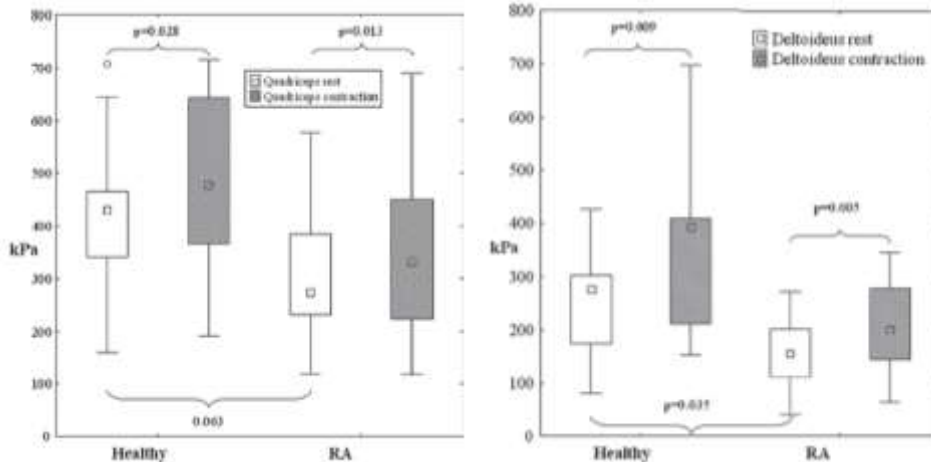
physiologyonline.physiology.org



128

After exercises RA patient's pain improves similar to healthy controls...

Friden C, Thoors U, Glenmark B, et al. Higher pain sensitivity and lower muscle strength in postmenopausal women with early rheumatoid arthritis compared with age-matched healthy women—a pilot study. *Disability and rehabilitation*. Aug 2013;35(16):1350-1356.



129

RA, Inflammation and Movement...

Growing body of evidence showing exercise:

- Reduces disease process
- Anti-inflammatory effect
- Does not increase, but rather decrease pain



Stenstrom CH, Minor MA. Evidence for the benefit of aerobic and strengthening exercise in rheumatoid arthritis. *Arthritis and rheumatism*. Jun 15 2003;49(3):428-434.
 Hurkmans E, van der Giesen FJ, Vliet Vlieland TP, Schoones J, Van den Ende EC. Dynamic exercise programs (aerobic capacity and/or muscle strength training) in patients with rheumatoid arthritis. The Cochrane database of systematic reviews. Oct 07 2009(4):CD006853.
 Wadley AJ, Veldhuijzen van Zanten JJ, Stavropoulos-Kalinoglou A, et al. Three months of moderate-intensity exercise reduced plasma 3-nitrotyrosine in rheumatoid arthritis patients. *European journal of applied physiology*. 2014;114(7):1483-1492.

130



Exercise in RA Patients

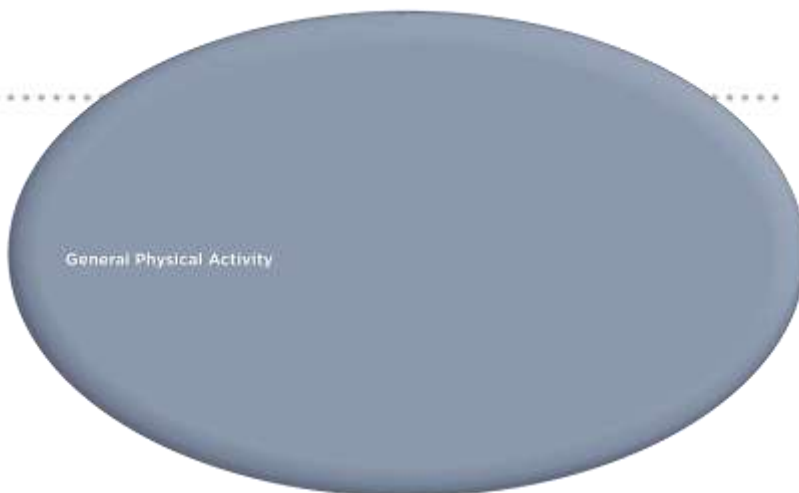
- 71% of RA patients do little/no physical activity
- 15% of RA patients do physical activity 1-2x/week
- 14% of RA patients do physical activity > 3x/week



Sokka T, Hakkinen A, Kautiainen H, et al. Physical inactivity in patients with rheumatoid arthritis: data from twenty-one countries in a cross-sectional, international study. *Arthritis and rheumatism*. Jan 15 2008;59(1):42-50.



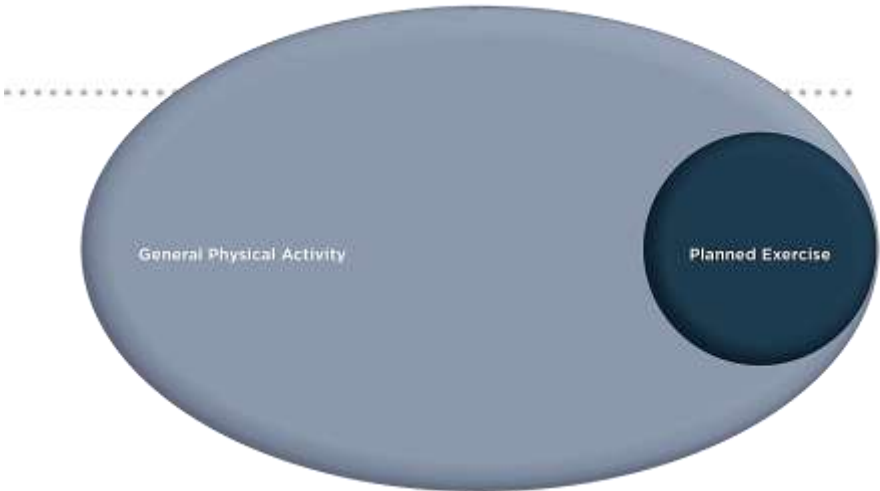
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General Physical Activity:
During the course of the day and being alive, you exert general activity, for example, getting up from your chair to go to the restroom, walking to your car, bending to tie shoes, etc.



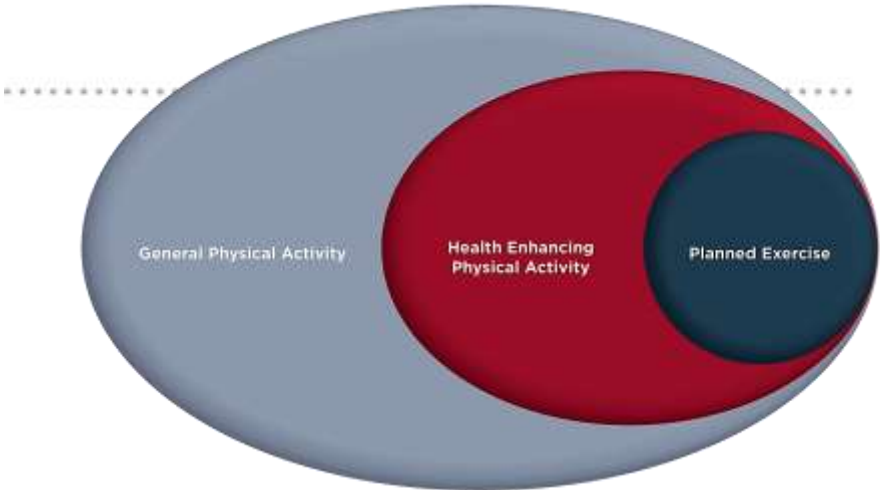
132



General Physical Activity:
 During the course of the day and being alive, you exert general activity, for example, getting up from your chair to go to the restroom, walking to your car, bending to tie shoes, etc.

Planned Exercise:
 Planned exercise is the deliberate activity of engaging in pre-planned exercise. According to the American College of Sports Medicine a weekly goal of 150 minutes should be set, or at least 3 sets of 20 minutes of vigorous exercise per week. This may include jogging, swimming, walking program and weight training.

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General Physical Activity:
 During the course of the day and being alive, you exert general activity, for example, getting up from your chair to go to the restroom, walking to your car, bending to tie shoes, etc.

Health Enhancing Physical Activity:
 Health enhancing physical activity (HEPA) is the deliberate attempt at doing activities towards your general health on a regular basis. Good examples include taking the stairs more often, standing at your desk versus sitting all the time, etc. This is deliberate, but generalized.

Planned Exercise:
 Planned exercise is the deliberate activity of engaging in pre-planned exercise. According to the American College of Sports Medicine a weekly goal of 150 minutes should be set, or at least 3 sets of 20 minutes of vigorous exercise per week. This may include jogging, swimming, walking program and weight training.

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Kory Zimney, PT, DPT



“I think many studies will find high intensity is better than low intensity or just increased ADL's for reducing pain, improving quality of life, and other biomarkers.

The point needs to be made that a high intensity program that an individual is non-compliant with is NOT as good as a low intensity program an individual is compliant with.”



135

Sitting is the new Smoking



Rezende LF, Sa TH, Mielke GI, Viscondi JY, Rey-Lopez JP, Garcia LM. All-Cause Mortality Attributable to Sitting Time: Analysis of 54 Countries Worldwide. *Am J Prev Med.* Aug 2016;51(2):253-263.



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Strategies to consider...

- Exercise log book
- No more than 5 exercises for home exercise program
- Educate AND exercise
- Make it personal
- Control/manage pain
- Keep instructions simple
- Motivate patients
- Low cost equipment

- Moseley GL. Do training diaries affect and reflect adherence to home programs? *Arthritis Rheum.* Aug 15 2006;55(4):662-664.
- Hurling R, Catt M, Boni MD, et al. Using internet and mobile phone technology to deliver an automated physical activity program: randomized controlled trial. *J Med Internet Res.* 2007;9(2):e7.
- Mailloux J, Finno M, Rainville J. Long-term exercise adherence in the elderly with chronic low back pain. *Am J Phys Med Rehabil.* Feb 2006;85(2):120-126.
- Medina-Mirapeix F, Escolar-Reina P, Gascon-Canovas JJ, Montilla-Herrador J, Collins SM. Personal characteristics influencing patients' adherence to home exercise during chronic pain: a qualitative study. *Journal of Rehabilitation Medicine.* Apr 2009;41(5):347-352.
- Duncan KA, Pozehl B. Staying on course: the effects of an adherence facilitation intervention on home exercise participation. *Prog Cardiovasc Nurs.* Spring 2002;17(2):59-65, 71.
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- Medina-Mirapeix F, Escolar-Reina P, Gascon-Canovas JJ, Montilla-Herrador J, Collins SM. Personal characteristics influencing patients' adherence to home exercise during chronic pain: a qualitative study. *Journal of Rehabilitation Medicine.* Apr 2009;41(5):347-352.
- Mori DL, Sogg S, Guarino P, et al. Predictors of exercise compliance in individuals with Gulf War veterans illnesses: Department of Veterans Affairs Cooperative Study 470. *Mil Med.* Sep 2006;171(9):917-923.



137

Current Best Evidence Gold Level Evidence Cochrane Reviews

1. ~~Cognitive Therapy~~
2. ~~Movement/exercise~~
3. Medication to “calm” the nervous system

- Bernardy K, Klose P, Busch AJ, Choy EH, Hauser W. Cognitive behavioural therapies for fibromyalgia. *The Cochrane database of systematic reviews.* 2013;9:CD009796.
- Busch A, Schachter CL, Peloso PM, Bombardier C. Exercise for treating fibromyalgia syndrome. *The Cochrane database of systematic reviews.* 2002(3):CD003786.
- Lunn MP, Hughes RA, Wiffen PJ. Duloxetine for treating painful neuropathy, chronic pain or fibromyalgia. *The Cochrane database of systematic reviews.* 2014;1:CD007115.
- Larun L, Brurberg KG, Odgaard-Jensen J, Price JR. Exercise therapy for chronic fatigue syndrome. *The Cochrane database of systematic reviews.* 2015;2:CD003200.
- Halperin JJ. Chronic Lyme disease: misconceptions and challenges for patient management. *Infect Drug Resist.* 2015;8:119-128.
- Huertas-Ceballos A, Logan S, Bennett C, Macarthur C. Psychosocial interventions for recurrent abdominal pain (RAP) and irritable bowel syndrome (IBS) in childhood. *The Cochrane database of systematic reviews.* 2008(1):CD003014.
- Price JR, Mitchell E, Tidy E, Hunot V. Cognitive behaviour therapy for chronic fatigue syndrome in adults. *The Cochrane database of systematic reviews.* 2008(3):CD001027.



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Skillful delivery of medicine...

- Membrane stabilizers
- Low dose anti-depressants



Derry S, Gill D, Phillips T, Moore RA. Milnacipran for neuropathic pain and fibromyalgia in adults. *The Cochrane database of systematic reviews*. 2012;3:CD008244.
 Hauser W, Urrutia G, Tort S, Uceyler N, Walitt B. Serotonin and noradrenaline reuptake inhibitors (SNRIs) for fibromyalgia syndrome. *The Cochrane database of systematic reviews*. 2013;1:CD010292.
 Lunn MP, Hughes RA, Wiffen PJ. Duloxetine for treating painful neuropathy, chronic pain or fibromyalgia. *The Cochrane database of systematic reviews*. 2014;1:CD007115.



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PNE+: A non-pharmacological program

- PNE
- Nutrition
- Breathing
- Biofeedback
- Graded motor imagery
- Safe, healing environment with compassion and empathy
- Manual therapy
- Neural mobilization
- Modalities
- Yoga
- Relaxation and meditation
- Aerobic exercise
- Humor
- Aquatic therapy
- Social interaction
- Coping skills
- Sleep hygiene
- Soft tissue/trigger point therapy
- Stabilization and resistance training
- Journaling
- Stretches, movement and body awareness
- Posture and position of power and confidence

Louw A, Puentedura E, Schmidt S, Zimney K. *Pain Neuroscience Education*. Vol 2. Minneapolis, MN: OPTP; 2018.



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Louw A, Puentedura E, Schmidt S, Zimney K. Pain Neuroscience Education. Vol 2. Minneapolis, MN: OPTP; 2018.



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Sleep Hygiene

Heart Attack:

- Daylight saving time: 25% increase in heart attack Monday after losing an hour sleep and risk falls 21% when 1h is added (46% shift)

Driving:

- 2 million people per week in the US will fall asleep driving
- Every 30 seconds there is a crash in the U.S. caused by sleepiness

Diabetes:

- Significantly higher rates of type 2 DM in people who sleep less than 6 hours regularly

Sandhu A, Seth M, Gurm HS. Daylight savings time and myocardial infarction. *Open Heart* 2014;1:e000019. doi:10.1136/openhrt-2013000019

Walker, M. *Why We Sleep: Unlocking the power of sleep and dreams*. 2017. Scribner, New York, NY.



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Calming Nerves: Sleep Hygiene

Below is a list of strategies to help you develop a healthy sleeping pattern. Choose one every day, and over time you will see the benefit. Use this as your sleep checklist:

- Set a time to go to bed—before 11pm.
- Quiet the house by turning off the computer and the TV.
- Reduce fluid intake in the evening.
- Reduce alcoholic beverages in the late evening.
- Darken and cool the bedroom.
- Remove kids and pets from your bed (no bed buddies).
- Park your ideas. Place a notepad and pen next to your bed.
- Relax, meditate or read a book before bed.
- Avoid checking e-mails or messages before bed.
- Stay in bed. If you cannot sleep, close your eyes and relax.
- Set a wake time, and stay in bed until then.
- Eliminate naps. If naps are needed, limit them to power naps of fewer than 20 minutes.
- Avoid caffeine in the late afternoons or evenings.
- Exercise during the day.

Louw A, Puentedura E. *Therapeutic Neuroscience Education: Teaching patients about pain*. Minneapolis, MN: OPTP; 2013.

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Coping Skills

1. Problem solve
2. Ice/Heat/TENS
3. Red dot stretches/exercises
4. Get away
5. Prioritize

Keefe FJ, Caldwell DS, Williams DA, et al. Pain coping skills training in the management of osteoarthritic knee pain: a comparative study. *Behaviour Therapy*. 1990;21:49-62.

Riddle DL, Keefe FJ, Nay WT, McKee D, Attarian DE, Jensen MP. Pain coping skills training for patients with elevated pain catastrophizing who are scheduled for knee arthroplasty: a quasi-experimental study. *Archives of physical medicine and rehabilitation*. Jun 2011;92(6):859-865.

Nielsen M, Keefe FJ, Bennell K, Jull GA. Physical therapist-delivered cognitive-behavioral therapy: a qualitative study of physical therapists' perceptions and experiences. *Physical therapy*. Feb 2014;94(2):197-209.

Gifford LS, ed *Topical Issues in Pain*. Falmouth: NOI Press; 1998.

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Social Interaction



Valtorta NK, Kanaan M, Gilbody S, Ronzi S, Hanratty B. Loneliness and social isolation as risk factors for coronary heart disease and stroke: systematic review and meta-analysis of longitudinal observational studies. *Heart*. Jul 01 2016;102(13):1009-1016.

Holt-Lunstad J, Smith TB, Baker M, Harris T, Stephenson D. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspect Psychol Sci*. Mar 2015;10(2):227-237.

Yang YC, Boen C, Gerken K, Li T, Schorpp K, Harris KM. Social relationships and physiological determinants of longevity across the human life span. *Proc Natl Acad Sci U S A*. Jan 19 2016;113(3):578-583.



145

Modalities



Kroeling P, Gross A, Goldsmith CH, et al. Electrotherapy for neck pain. *The Cochrane database of systematic reviews*. 2009(4):CD004251.

Iversen MD, Chhabriya RK, Shadick N. Predictors of the use of physical therapy services among patients with rheumatoid arthritis. *Physical therapy*. Jan 2011;91(1):65-76.



146

Aquatic Therapy



Evcik D, Yigit I, Pusak H, Kavuncu V. Effectiveness of aquatic therapy in the treatment of fibromyalgia syndrome: a randomized controlled open study. *Rheumatol Int.* Jul 2008;28(9):885-890.

Louw A, Puente-dura EL, Mintken P. Use of an abbreviated neuroscience education approach in the treatment of chronic low back pain: a case report. *Physiotherapy theory and practice.* Jan 2012;28(1):50-62.

Baena-Beato PA, Artero EG, Arroyo-Morales M, Robles-Fuentes A, Gatto-Cardia MC, Delgado-Fernandez M. Aquatic therapy improves pain, disability, quality of life, body composition and fitness in sedentary adults with chronic low back pain. A controlled clinical trial. *Clinical rehabilitation.* Apr 2014;28(4):350-360.



147

Welcoming, safe, healing environment



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. *Physical therapy.* Apr 2013;93(4):470-478.

Fuentes J, Armijo-Olivo S, Funabashi M, et al. Enhanced therapeutic alliance modulates pain intensity and muscle pain sensitivity in patients with chronic low back pain: an experimental controlled study. *Physical therapy.* Apr 2014;94(4):477-489.

Benz L. Called to Care. Pennsylvania: Psychology, University of Pennsylvania; 2013.



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Goal Setting/Pacing

- Functional
- Job
- Social



DEEP DESIRES

Schmidt SG. Recognizing potential barriers to setting and achieving effective rehabilitation goals for patients with persistent pain. *Physiotherapy Theory and Practice*. Jul 2016;32(5):415-426.



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Goal Setting/Pacing/Graded Exposure

Patient Example:

- Meals ←
- Laundry
- Sweeping floors
- Answering e-mails
- Weeding a garden
- Walking
- Sex
- Etc.

7:00 - 8:00	Kids off to school	
8:00 - 8:05	<u>Dinner preparation</u>	
8:05 - 8:50	Morning walk	
8:50 - 11:00	House work	
11:00 - 11:05	<u>Dinner preparation</u>	
11:05 - 11:30	Stretching, meditation	
11:30 - 12:15	Music	
12:15 - 12:30	Short walk	20 minutes
12:30 - 1:30	House work	
1:30 - 1:35	<u>Dinner preparation</u>	
1:35 - 2:10	Rest / Read	
2:10 - 3:00	House work	
3:00 - 3:05	<u>Dinner preparation</u>	
3:05 - 4:30	Kids home work	
4:30 - 5:00	Walk - with kids	
5:00	Dinner - put it all together...	



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Goal Setting/Pacing

- Be specific:
 - Charity walk
 - Gardening
 - Party



Schmidt SG. Recognizing potential barriers to setting and achieving effective rehabilitation goals for patients with persistent pain. *Physiotherapy Theory and Practice*. Jul 2016;32(5):415-426.



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Treat the Patient, not the Label

- ✓ They Hurt
- ✓ They're Tired
- ✓ They've been Everywhere
- ✓ They need someone to:
 - Listen
 - Be Compassionate and Empathetic
 - Examine them thoroughly
 - Explain why they hurt
 - Become “healthier”
 - Give them hope...

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



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Final evidence....

The results of this updated systematic review of PNE for MSK pain provides strong evidence for PNE improving pain ratings, pain knowledge, disability, pain catastrophization, fear-avoidance, attitudes and behaviors regarding pain, physical movement and healthcare utilization



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 Louw A, Diener I, Butler DS, Puentedura EJ. The effect of neuroscience education on pain, disability, anxiety, and stress in chronic musculoskeletal pain. *Archives of physical medicine and rehabilitation*. Dec 2011;92(12):2041-2056.
 Moore RA, Wiffen PJ, Derry S, McQuay HJ. Gabapentin for chronic neuropathic pain and fibromyalgia in adults. *The Cochrane database of systematic reviews*. 2011(3):CD007938.
 Lynch ME, Watson CP. The pharmacotherapy of chronic pain: a review. *Pain research & management*. Spring 2006;11(1):11-38.



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PNE for Acute LBP

- 80 patients with acute LBP
- Subjective and Objective measures
- PNE 10-15 minutes
- Re-measure:
 - Flexion
 - SLR
 - Pain rating
 - GROC



Louw, Farrell, Puentedura, et. al. – Journal of Manual and Manipulative Therapy 2019

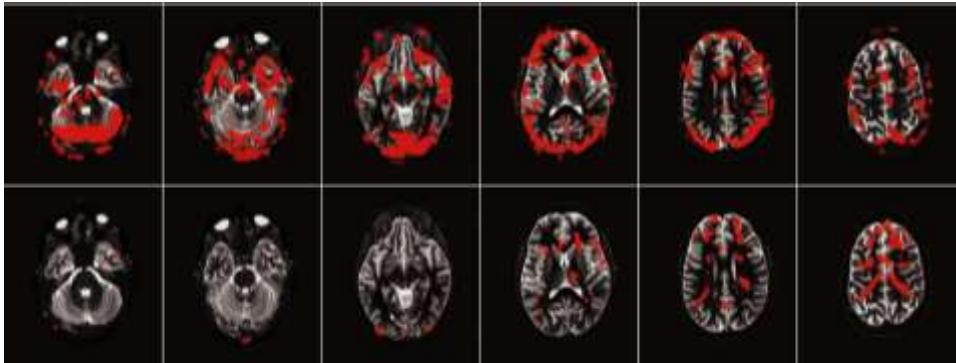


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Therapeutic Neuroscience Education

Now it's your turn...

To turn a brain from one that is extremely threatened,
confused & hopeless...



...into one that understands, is less threatened & has hope.

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**ALL individuals have an untapped potential
for improvement**

Herman Kabat, MD, PhD



KP Heritage Resources

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