Teaching People About Pain

Pain Neuroscience Education

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International Spine & Pain Institute

EIM Evidence in Motion

TNRG Therapeutic Neuroscience Research Group

UNLV

St Ambrose University

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Disclaimers...

I publish books on pain and receive an honorarium for the sales. These are not being promoted in the presentation. The intent is to share our research and not promote products

I co-own and teach for a seminar company offering continuing education for healthcare providers. The session is not designed to promote the attendance of the seminars

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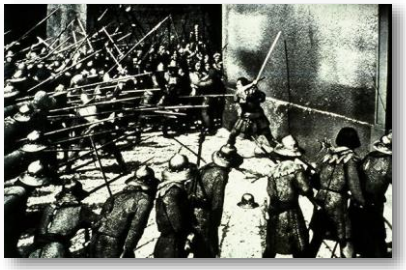

Wolff MS, Hoskins Michel T, Krebs DE, Watts NT. Chronic pain- assessment of orthopedic physical therapist's knowledge and attitudes. *Physical Therapy.* 1991;71:207-214.

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

Louw A, Louw Q, Crous LCC. Preoperative Education for Lumbar Surgery for Radiculopathy. South African Journal of Physiotherapy. July 2009 2009;65(2):3-8.

Moseley GL. Unravelling the barriers to reconceptualisation of the problem in chronic pain: the actual and perceived ability of patients and health professionals to understand the neurophysiology. J Pain. 2003;4(4):184-189.

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Global Burden of Disease Study C. Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013. Lancet. Aug 22 2015;386(9995):743-800.

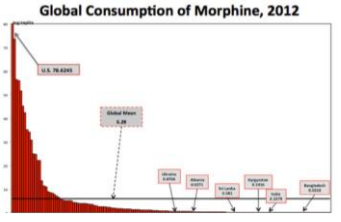
Woolf AD, Pfleger B. Burden of major musculoskeletal conditions. Bull World Health Organ. 2003;81(9):646-656.

>100 Million Americans have some form of persistent pain

Institute of Medicine 2012: Relieving Pain in America

CDC Centers for Disease Control and Prevention

US Opioid Epidemic...



Americans, constituting only 5% of the world's population, have been consuming 80% of the global opioid supply, and 99% of the global hydrocodone supply.

Manchikanti, L., et al., *Therapeutic use, abuse, and nonmedical use of opioids: a ten-year perspective.* Pain physician, 2010. 13(5): p. 401-35.

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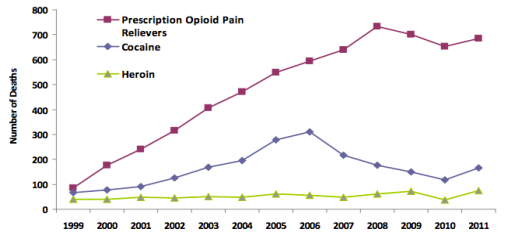
US Opioid Epidemic…



Patrick, S.W., et al., *Implementation Of Prescription Drug Monitoring Programs Associated With Reductions In Opioid-Related Death Rates.* Health affairs, 2016.

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Early History of Pain

- Aristotle: "*Passion of the soul*"
- Hippocrates: "*Fluid imbalance*"
- Prior to Renaissance: "*Punishment or test from God*"
- Chinese Medicine (3000 years ago)" *Ying and yang*"

Moayedi M, Weissman-Fogel I, Crawley AP, et al. Contribution of chronic pain and neuroticism to abnormal forebrain gray matter in patients with temporomandibular disorder. *Neuroimage.* Mar 1 2011;55(1):277-286.

Bonica JJ. History of pain concepts and pain therapy. The Mount Sinai journal of medicine, New York. May 1991;58(3):191-202.

Chen J. History of pain theories. Neurosci Bull. Oct 2011;27(5):343-350.

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Rene and the Renaissance Period

- Mechanical view
- Hollow tube with a cord, valves and spirits

Chen J. History of pain theories. *Neurosci Bull.* Oct 2011;27(5):343-350.

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Avoid the Fire…how is that working out?

Vlaeyen JW, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. Pain. Apr 2000;85(3):317-332.

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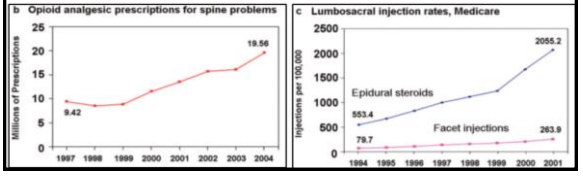
Putting Out Fires

Medical

- Injections
- Medication
- 629% increase in Medicare expenditures for epidural steroid injections
- 423% increase in expenditures for opioids for back pain in Medicare patients

Martin BI, Turner JA, Mirza SK, Lee MJ, Comstock BA, Deyo RA. Trends in health care expenditures, utilization, and health status among US adults with spine problems, 1997-2006. *Spine (Phila Pa 1976).* Sep 1 2009;34(19):2077-2084.



Cutting Cords

Medical

- Surgery
- Nerve ablation/ radiofrequency

Bogduk N. Pulsed radiofrequency. *Pain Med.* Sep-Oct 2006;7(5):396-407.

Bogduk N. Diagnosing lumbar zygapophysial joint pain. Pain Med. Mar-Apr 2005;6(2):139-142.

Atlas SJ, Keller RB, Wu YA, Deyo RA, Singer DE. Long-term outcomes of surgical and nonsurgical management of lumbar spinal stenosis: 8 to 10 year results from the maine lumbar spine study. Spine (Phila Pa 1976). Apr 15 2005;30(8):936-943

Korres DS, Loupassis G, Stamos K. Results of lumbar discectomy: a study using 15 different evaluation methods. European Spine Journal 1992;1:20–4

Findlay GF, Hall BI, Musa BS, Oliveria MD, Fear SC. A 10-year follow-up of the outcome of lumbar microdiscectomy. Spine 1998; 23:1168–71

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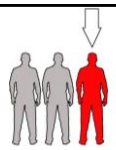
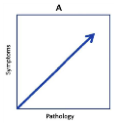
Cutting Cords



It can easily be stated that at least 1/3 of lumbar surgery patients continue to have significant persistent pain, disability and functional loss.

Atlas SJ, Keller RB, Wu YA, Deyo RA, Singer DE. Long-term outcomes of surgical and nonsurgical management of lumbar spinal stenosis: 8 to 10 year results from the maine lumbar spine study. *Spine (Phila Pa 1976)*. Apr 15 2005;30(8):936-943
Korres DS, Loupassis G, Stamos K. Results of lumbar discectomy: a study using 15 different evaluation methods. *European Spine Journal* 1992;1:20–4
Findlay GF, Hall BI, Musa BS, Oliveria MD, Fear SC. A 10-year follow-up of the outcome of lumbar microdiscectomy. *Spine* 1998; 23:1168–71
Loupasis GA, Stamos K, Katonis PG, Sapkas G, Korres DS,Hartofilakidis G. Seven- to 20-year outcome of lumbar discectomy. *Spine* 1999;24:2313–7.
Yorimitsu E, Chiba K, Toyama Y, et al.Long term outcomes of standard discectomy for Lumbar Disc Herniation. *Spine* 2001;26:652– 8.
Gibson JN, Waddell G. Surgery for degenerative lumbar spondylosis: updated Cochrane Review. Spine. Oct 15 2005;30(20):2312-2320.
Button G, Gupta M, Barrett C, Cammack P, Benson D. Three- to six-year follow-up of stand-alone BAK cages implanted by a single surgeon. Spine J. Mar-Apr 2005;5(2):155-160.

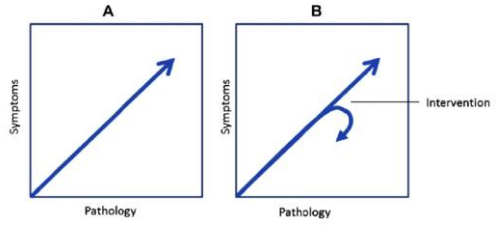
What's wrong with Rene?



- Assumption: there is a direct link between the amount of tissue damage and the level of pain experienced. (Patients truly believe this)
- All pain is caused by injury and increased pain means more damage
- Pain is either physical or psychological (mental versus physical)
- In chronic pain tissues are not healing and damage is ongoing
- Nociception and pain is synonymous

Louw A, Butler DS. Chronic Pain. In: S.B. B, Manske R, eds. Clinical Orthopaedic Rehabilitation. 3rd Edition ed. Philadelphia, PA: Elsevier; 2011.
Wade, D., *Why physical medicine, physical disability and physical rehabilitation? We should abandon Cartesian dualism.* Clin Rehab, 2006. **20**: p. 85-90.

The REAL issue...



Halderman S. Presidential address, North American Spine Society: failure of the pathology model to predict back pain. *Spine*. 1990;15(7):718-724.

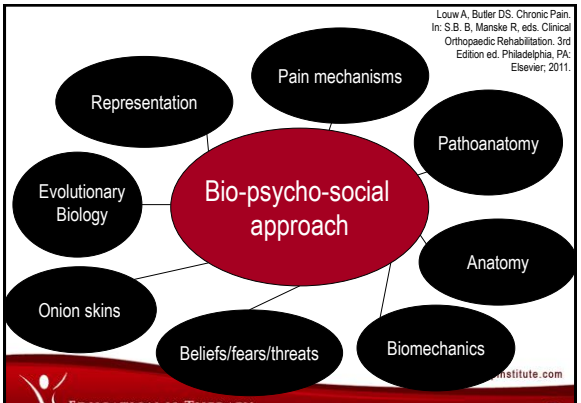
This happens...

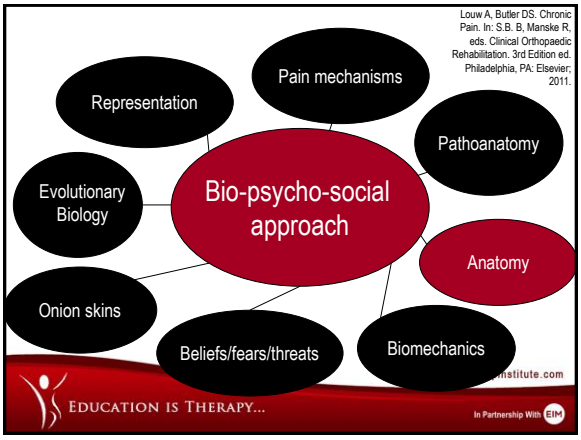
Iwamoto J, Takeda T, Wakano K. Returning athletes with severe low back pain and spondylolysis to original sporting activities with conservative treatment. *Scand J Med Sci Sports*. Dec 2004;14(6):346-351.

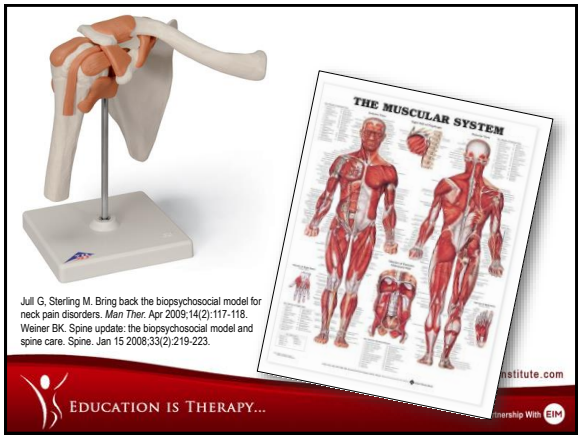
This also happens (thank goodness)

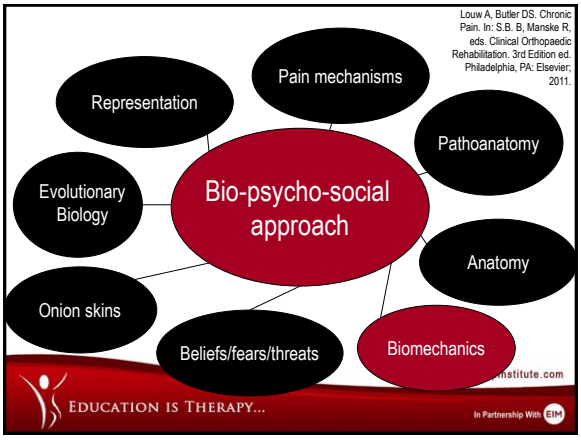
Louw A, Puentedura EJ, Zimney K. A clinical contrast: physical therapists with low back pain treating patients with low back pain. *Physiotherapy Theory and Practice*. Nov 2015;31(8):562-567.
Simotas AC, Shen T. Neck pain in demolition derby drivers. Arch Phys Med Rehabil. Apr 2005;86(4):693-696.

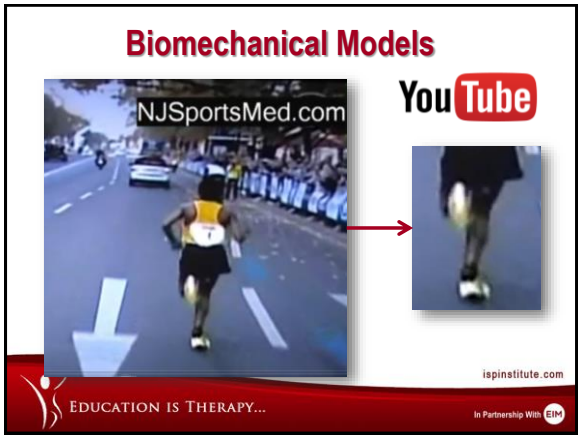
Louw A, Butler DS. Chronic Pain. In: S.B. B, Manske R, eds. Clinical Orthopaedic Rehabilitation. 3rd Edition ed. Philadelphia, PA: Elsevier; 2011.

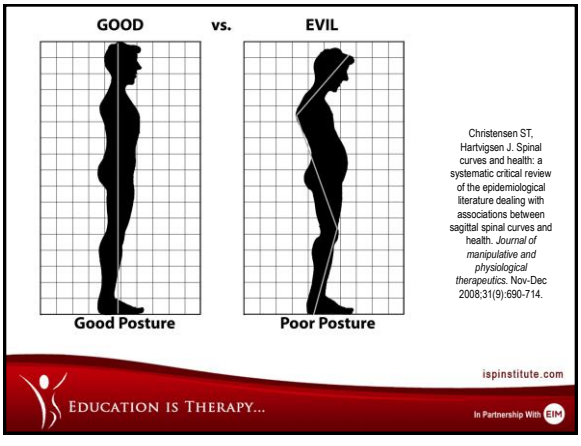


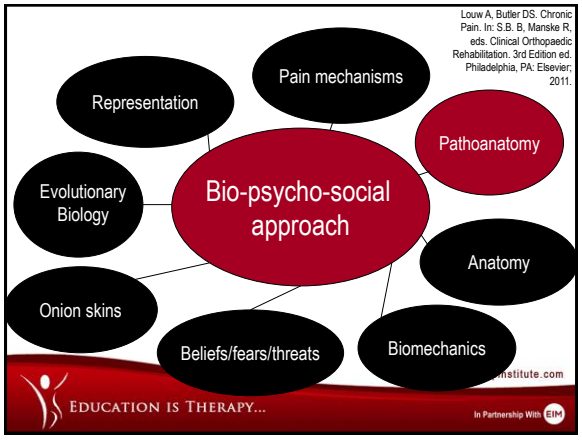












Tissue Pathology

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.

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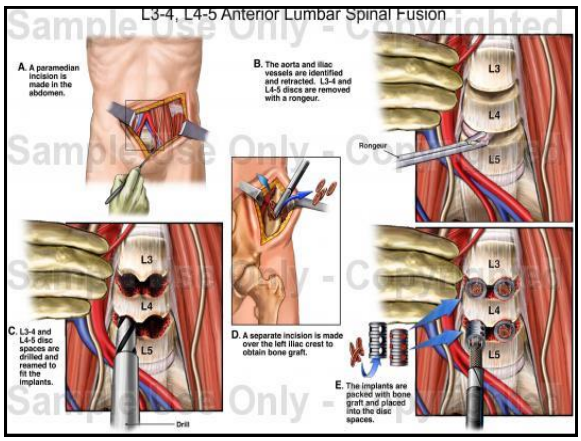

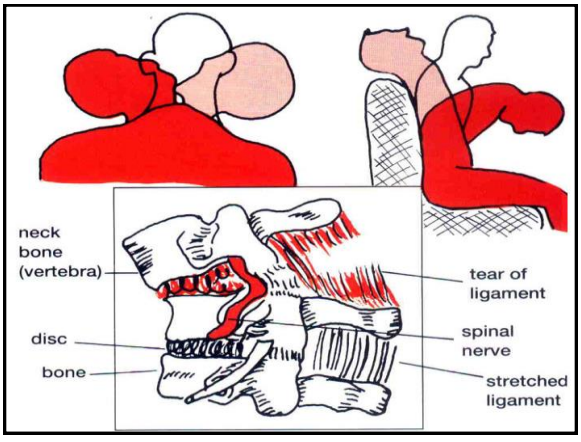

These models are very prevalent

- Prevailing biomedical models focus on tissues and tissue injury
- Orthopedic-based professions commonly use anatomy and patho-anatomy based models to explain pain to their patients

Houben RM, Ostelo RW, Vlaeyen JW, Wolters PM, Peters M, Stomp-van den Berg SG. Health care providers' orientations towards common low back pain predict perceived harmfulness of physical activities and recommendations regarding return to normal activity. *Eur J Pain.* Apr 2005;9(2):173-183.
Henrotin YE, Cedraschi C, Duplan B, Bazin T, Duquesnoy B. Information and low back pain management: a systematic review. Spine. May 15 2006;31(11):E326-334.
Weiner BK. Spine update: the biopsychosocial model and spine care. Spine. Jan 15 2008;33(2):219-223.
Spoto MM, Collins J. Physiotherapy diagnosis in clinical practice: a survey of orthopaedic certified specialists in the USA. Physiother Res Int. Mar 2008;13(1):31-41.

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Research into anatomy, biomechanical and pathoanatomy models

Not only have these models shown limited efficacy in decreasing pain and disability, but they may **increase fear in patients**, which in turn, may increase their pain

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.
Morr S, Shanti N, Carrer A, Kubeck J, Gerling MC. Quality of information concerning cervical disc herniation on the Internet. Spine J. Apr 2010;10(4):350-354.

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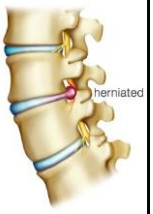
Don't think they believe this?

Patients who underwent discectomy and shown their "bad disc" material recovered significantly better than those who were not shown their excised disc material

- Leg pain (91.5 vs. 80.4%; p<0.05)
- Back pain (86.1 vs. 75.0%; p<0.05)
- Limb weakness (90.5 vs. 56.3%; p<0.02)
- Paraesthesia (88 vs. 61.9%; p<0.05)
- Reduced analgesic use (92.1 vs. 69.4%; p<0.02)



Tait MJ, Levy J, Nowell M, et al. Improved outcome after lumbar microdiscectomy in patients shown their excised disc fragments: a prospective, double blind, randomised, controlled trial. *J Neurol Neurosurg Psychiatry.* Sep 2009;80(9):1044-1046.

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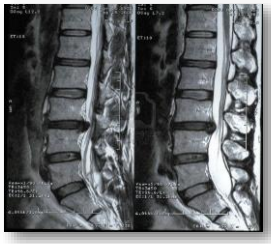
Lumbar Discs



40% of people with no back pain has a bulging disc

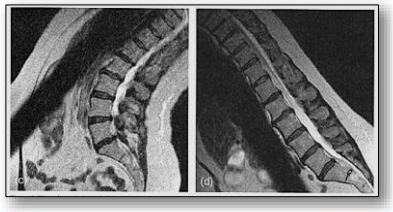
Disc bulges absorb

Yukawa Y, Kato F, Matsubara Y, Kajino G, Nakamura S, Nitta H. Serial magnetic resonance imaging follow-up study of lumbar disc herniation conservatively treated for average 30 months: relation between reduction of herniation and degeneration of disc. *J Spinal Disord*. Jun 1996;9(3):251-256.
Masui T, Yukawa Y, Nakamura S, et al. Natural history of patients with lumbar disc herniation observed by magnetic resonance imaging for minimum 7 years. *J Spinal Disord Tech*. Apr 2005;18(2):121-126.
Mochida K, Komori H, Okawa A, Muneta T, Haro H, Shinomiya K. Regression of cervical disc herniation observed on magnetic resonance images. *Spine*. May 1 1998;23(9):990-995; discussion 996-997.
Matsubara Y, Kato F, Mimatsu K, Kajino G, Nakamura S, Nitta H. Serial changes on MRI in lumbar disc herniations treated conservatively. *Neuroradiology*. Jul 1995;37(5):378-383.
Komori H, Okawa A, Haro H, Muneta T, Yamamoto H, Shinomiya K. Contrast-enhanced magnetic resonance imaging in conservative management of lumbar disc herniation. *Spine*. Jan 1 1998;23(1):67-73.

Lumbar Discs

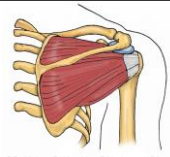
Discs respond and look different between static and movement-MRI and different positions

Miyazaki M, Hong SW, Yoon SH, et al. Kinematic analysis of the relationship between the grade of disc degeneration and motion unit of the cervical spine. *Spine (Phila Pa 1976)*. Jan 15 2008;33(2):187-193.



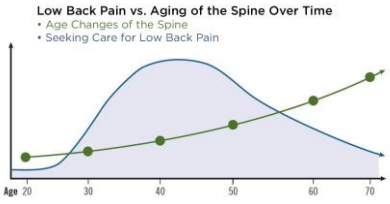
Rotator Cuff

- 1/3 people over age 30 has abnormal findings on MRI
- 2/3 people over age 70 has abnormal findings on MRI
- After successful rotator cuff surgery 90% of people have abnormal findings on MRI



Spielmann AL, Forster BB, Kokan P, Hawkins RH, Janzen DL. Shoulder after rotator cuff repair: MR imaging findings in asymptomatic individuals--initial experience. *Radiology*. Dec 1999;213(3):705-708.
Sher JS, Uribe JW, Posada A, Murphy BJ, Zlatkin MB. Abnormal findings on magnetic resonance images of asymptomatic shoulders. *The Journal of bone and joint surgery. American volume*. Jan 1995;77(1):10-15.
Reilly P, Macleod I, Macfarlane R, Windley J, Emery RJ. Dead men and radiologists don't lie: a review of cadaveric and radiological studies of rotator cuff tear prevalence. *Ann R Coll Surg Engl*. Mar 2006;88(2):116-121.
Milgrom C, Schaffler M, Gilbert S, van Holsbeeck M. Rotator-cuff changes in asymptomatic adults. The effect of age, hand dominance and gender. *J Bone Joint Surg Br*. Mar 1995;77(2):296-298.

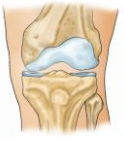
Aging and Low Back Pain



Taylor JR, Twomey LT. Age changes in lumbar zygapophyseal joints. Observations on structure and function. *Spine (Phila Pa 1976)*. Sep 1986;11(7):739-745.
Twomey L. Clinical Anatomy of the Lumbar Spine and Sacrum. Third ed. New York: Churchill Livingstone; 1997.

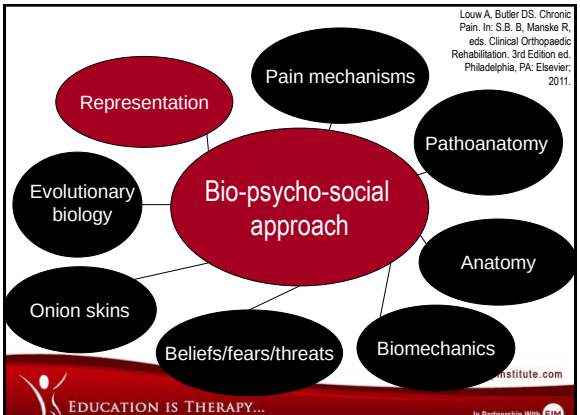
Knees

- 25% to 50% of MRI's show knee degeneration in pain-free people
- MRI scans of 35% of collegiate basketball players with no knee pain show significant abnormalities
- **1 in 3 knee replacements are unnecessary**



Munk B, Lundorf E, Jensen J. Long-term outcome of meniscal degeneration in the knee: poor association between MRI and symptoms in 45 patients followed more than 4 years. *Acta Orthop Scand*. Feb 2004;75(1):89-92.
Bedson J, Croft PR. The discordance between clinical and radiographic knee osteoarthritis: a systematic search and summary of the literature. *BMC musculoskeletal disorders*. 2008;9:116.
Major NM, Helms CA. MR imaging of the knee: findings in asymptomatic collegiate basketball players. *AJR Am J Roentgenol*. Sep 2002;179(3):641-644.
Riddle DL, Jiranek WA, Hayes CW. Use of a validated algorithm to judge the appropriateness of total knee arthroplasty in the United States: a multicenter longitudinal cohort study. Arthritis Rheumatol. Aug 2014;66(8):2134-2143.

Louw A, Butler DS. Chronic Pain. In: S.B. B, Manske R, eds. Clinical Orthopaedic Rehabilitation. 3rd Edition ed. Philadelphia, PA: Elsevier; 2011.



Would this hurt?

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

Louw A. *Why Do I Hurt? A Neuroscience Approach to Pain.* Minneapolis: OPTP; 2013.
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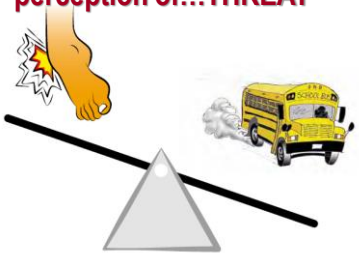
Pain is a decision by the brain based on perception of...THREAT



Louw A. *Why Do I Hurt? A Neuroscience Approach to Pain.* Minneapolis: OPTP; 2013.
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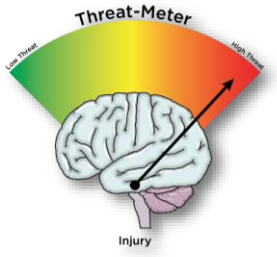
Pain is 100% produced by the brain...

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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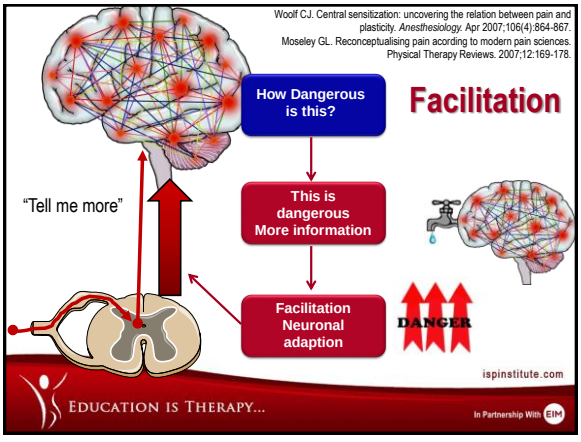
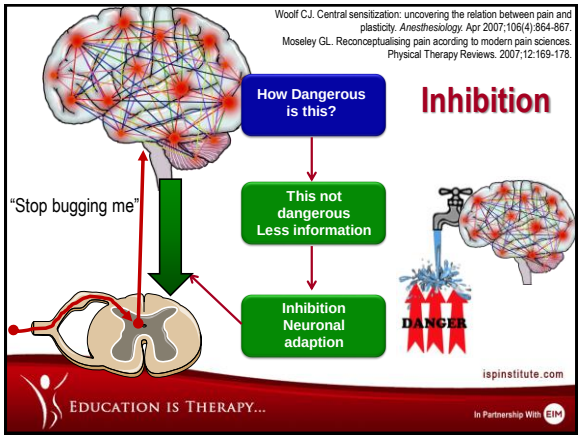
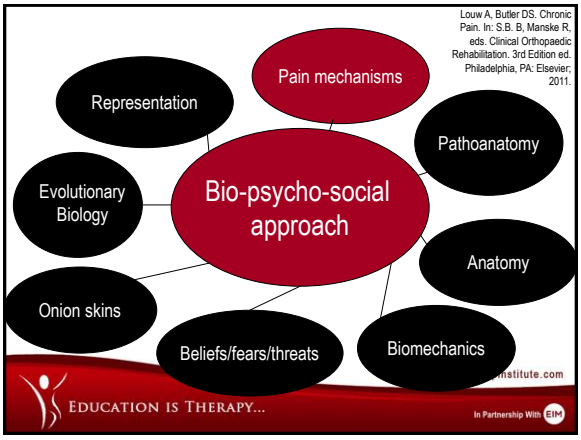
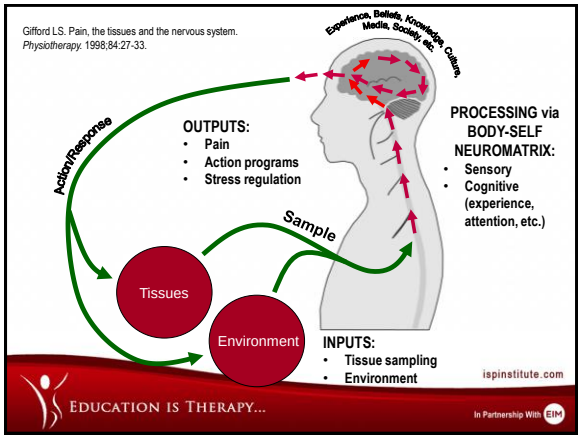
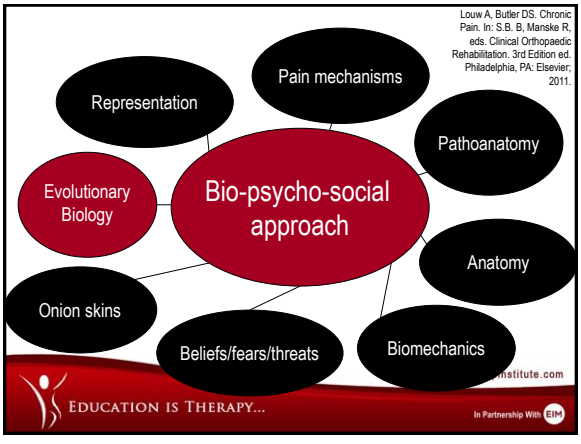
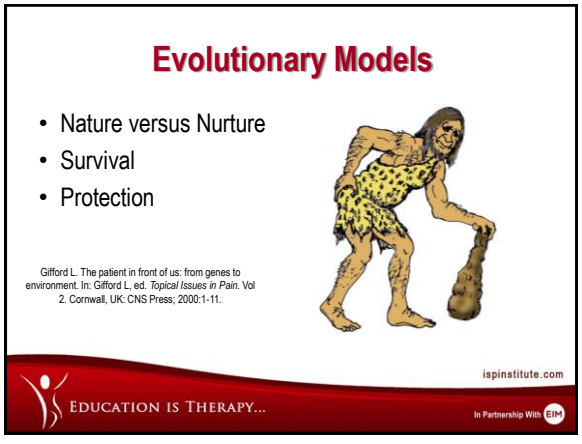


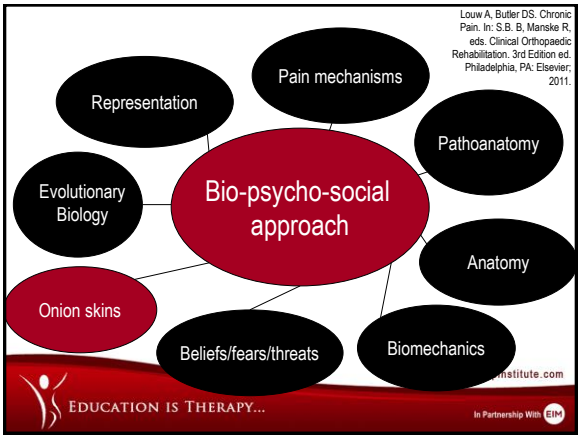


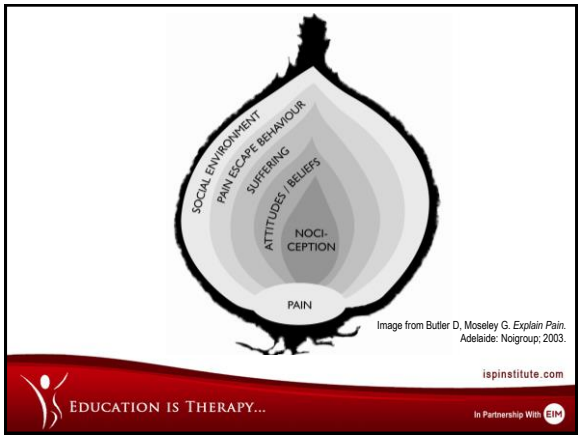


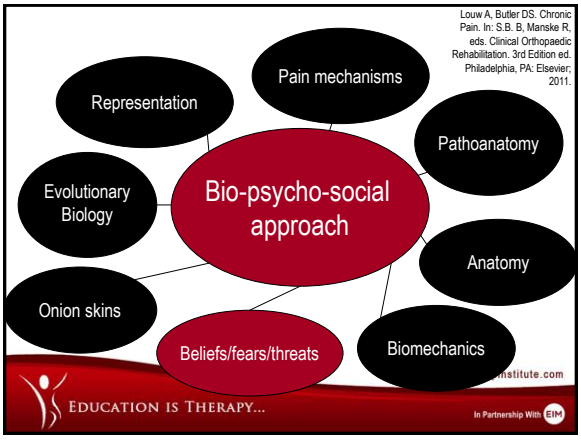


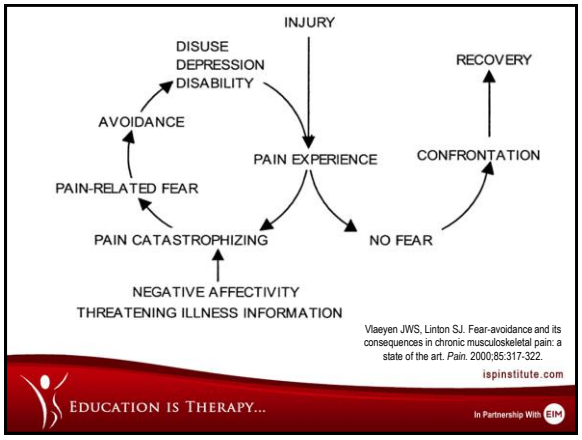


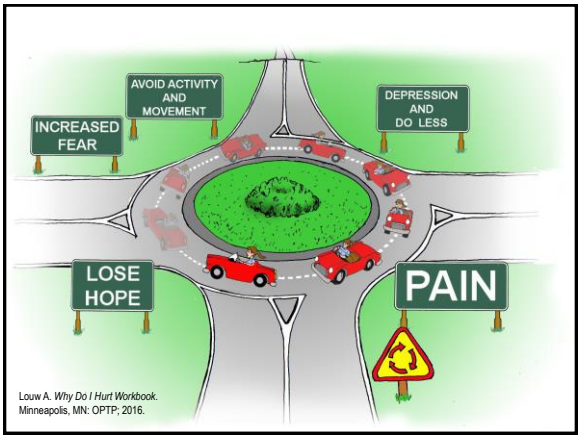


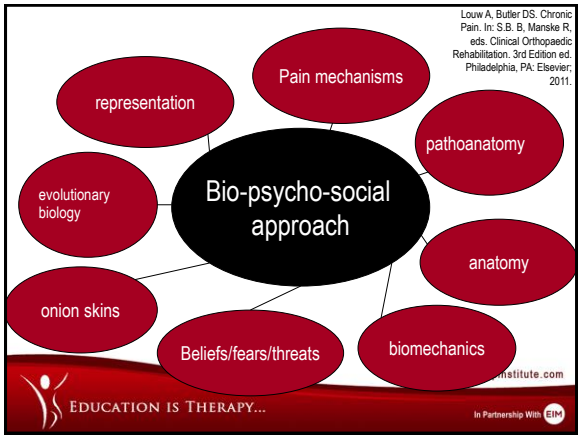


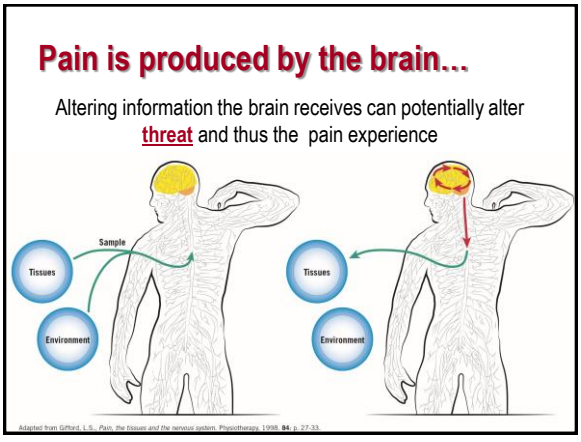


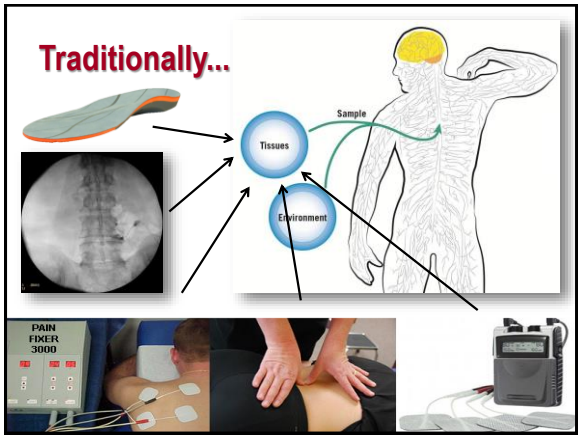




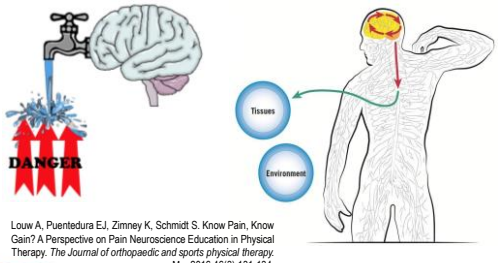








What about a top-down approach?



Louw 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.

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EDUCATION IS THERAPY... In Partnership With EIM

It is well established that cognitions are correlated to pain

- Fear
- Catastrophization
- Knowledge
- Anticipation and consequence of pain

Pain is complex
Pain and injury is the not the same thing
Injury may not result in pain
Pain can be present without injury or disease

Vlaeyen JWS, Kole-Snijders AMJ, Boeren RGB, van Eek H. Fear of movement/(re)injury in chronic low back pain and its relation to behavioural performance. *Pain.* 1995;62:363-372.
Kovacs FM, Seco J, Royuela A, Pena A, Muriel A. The correlation between pain, catastrophizing, and disability in subacute and chronic low back pain: a study in the routine clinical practice of the Spanish National Health Service. *Spine.* Feb 15 2011;36(4):339-345.
Moseley GL, Hodges PW, Nicholas MK. A randomized controlled trial of intensive neurophysiology education in chronic low back pain. *Clinical Journal of Pain.* 2004;20:324-330.Moseley GL. A pain neuromatrix approach to patients with chronic pain. *Man Ther.* Aug 2003;8(3):130-140.

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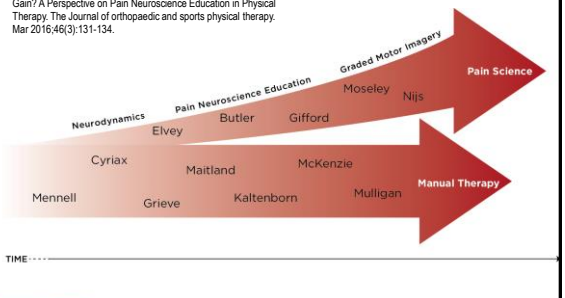
Gifford L. *Aches and Pain*. Cornwall: Wordpress; 2014.
Louw A, Puentedura EJ, Zimney K, Schmidt S. Know Pain, Know Gain? A Perspective on Pain Neuroscience Education in Physical Therapy. The Journal of orthopaedic and sports physical therapy. Mar 2016;46(3):131-134.



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The "ah-ha" moment...(for us)

EDUCATION IS THE

Teaching People About Pain...1998

embraced all the dimensions of pain. It was an honour to present the model, in my 'Explaining Pain to Patients' presentation at the International Association for the Study of Pain (IASP) world congress in Vienna in 1999.

PPA newsletter
The Physiotherapy Pain Association (for Chartered Physiotherapists)
April/May 1998

PPA members have put forward 3 proposed workshops, 2 of which have been accepted by the IASP congress committee. These are:
1. Explaining Pain to patients, family, health care professionals and employers.

Gifford L, Muncey H. Explaining Pain to Patients. Paper presented at: International Association on the Study of Pain1999; Vienna, Austria.

IASP International Association for the Study of Pain

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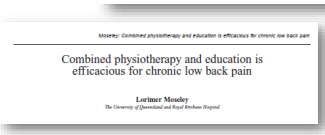
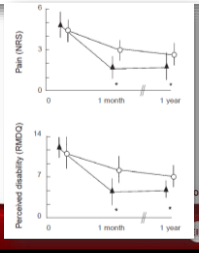
First RCT

Each subject participated in a one-hour education session, once per week for four weeks. The education session was in a one-to-one seminar format, was conducted by an independent therapist, and focused on the neurophysiology of pain with no particular reference to the lumbar spine. In addition, the subjects completed a short workbook which consisted of one page of revision material and three comprehension exercises per day for 10 days.





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

EDUCATION IS THERAPY...

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

2:1 PNE NNT for function

3:1 PNE NNT for pain

6:1 Gabapentin NNT for pain

7:1 Antidepressant (SSRI) NNT for pain

Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature. *Physiotherapy Theory and Practice.* Jul 2016;32(5):332-355.
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.

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PNE: Education Delivery Methods

Professionals
- Physical therapists

Duration and frequency
- High: 8 hours
- Low: 10-15 minutes

Educational format
- One-on-one verbal communication
- Two studies utilized group sessions.

Educational tools
- Prepared pictures
- Metaphors
- Hand drawings
- Workbook with reading/Q&A
- Neurophysiology questionnaire

Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature. *Physiotherapy Theory and Practice.* Jul 2016;32(5):332-355
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.

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PNE+

- Mobilization and manipulation
- Soft tissue massage
- Muscle and neural mobilization
- Trunk stabilization
- Circuit based aerobic exercise
- Movement exercises
- Pacing of ADLs
- Graded exposure with ADLs
- Trigger point dry needling
- Neck stabilization exercises
- Aquatic exercise program

Beltran-Alacreu, H., I. López-de-Uralde-Villanueva, et al. (2015). "Manual Therapy, Therapeutic Patient Education, and Therapeutic Exercise, an Effective Multimodal Treatment of Nonspecific Chronic Neck Pain: A Randomized Controlled Trial." American journal of physical medicine & rehabilitation/Association of Academic Physiatrists.
Meeus, M., J. Nijs, et al. (2010). "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." Archives of physical medicine and rehabilitation 91(8): 1153-1159.
Moseley, G. (2002). "Combined physiotherapy and education is efficacious for chronic low back pain." Aust J Physio 48: 297-302.
Moseley, G. L. (2003). "Joining Forces - Combining Cognition - Targeted Motor Control Training with Group or Individual PainPhysiology Education: A Successful Tretment For Chronic Low Back Pain." Journal of Manual & Manipulative Therapy 11(2): 88-94.
Pires, D., E. B. Cruz, et al. (2015). "Aquatic exercise and pain neurophysiology education versus aquatic exercise alone for patients with chronic low back pain: a randomized controlled trial." Clinical rehabilitation 29(6): 538-547.
Ryan, C. G., H. G. Gray, et al. (2010). "Pain biology education and exercise classes compared to pain biology education alone for individuals with chronic low back pain: a pilot randomised controlled trial." Manual therapy 15(4): 382-387.
Téllez-García, M., A. I. de-la-Llave-Rincón, et al. (2014). "Neuroscience education in addition to trigger point dry needling for the management of patients with mechanical chronic low back pain: A preliminary clinical trial." J Bodyw Mov Ther 19(3): 464-472.
Vibe Fersum, K., P. O'Sullivan, et al. (2013). "Efficacy of classification-based cognitive functional therapy in patients with non-specific chronic low back pain: A randomized controlled trial." European Journal of Pain 17(6): 916-928.

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The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature

			PNE Movement	PNE Only
Moseley 2002	VibeFersum 2012			
Moseley 2003	Gallagher 2013	Tellez 2014		
Moseley 2004	Van Oostervijk 13	Beltran 2015		
Ryan 2010	Ittersum 2014	Pires 2015		
Meeus 2010	Louw 2014			

In all but one of these studies did patients have statistically significant ($p<0.05$) decrease in pain ratings

The other group: NONE

Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature. *Physiotherapy Theory and Practice.* Jul 2016;32(5):332-355.

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PNE: Content

- Neurophysiology of pain
- No reference to anatomical or patho-anatomical models
- No discussion of emotional or behavioral aspects to pain
- Nociception and nociceptive pathways
- Neurones
- Synapses
- Action potential
- Spinal inhibition and facilitation
- Peripheral sensitization
- Central sensitization
- Plasticity of the nervous system

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.

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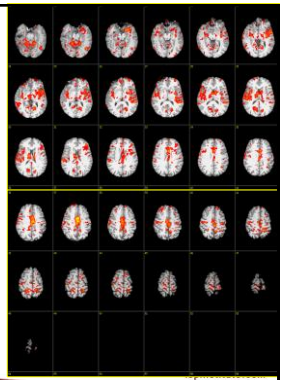
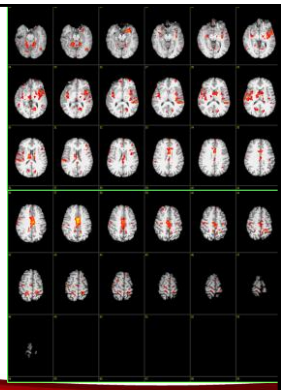
- 34 year-old female
- 4.5 years of pain
- Started as LBP, then spread to her buttocks and now into both legs
- Pain would flare up with stress at work
- First child 2.5 years ago – "horrible" labor, delivery and pain
- Now constant LBP
- Not able to return to work
- Now severe spasms in both legs
- CT, MRI and X-Ray WNL
- Meds: High doses of pain killers and narcotics



Moseley GL. Widespread brain activity during an abdominal task markedly reduced after pain physiology education: fMRI evaluation of a single patient with chronic low back pain. *Aust J Physiother.* 2005;51(1):49-52.

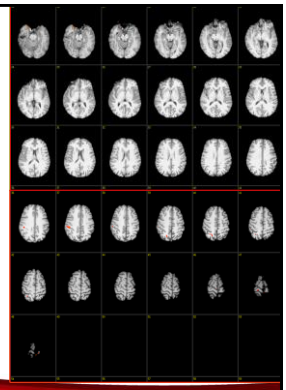
Spinal Stabilization Exercises

- 1 week practice
- 5 minutes each waking hour



Moseley GL. Widespread brain activity during an abdominal task markedly reduced after pain physiology education: fMRI evaluation of a single patient with chronic low back pain. *Aust J Physiother.* 2005;51(1):49-52.

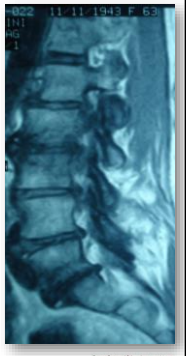
1 – to – 1 pain neuroscience education



Moseley GL. Widespread brain activity during an abdominal task markedly reduced after pain physiology education: fMRI evaluation of a single patient with chronic low back pain. *Aust J Physiother.* 2005;51(1):49-52.

Suzy's case

- What about my recent patient?
  - Doctor's wife
  - Years of "chronic LBP"
  - Numerous different treatments
    - Latest = ESI, RF, PT
  - ODI = 3675940.1
  - Docs mentioned FM
  - "Surgeons won't touch her"
  - MRI – severe DDD



Louw A, Puentedura 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.

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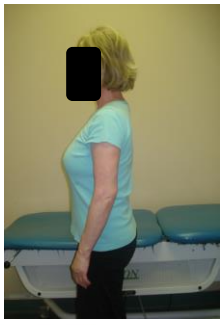

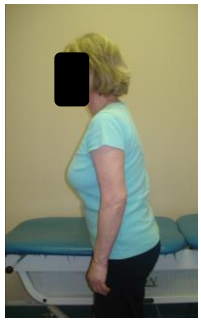

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1st PT session

- Thorough subjective examination
- Skilled, "low tech" physical examination
- Pain Neuroscience Education:
  - Prognostic information
  - Self-treatment ideas and plan
  - What PT can do for her
  - GOALS

Louw A, Puentedura 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.

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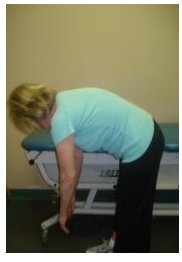
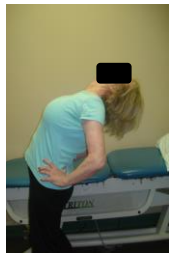
After the 1st session (no physical treatment)





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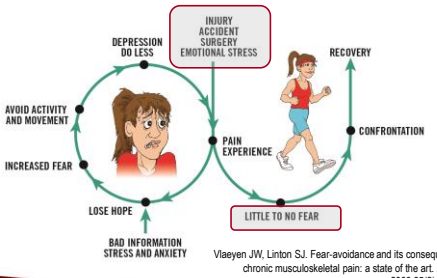
Louw A, Puentedura EL, Mintken P. Use of an abbreviated neuroscience education approach in the treatment of chronic low back pain: a case report. *Physiotherapy theory and practice.* Jan 2012;28(1):50-62.

What about PNE for acute conditions?



Vlaeyen JW, Linton SJ. Fear-avoidance and its consequences in chronic musculoskeletal pain: a state of the art. *Pain.* Apr 2000;85(3):317-332.

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Preoperative Pain Neuroscience Education Program for Lumbar Surgery

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.

Want more info on pain	Focus on anatomy	Not helpful unless pain education
1. Experiences of lumbar surgery patients	2. Surgeon's preoperative education	3. Pre-op education for pain in orthopaedics
4. Public perception of lumbar surgery	5. Viewing surgery images prior to lumbar surgery	6. Neuroscience Education for Pain and Disability
Afraid and expect poor outcome	Induces fear	Effective in reducing pain and disability

Development of a Preoperative Neuroscience Education Program for Lumbar Radiculopathy

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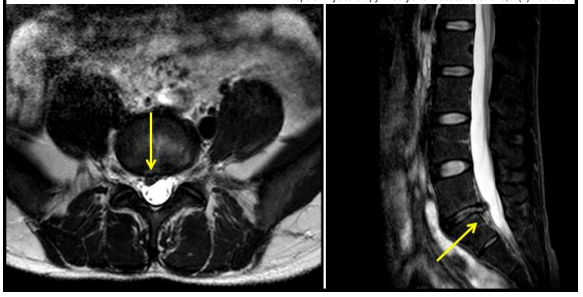
Preoperative Neuroscience Education: Single fMRI case

MRI: marked herniated L5/S1 disc; central and left towards the nerve root

Louw A, Puentedura EJ, Diener I, Peoples RR. Preoperative therapeutic neuroscience education for lumbar radiculopathy: a single-case fMRI report. Physiotherapy Theory and Practice. Oct 2015;31(7):496-508.



Preoperative Neuroscience Education: Single fMRI case

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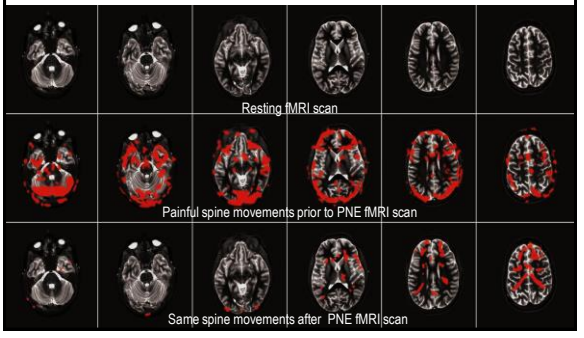
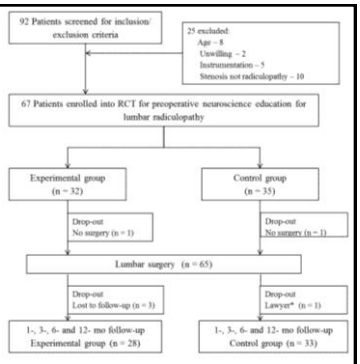


RCT - 1 Year

Louw A, Diener I, Landers MR, Puentedura EJ. Preoperative pain neuroscience education for lumbar radiculopathy: a multicenter randomized controlled trial with 1-year follow-up. Spine. Aug 15 2014;39(18):1449-1457.



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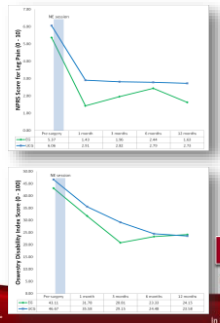
Preoperative Neuroscience Education for Lumbar Radiculopathy: A Multicenter RCT

One year follow-up

Superior results (no statistical significance):

- Back Pain
- Leg Pain
- Catastrophization
- Fear Avoidance
- Pain Knowledge



Louw A, Diener I, Landers MR, Puentedura EJ. Preoperative pain neuroscience education for lumbar radiculopathy: a multicenter randomized controlled trial with 1-year follow-up. Spine. Aug 15 2014;39(18):1449-1457.

But...

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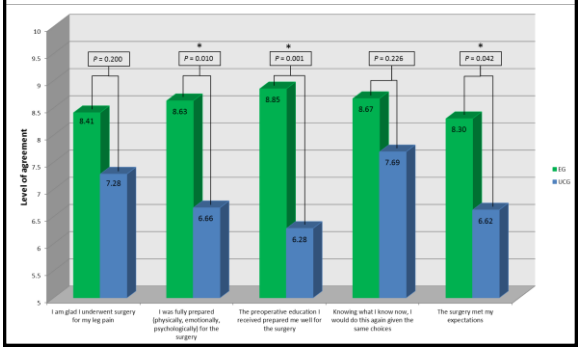
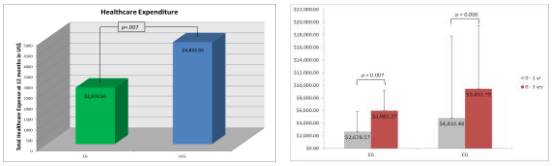
Satisfaction with Surgery

Louw A, Diener I, Landers MR, Puentedura EJ. Preoperative pain neuroscience education for lumbar radiculopathy: a multicenter randomized controlled trial with 1-year follow-up. Spine. Aug 15 2014;39(18):1449-1457.



Healthcare Cost 1 and 3 years out…

45% less on medical tests and treatments…



Louw A, Diener I, Landers MR, Puentedura EJ. Preoperative pain neuroscience education for lumbar radiculopathy: a multicenter randomized controlled trial with 1-year follow-up. Spine. Aug 15 2014;39(18):1449-1457.

Louw A, Diener I, Landers MR, Zimney K, Puentedura EJ. Three-year follow-up of a randomized controlled trial comparing preoperative neuroscience education for patients undergoing surgery for lumbar radiculopathy. J Spine Surg. Dec 2016;2(4):289-298.

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Louw, Reed, Zimney, Puentedura, Grimm and Landers – submitted for publication 2017

122 patients undergoing TKA

PNE
Preoperative Hospital Education

Preoperative Hospital Education

6 Months
Pain
Function
Pain Medication use
Blood pressure and Heart Rate
Length of Hospital stay
Knee ROM
Satisfaction with surgery
Healthcare utilization

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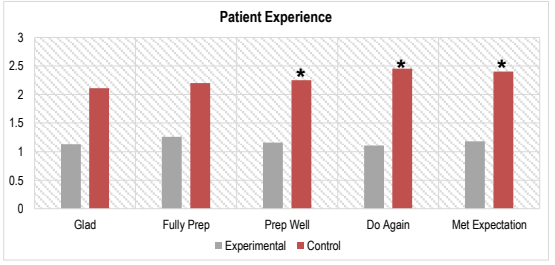
RCT: Preoperative PNE for TKA



Louw, Reed, Zimney, Puentedura, Grimm and Landers – submitted for publication 2017

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Teaching Middle School Kids PNE

Louw A, Podolak J, Zimney K, Schmidt S, Puentedura E. Can Pain Beliefs Change in Middle School Students? A Study of the Effectiveness of Pain Neuroscience Education. *Physiother Theory Pract.* 2017 - Accepted for publication.

Louw A, Benz P, Podolak J, Zimney K, Wassinger CA. Pain Neuroscience Education for Middle School Kids and Fear of Physical Activity. Physiotherapy 2017 - Submitted for Publication.

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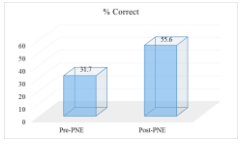
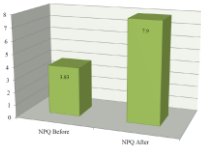
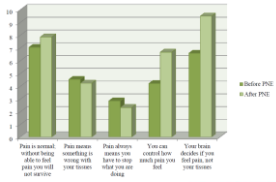
Teaching Middle School Kids PNE







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How Does PNE Work?

Low Threat

High Threat

Activation of opioid and cannaboid systems

Benedetti F, Thoen W, Blanchard C, Vighetti S, Arduino C. Pain as a reward: changing the meaning of pain from negative to positive co-activates opioid and cannabinoid systems. Pain. Mar 2013;154(3):361-367.
Moseley GL. Reconceptualising pain according to modern pain sciences. *Physical Therapy Reviews*. 2007;12:169-178.
Louw A. Treating the brain in chronic pain. In: C FdlP, J C, Dommerholt J, eds. Manual Therapy for Musculoskeletal Pain Syndromes. Vol 1. London: Churchill Livingston; 2015

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PNE Evidence

We TREAT pain; not merely MANAGING it…

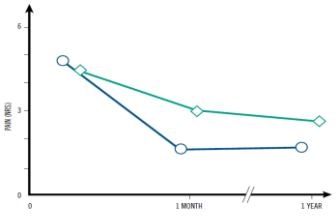

Figure 2.4: Pain rating changes in one year after TNE. Graph from Moseley, 2002.

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.
Moseley L. Combined physiotherapy and education is efficacious for chronic low back pain. *Aust J Physiother*. 2002;48(4):297-302.
Moseley GL. Joining forces - combining cognition-targeted motor control training with group or individual pain physiology education: a successful treatment for chronic low back pain. J Man Manip Therap. 2003;11(2):88-94.
Van Oosterwijck J, Meeus M, Paul L, et al. Pain physiology education improves health status and endogenous pain inhibition in fibromyalgia: a double-blind randomized controlled trial. The Clinical journal of pain. Oct 2013;29(10):873-882.

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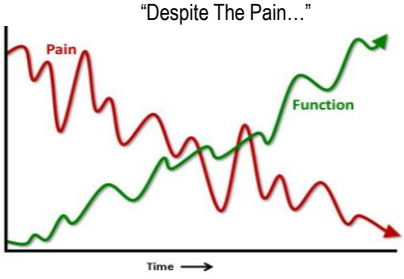
Pain and Behavioral Shift:

"Despite The Pain…"



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.

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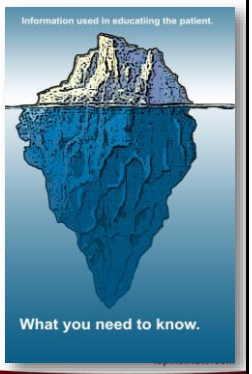
The Neuroscience of Pain



Louw A, Puentedura E. *Therapeutic Neuroscience Education: Teaching patients about pain*. Minneapolis, MN: OPTP; 2013.
Moseley GL. Reconceptualising pain according to modern pain sciences. *Physical Therapy Reviews*. 2007;12:169-178.
Gifford L. Aches and Pain. Cornwall: Wordpress; 2014.

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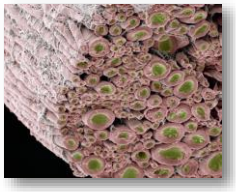
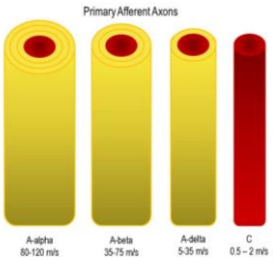
1. Pain fibers and Pain nerves





Barker RA, Barasi S. *Neuroscience at a Glance*. Oxford: Blackwell; 1999.
Bear MF, Connors BW, Paradiso MA, eds. Neuroscience: Exploring the Brain. 2nd ed. Baltimore: Lipincott, Williams and Wilkins; 2001.

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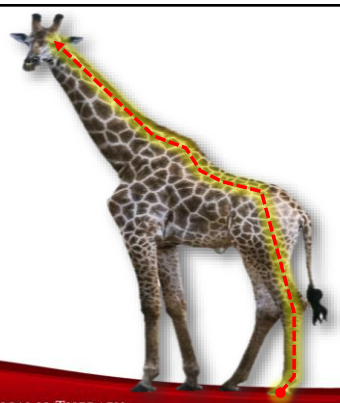

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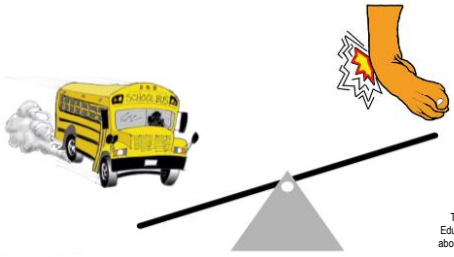

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1. Pain fibers and Pain nerves

- Eyes: Contain light receptors; not vision
- Ears: Contain vibration receptors; not hearing
- Tissues: Contain nociceptive receptors; not pain
- Tissues: Contain danger receptors; not pain

Nociceptive or Danger fibers

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

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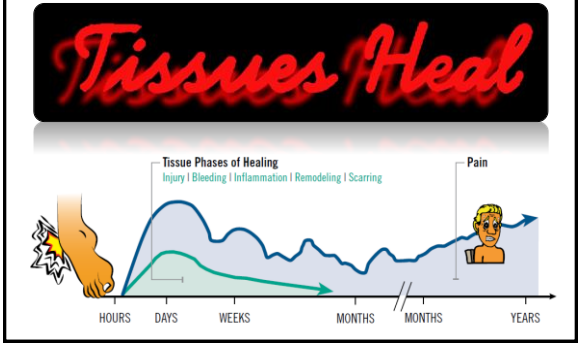
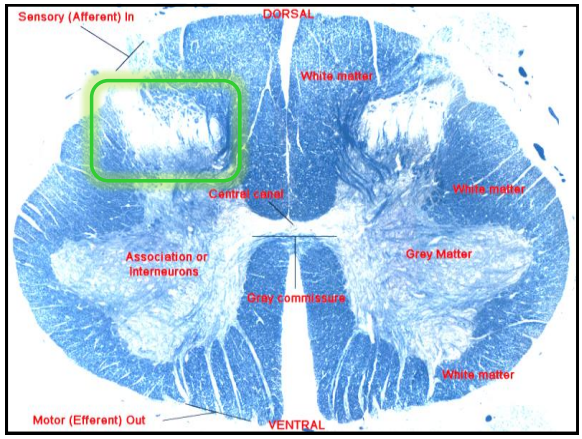
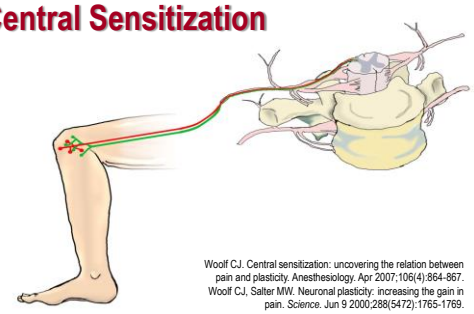
Injury and Pain...





3. Central Sensitization



Woolf CJ. Central sensitization: uncovering the relation between pain and plasticity. Anesthesiology. Apr 2007;106(4):864-867.
Woolf CJ, Salter MW. Neuronal plasticity: increasing the gain in pain. *Science*. Jun 9 2000;288(5472):1765-1769.

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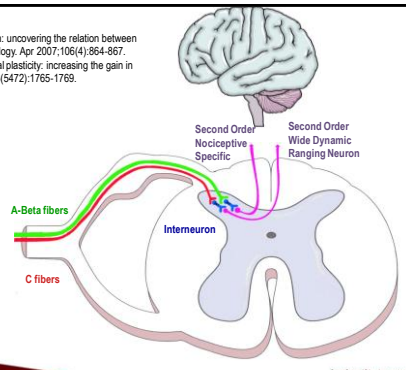

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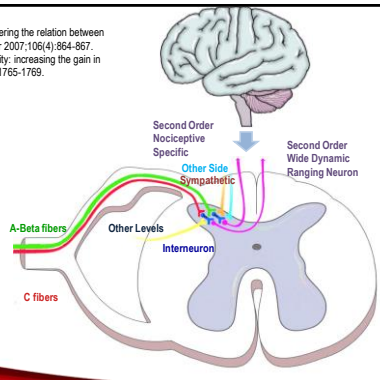

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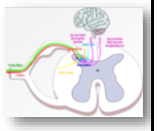
Woolf CJ, Salter MW. Neuronal plasticity: increasing the gain in pain. Science. Jun 9 2000;288(5472):1765-1769.
Louw A, Puentedura E. *Therapeutic Neuroscience Education: Teaching patients about pain.* Minneapolis, MN: OPTP; 2013.

End-Result?



Process	Consequence
• Death of the inhibitory neurons	• Decreased gating from the periphery
• C-fibers pull back; A-fibers grow in	• Allodynia
• Upregulation of second-order neurons	• Increased firing towards the brain
• Inappropriate synapsing – other levels	• Spreading pain
• Inappropriate synapsing – other fibers	• Sympathetic, immune, motor contributions
• Inappropriate synapsing – other side	• Bilateral "mirror" pains
• Decreased endogenous mechanisms	• Allodynia and Hyperalgesia

Central Sensitization

Woolf CJ. Central sensitization: uncovering the relation between pain and plasticity. Anesthesiology. Apr 2007;106(4):864-867.
Woolf CJ, Salter MW. Neuronal plasticity: increasing the gain in pain. Science. Jun 9 2000;288(5472):1765-1769.
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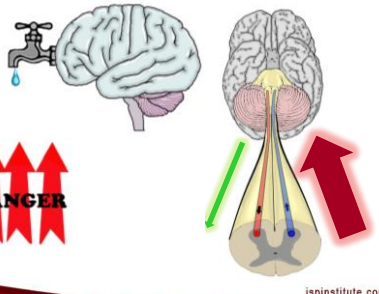

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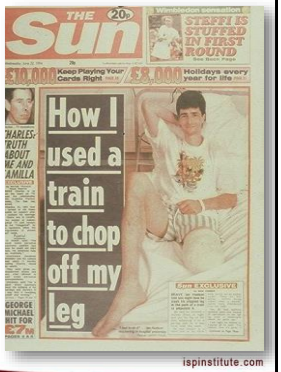
Central Sensitization

Gifford L. *Aches and Pain*. Cornwall: Wordpress; 2014.



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Injury to a peripheral nerve and electrical stimulation of C-fibers each cause an increase in the permeability of the blood-spinal cord barrier and blood-brain barrier

Beggs S, Liu XJ, Kwan C, Salter MW. Peripheral nerve injury and TRPV1-expressing primary afferent C-fibers cause opening of the blood-brain barrier. *Mol Pain*. 2010;6:74.

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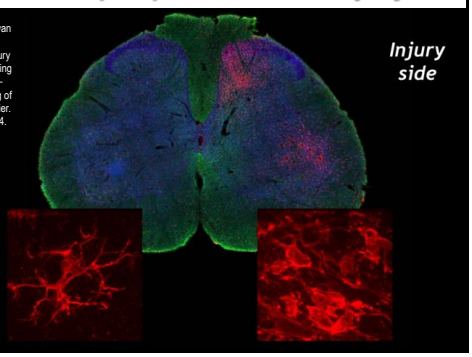
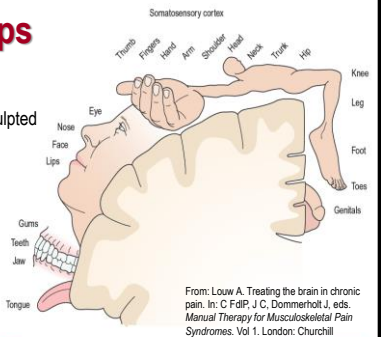
Response of microglia in the spinal cord after peripheral nerve injury

Beggs S, Liu XJ, Kwan C, Salter MW. Peripheral nerve injury and TRPV1-expressing primary afferent C-fibers cause opening of the blood-brain barrier. *Mol Pain*. 2010;6:74.



Plastic maps

- Biologically coded
- Environmentally sculpted
- Changes occur in minutes…



From: Louw A. Treating the brain in chronic pain. In: C FdlP, J C, Dommerholt J, eds. *Manual Therapy for Musculoskeletal Pain Syndromes*. Vol 1. London: Churchill Livingston; 2015

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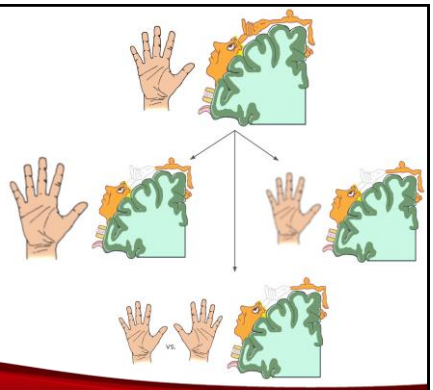
Maihöfner C, Handwerker HO, Neundörfer B, Birklein F. Patterns of cortical reorganization in complex regional pain syndrome. *Neurology*. December 23, 2003 2003;61(12):1707-1715. Flor H. The functional organization of the brain in chronic pain. Prog Brain Res. 2000;129:313-322.



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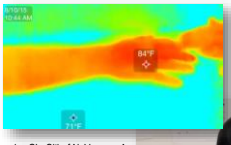

It happens fast

Moseley GL, Olthof N, Venema A, et al. Psychologically induced cooling of a specific body part caused by the illusory ownership of an artificial counterpart. *Proc Natl Acad Sci U S A*. Sep 2 2008;105(35):13169-13173. Stavrinou ML, Della Penna S, Pizzella V, et al. Temporal dynamics of plastic changes in human primary somatosensory cortex after finger webbing. Cereb Cortex. Sep 2007;17(9):2134-2142.

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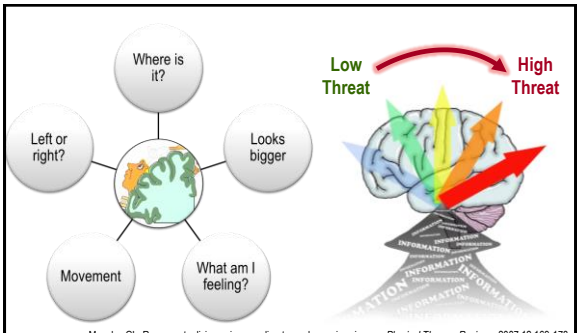

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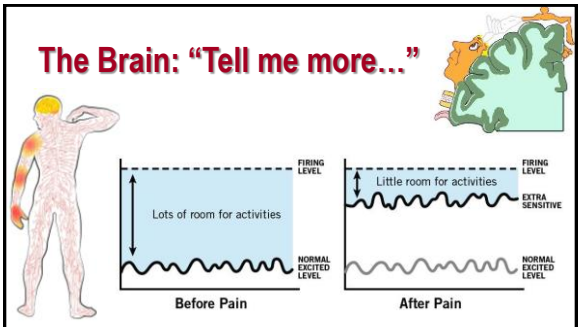
The Brain: "Tell me more…"



Louw A. Treating the brain in chronic pain. In: C FdlP, J C, Dommerholt J, eds. *Manual Therapy for Musculoskeletal Pain Syndromes.* Vol 1. London: Churchill Livingston; 2015

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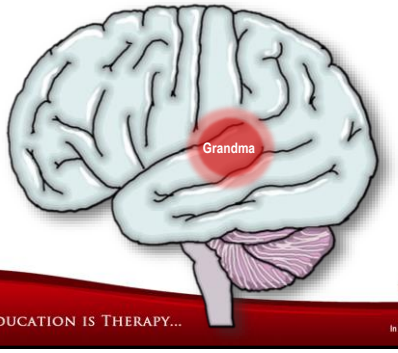
Lets start with an Experiment



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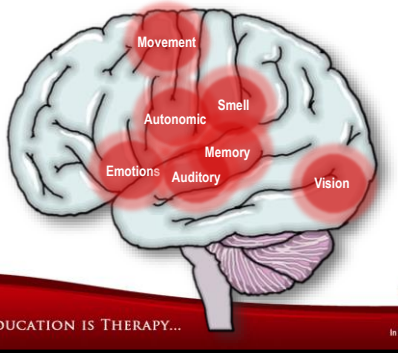
Actually…



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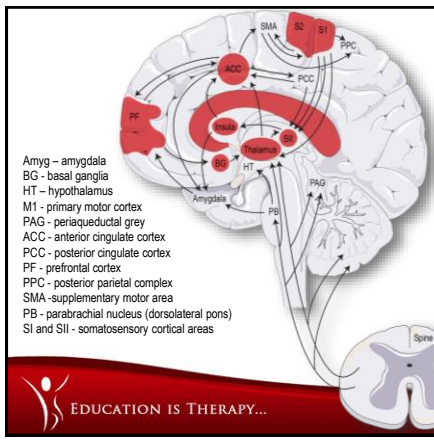

Amyg – amygdala
BG - basal ganglia
HT – hypothalamus
M1 - primary motor cortex
PAG - periaqueductal grey
ACC - anterior cingulate cortex
PCC - posterior cingulate cortex
PF - prefrontal cortex
PPC - posterior parietal complex
SMA -supplementary motor area
PB - parabrachial nucleus (dorsolateral pons)
SI and SII - somatosensory cortical areas

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.
Louw A. Treating the brain in chronic pain. In: C FdlP, J C, Dommerholt J, eds. Manual Therapy for Musculoskeletal Pain Syndromes. Vol 1. London: Churchill Livingston; 2015.

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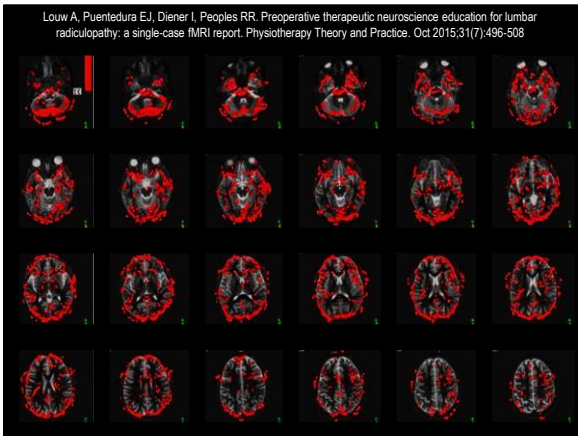
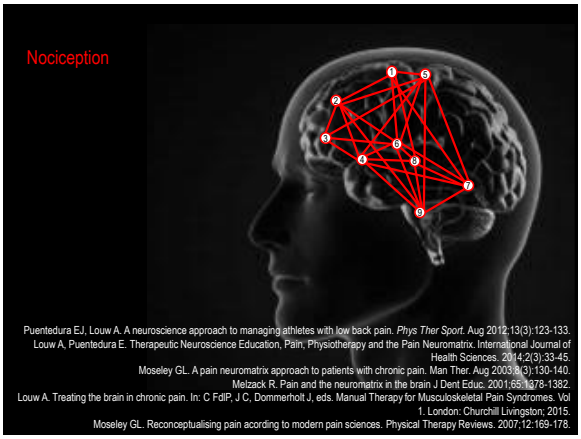


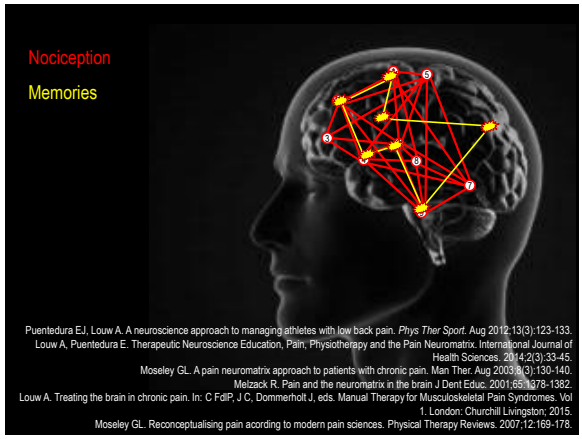
Louw A, Puentedura EJ, Diener I, Peoples RR. Preoperative therapeutic neuroscience education for lumbar radiculopathy: a single-case fMRI report. Physiotherapy Theory and Practice. Oct 2015;31(7):496-508

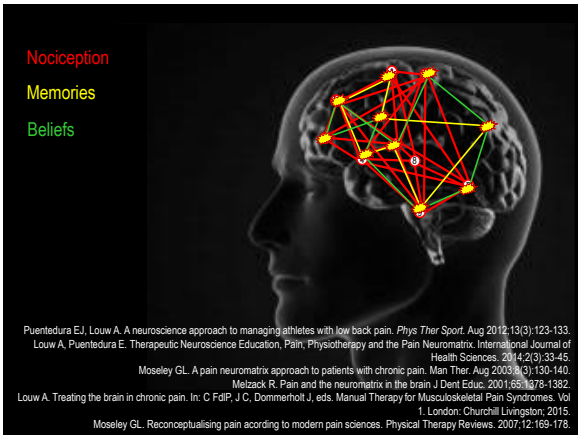
A TYPICAL PAIN NEUROMATRIX

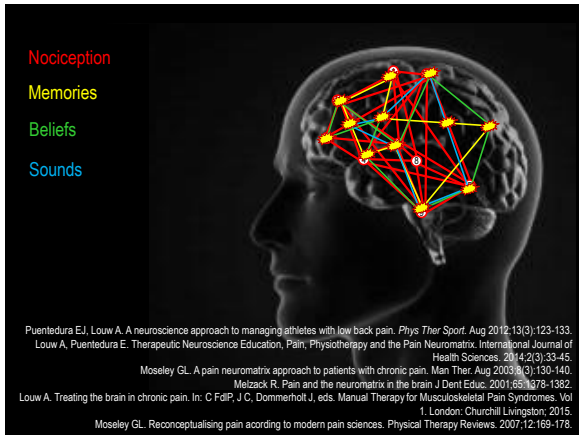
1. PREMOTOR/ MOTOR CORTEX
   organize and prepare movements
2. CINGULATE CORTEX
   concentration, focusing
3. PREFRONTAL CORTEX
   problem solving, memory
4. AMYGDALA
   fear, fear conditioning, addiction
5. SENSORY CORTEX
   sensory discrimination
6. HYPOTHALAMUS/ THALAMUS
   stress responses, autonomic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

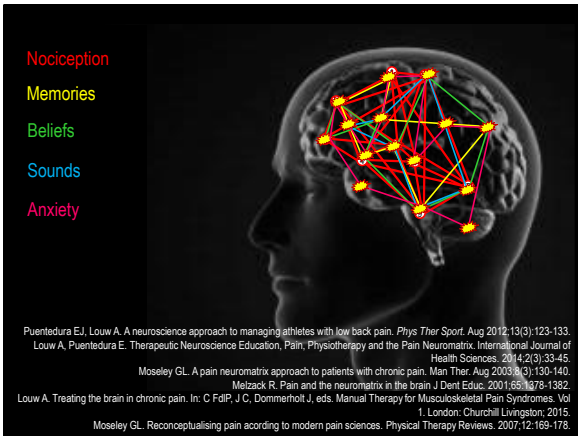
Puentedura EJ, Louw A. A neuroscience approach to managing athletes with low back pain. *Phys Ther Sport.* Aug 2012;13(3):123-133.

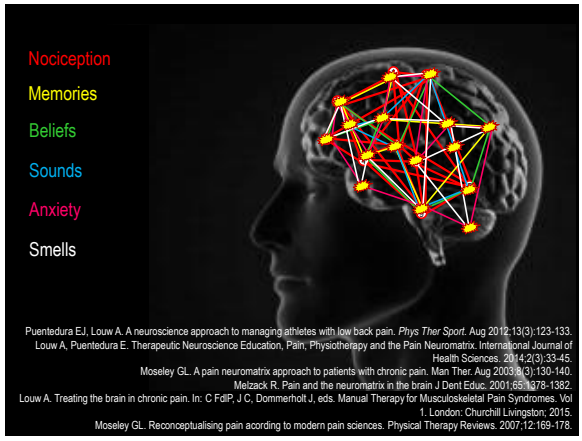


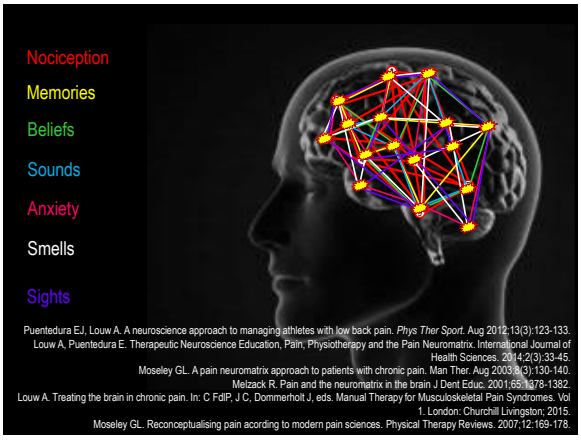


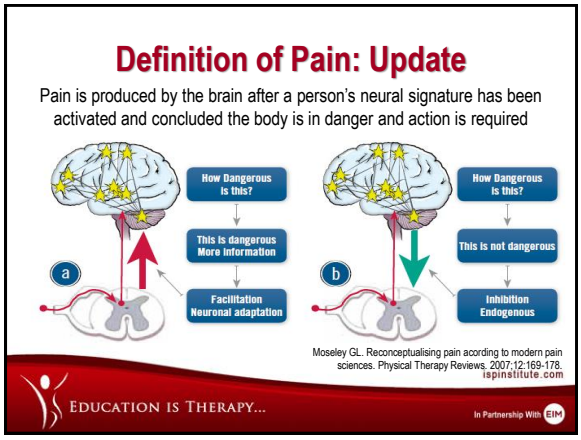


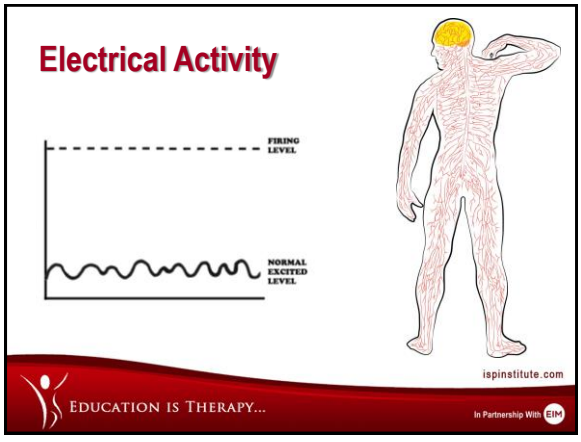


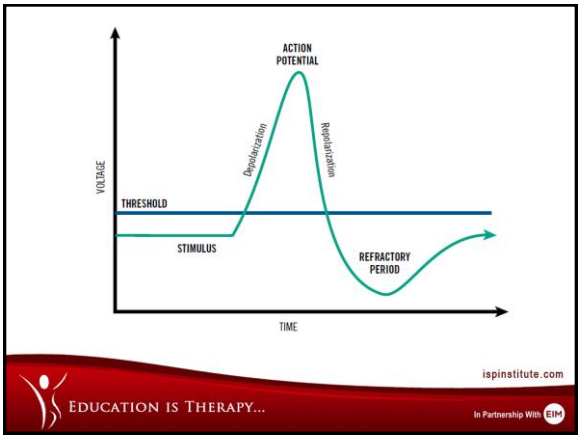


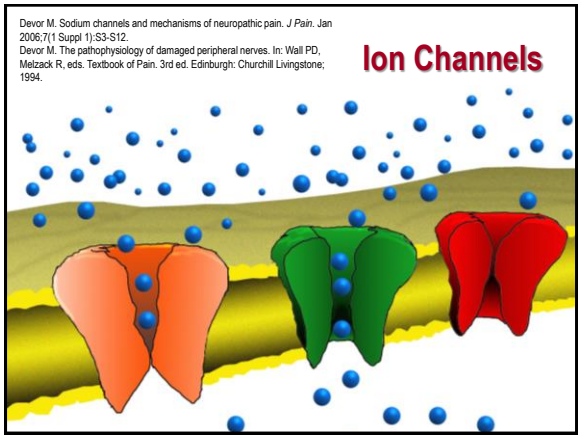




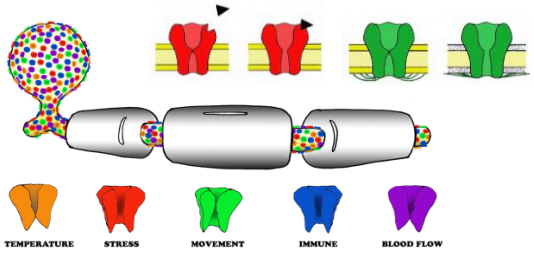








Various kinds of channels…



Devor M. Sodium channels and mechanisms of neuropathic pain. *J Pain.* Jan 2006;7(1 Suppl 1):S3-S12.
Devor M. The pathophysiology of damaged peripheral nerves. In: Wall PD, Melzack R, eds. Textbook of Pain. 3rd ed. Edinburgh: Churchill Livingstone; 1994.

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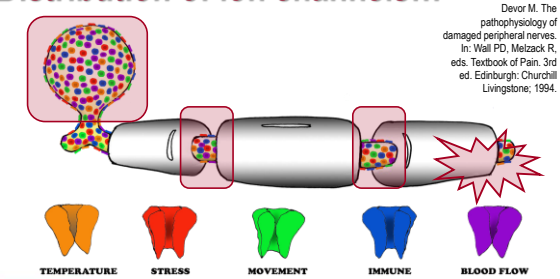
Distribution of ion channels…

Devor M. Sodium channels and mechanisms of neuropathic pain. *J Pain.* Jan 2006;7(1 Suppl 1):S3-S12.
Devor M. The pathophysiology of damaged peripheral nerves. In: Wall PD, Melzack R, eds. Textbook of Pain. 3rd ed. Edinburgh: Churchill Livingstone; 1994.



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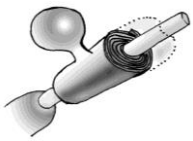
Removing myelin

Devor M. The pathophysiology of damaged peripheral nerves. In: Wall PD, Melzack R, eds. Textbook of Pain. 3rd ed. Edinburgh: Churchill Livingstone; 1994.



- Mechanical
- Immune
- Chemical

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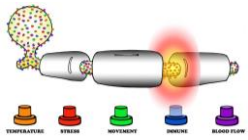
Development of an Abnormal Impulse Generating Site

Devor M. The pathophysiology of damaged peripheral nerves. In: Wall PD, Melzack R, eds. Textbook of Pain. 3rd ed. Edinburgh: Churchill Livingstone; 1994.



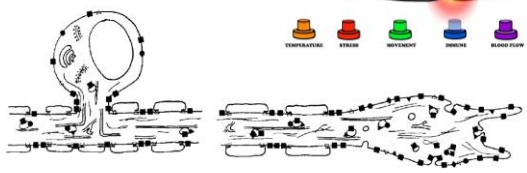
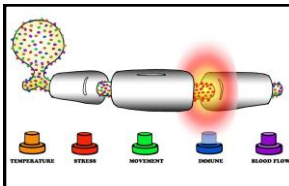
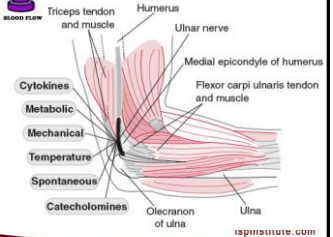


Fig. I.4 Schematic representation of a single sensory neurone highlighting ion channels and receptor proteins in the cell wall. Adapted from: Devor et al 1994
∇ K^+ channel ● Ca^{++} channel
■ Na^+ channel ▲ Adrenoreceptor = ligand gated ion channel sensitive to adrenaline.
◆ Mechaznoreceptor or Stretch activated receptor



Nerve Sensitization…

Louw A, Butler DS. Chronic Pain. In: S.B. B, Manske R, eds. *Clinical Orthopaedic Rehabilitation*. 3rd Edition ed. Philadelphia, PA: Elsevier; 2011.



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Neuroplasticity: There is hope…

Devor M. Sodium channels and mechanisms of neuropathic pain. *J Pain.* Jan 2006;7(1 Suppl 1):S3-S12.
Devor M. The pathophysiology of damaged peripheral nerves. In: Wall PD, Melzack R, eds. Textbook of Pain. 3rd ed. Edinburgh: Churchill Livingstone; 1994.

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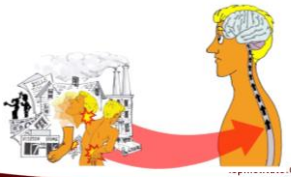
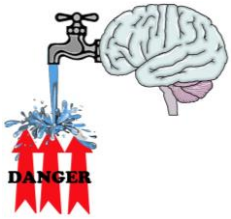
Environment…

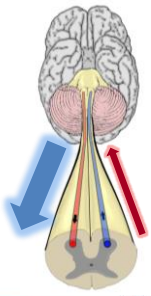
- Stressful situations
- Sports
- Demolition derby drivers

Sterling M, Jull G, Kenardy J. Physical and psychological factors maintain long-term predictive capacity post-whiplash injury. *Pain*. May 2006;122(1-2):102-108.
Walton DM, Pretty J, MacDermid JC, Teasell RW. Risk factors for persistent problems following whiplash injury: results of a systematic review and meta-analysis. The Journal of orthopaedic and sports physical therapy. May 2009;39(5):334-350.
Hellsing A, Linton SJ, Kalvemark M. A prospective study of patients with acute back and neck pain in Sweden. Physical Therapy. 1994;74:116-128.
Raudenbush B, Canter RJ, Corley N, et al. Pain threshold and tolerance differences among intercollegiate athletes: implication of past sports injuries and willingness to compete among sports teams. North American Journal of Psychology Publisher. March 2012 2012;14(1).
Simotas AC, Shen T. Neck pain in demolition derby drivers. Arch Phys Med Rehabil. Apr 2005;86(4):693-696.



Descending modulation…





Pain is a Perception of THREAT

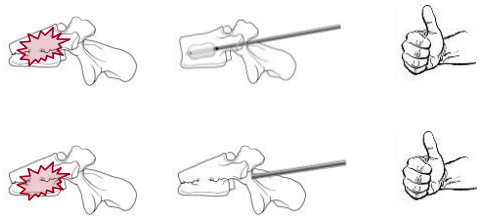
Original Research Article

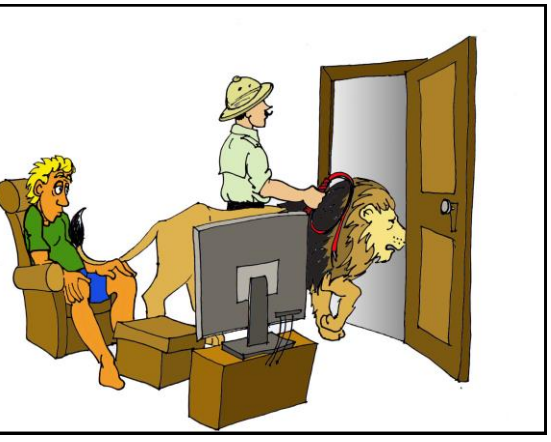
Sham Surgery in Orthopedics: A Systematic Review of the Literature

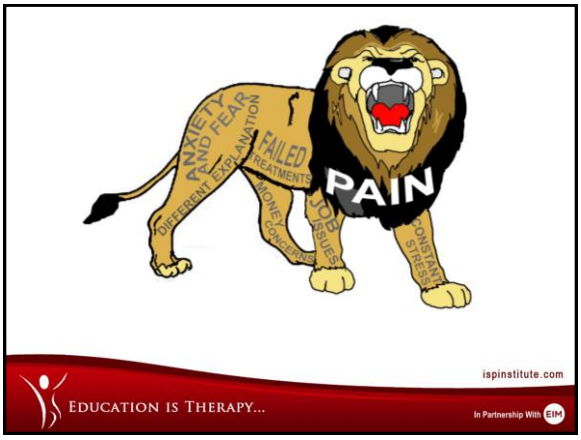
Conclusion: Although care should be taken…sham surgery has been shown to be just as effective as actual surgery in reducing pain and disability.

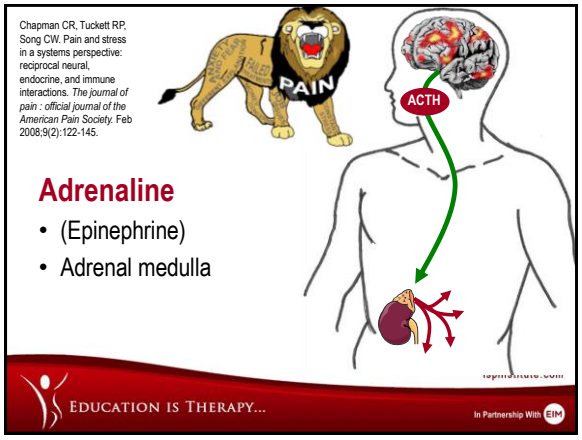
Louw A, Diener I, Fernandez-de-Las-Penas C, Puentedura EJ. Sham Surgery in Orthopedics: A Systematic Review of the Literature. *Pain Medicine*. Jul 11 2016.

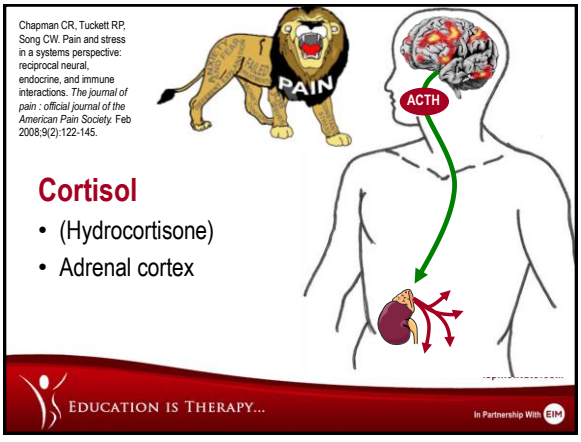
Louw A, Diener I, Fernandez-de-Las-Penas C, Puentedura EJ. Sham Surgery in Orthopedics: A Systematic Review of the Literature. *Pain Medicine*. Jul 11 2016.

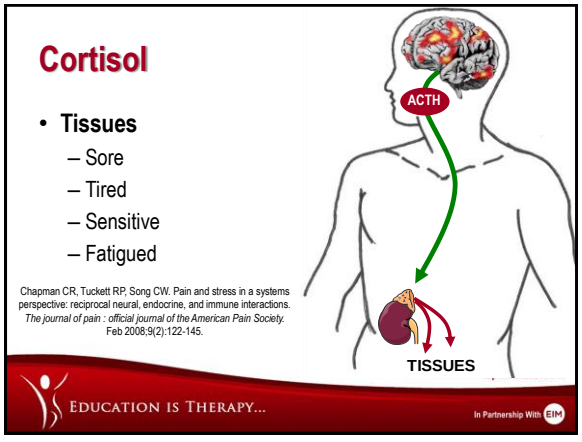


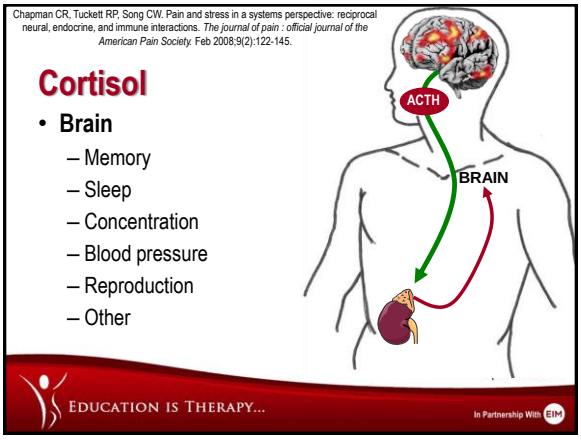


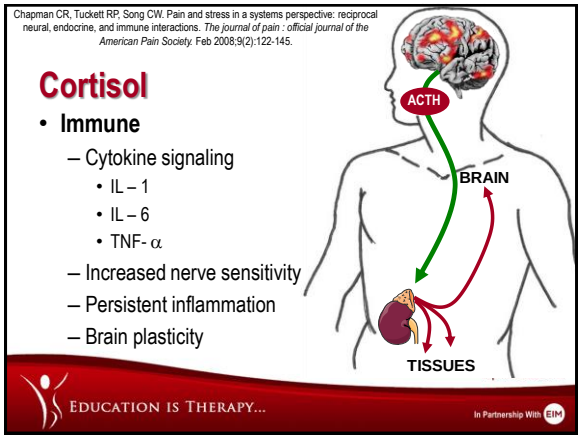


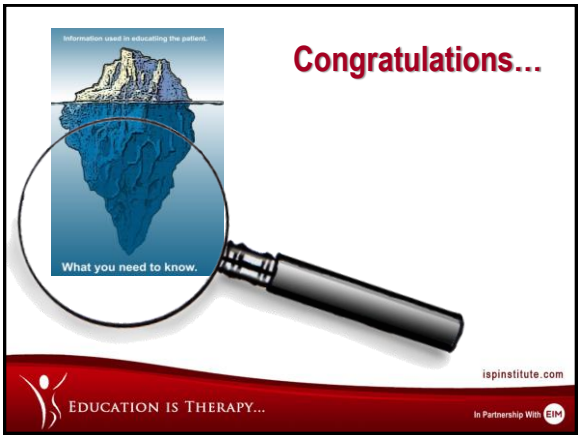


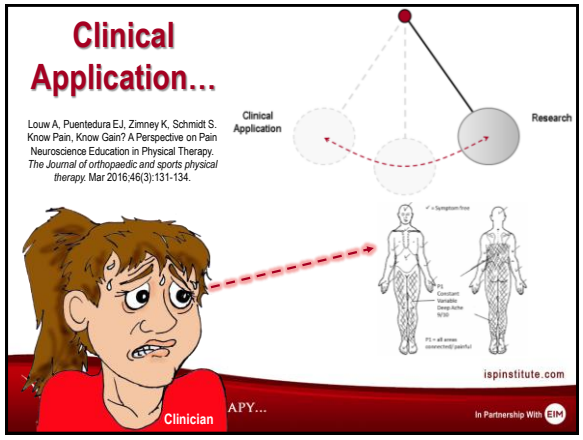


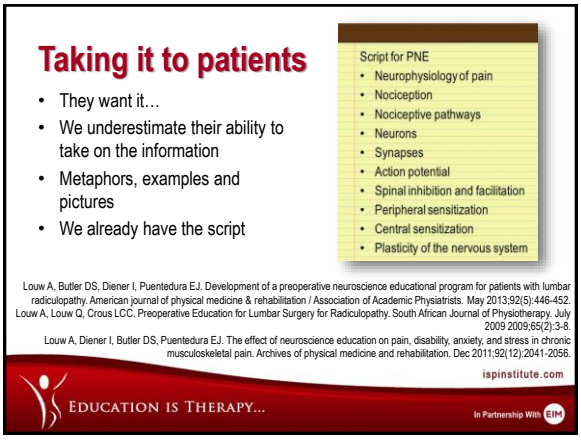


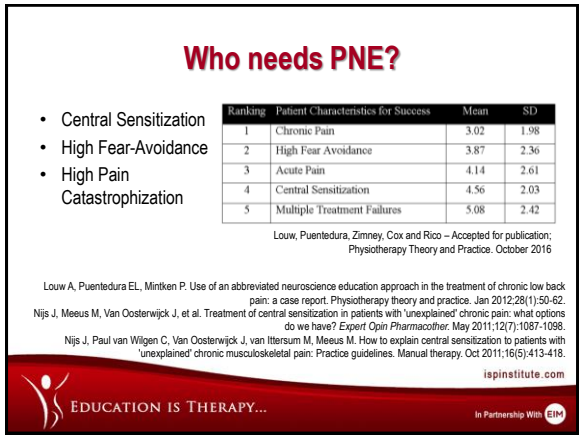


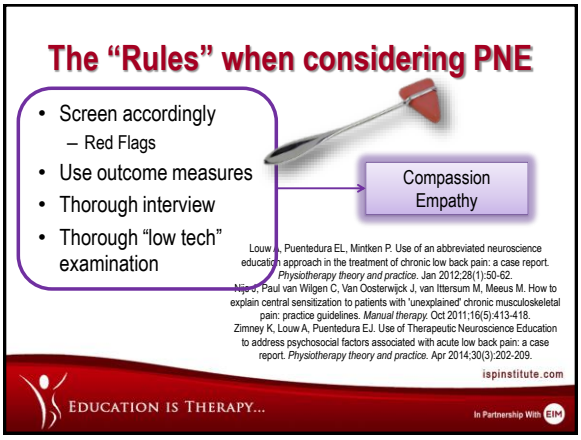


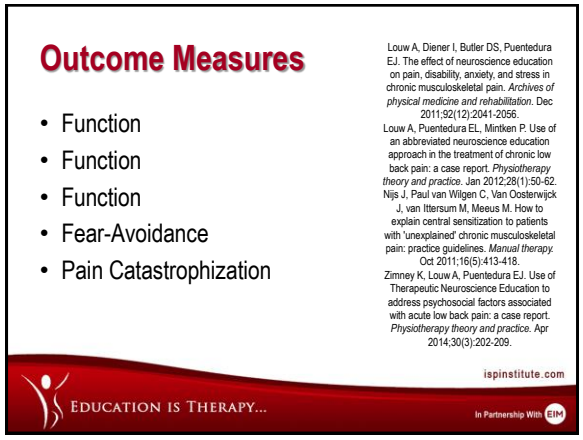












Interview…peeling layers

Beyond the basics:

- What do you think is going on with your back?
- What do you think should be done for your back?
- Why do you think you still hurt?
- What would it take for you to get better?
- Where do you see yourself in 3 years in regards to your back?

Diener I, Kargela M, Louw A. Listening is therapy: Patient interviewing from a pain science perspective. *Physiotherapy Theory and Practice.* Jul 2016;32(5):356-367.

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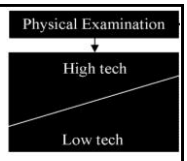
Physical Examination

- **THOROUGH**
- More "low tech" than high tech
  - Large, functional, physiological
- Neuro
  - Neurodynamic tests (active > passive)
  - Nerve palpation
  - Pressure algometry
  - Two Point Discrimination



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.
Linton SJ. The socioeconomic impact of chronic back pain: is anyone benefiting? *Pain.* Apr 1998;75(2-3):163-168.
Diener I, Kargela M, Louw A. Listening is therapy: Patient interviewing from a pain science perspective. Physiotherapy Theory and Practice. Jul 2016;32(5):356-367.

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Starting "the pain talk"

- Has anyone explained to you why you hurt?
- Would you like to know why your pain is not getting better?
- Before we start some of the "physical" treatment, I'd like to explain to you a little more about your pain

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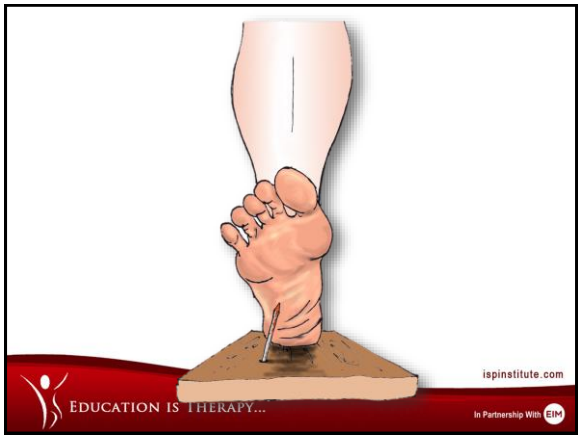

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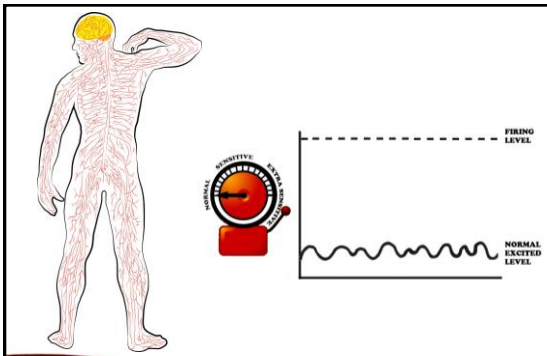

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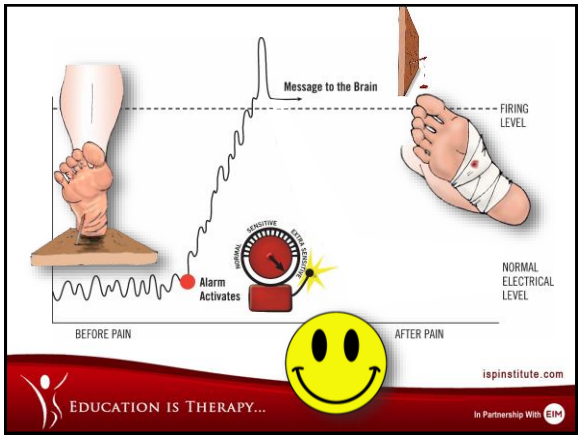

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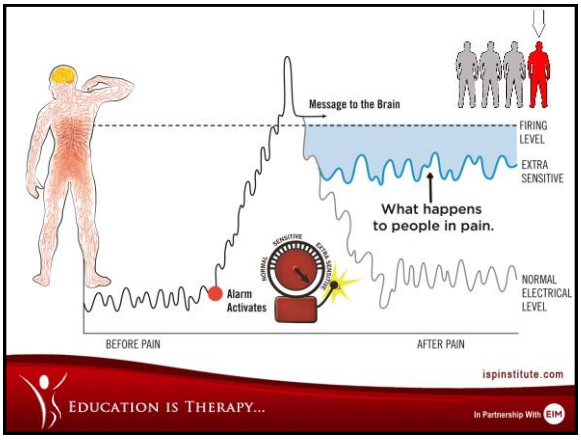

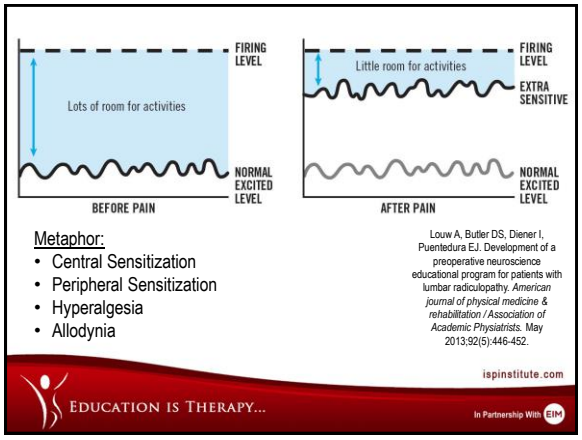

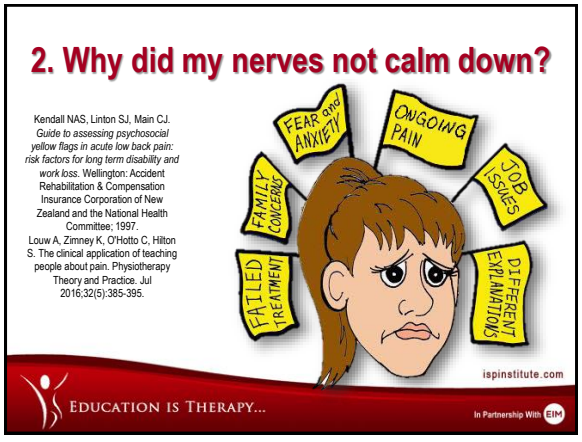

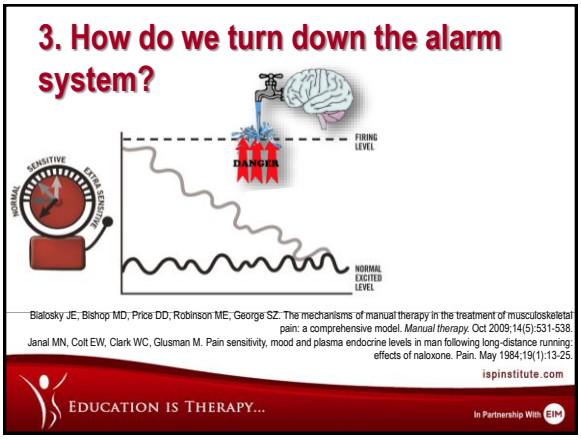

Pain Science is NOT hands-off

			PNE Movement	PNE Only
Moseley 2002	VibeFersum 2012			
Moseley 2003	Gallagher 2013	Tellez 2014		
Moseley 2004	Van Oostervijk 13	Beltran 2015		
Ryan 2010	Ittersum 2014	Pires 2015		
Meeus 2010	Louw 2014			

In all but one of these studies did patients have statistically significant ($p<0.05$) decrease in pain ratings

The other group: NONE

Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature. *Physiotherapy Theory and Practice.* Jul 2016;32(5):332-355.

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PNE+

- Mobilization and manipulation
- Soft tissue massage
- Muscle and neural mobilization
- Trunk stabilization
- Circuit based aerobic exercise
- Movement exercises
- Pacing of ADLs
- Graded exposure with ADLs
- Trigger point dry needling
- Neck stabilization exercises
- Aquatic exercise program

Beltran-Alacreu, H., I. López-de-Uralde-Villanueva, et al. (2015). "Manual Therapy, Therapeutic Patient Education, and Therapeutic Exercise, an Effective Multimodal Treatment of Nonspecific Chronic Neck Pain: A Randomized Controlled Trial." American journal of physical medicine & rehabilitation/Association of Academic Physiatrists.

Meeus, M., J. Nijs, et al. (2010). "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." Archives of physical medicine and rehabilitation 91(8): 1153-1159.

Moseley, G. (2002). "Combined physiotherapy and education is efficacious for chronic low back pain." Aust J Physio 48: 297-302.

Moseley, G. L. (2003). "Joining Forces - Combining Cognition - Targeted Motor Control Training with Group or Individual PainPhysiology Education: A Successful Tretment For Chronic Low Back Pain." Journal of Manual & Manipulative Therapy 11(2): 88-94.

Pires, D., E. B. Cruz, et al. (2015). "Aquatic exercise and pain neurophysiology education versus aquatic exercise alone for patients with chronic low back pain: a randomized controlled trial." Clinical rehabilitation 29(6): 538-547.

Ryan, C. G., H. G. Gray, et al. (2010). "Pain biology education and exercise classes compared to pain biology education alone for individuals with chronic low back pain: a pilot randomised controlled trial." Manual therapy 15(4): 382-387.

Téllez-García, M., A. I. de-la-Llave-Rincón, et al. (2014). "Neuroscience education in addition to trigger point dry needling for the management of patients with mechanical chronic low back pain: A preliminary clinical trial." J Bodyw Mov Ther 19(3): 464-472.

Vibe Fersum, K., P. O'Sullivan, et al. (2013). "Efficacy of classification-based cognitive functional therapy in patients with non-specific chronic low back pain: A randomized controlled trial." European Journal of Pain 17(6): 916-928.

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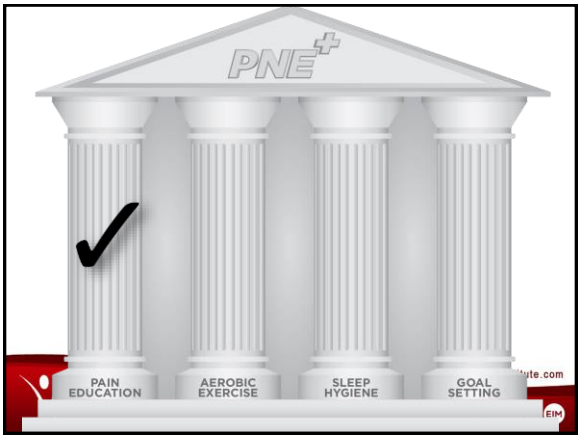
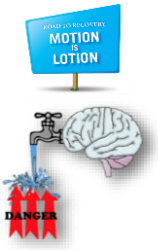


Movement is the biggest pain killer on the planet



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.

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.

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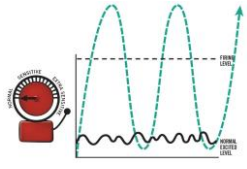
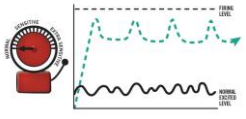
Exercise and activity mistakes

"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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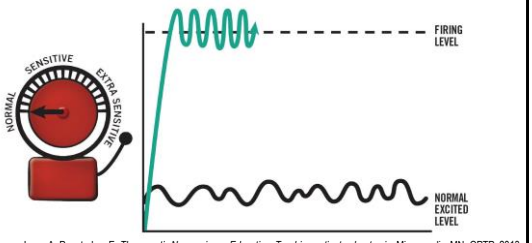
Pacing



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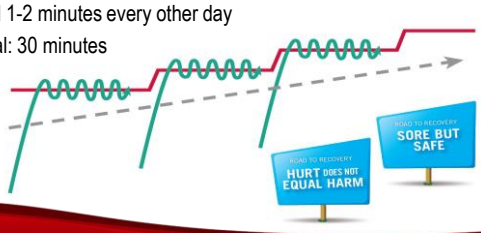
It does not take much…

- 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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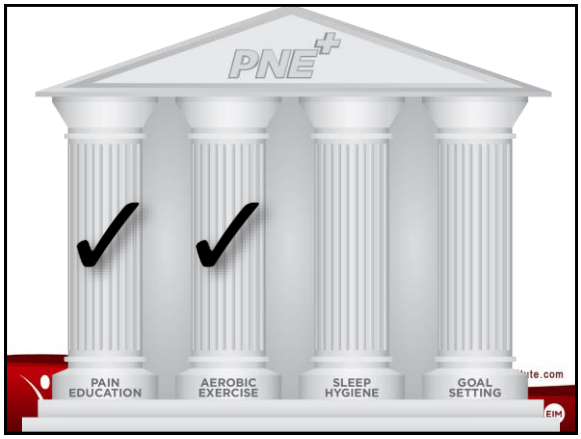

Calming Nerves: Sleep Hygiene

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.

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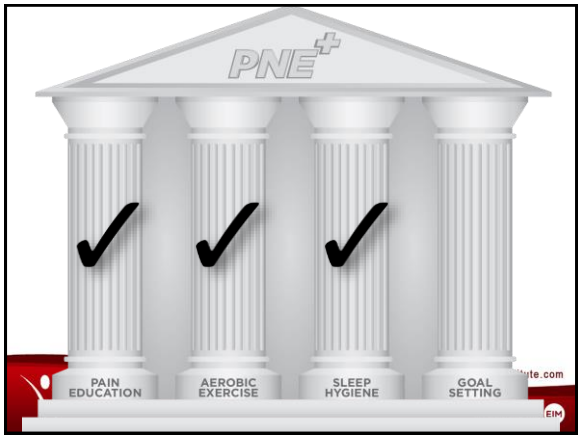

Goal Setting

Most patients:

- No goals
- Poorly defined goals

You have to have a reason to get out of bed

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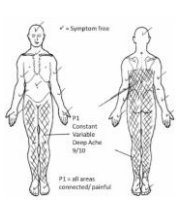
Goal Setting/Pacing/Graded Exposure



A = Living Room	Monday A1	Tuesday A2
B = Entry Way	Wednesday B1	Thursday B2
C = Master Bedroom	Friday C1	Saturday C2
D = Guest Bedroom	Monday D1	Tuesday D2
E = Hallways	Wed E1	Thu E2

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Goal Setting/Pacing/Graded Exposure

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

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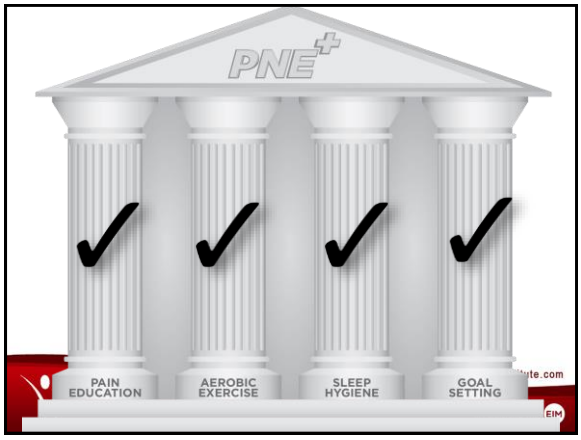
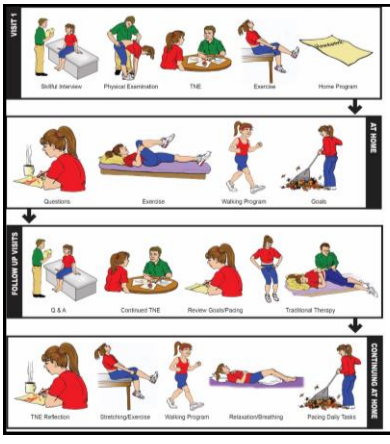
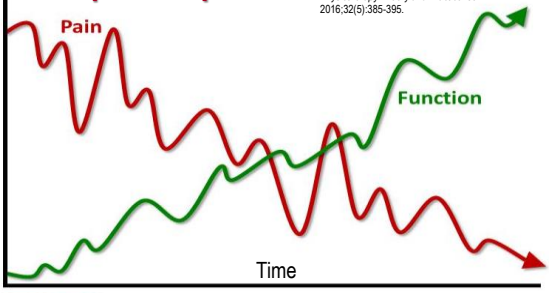




Louw A, Zimney K, O'Hotto C, Hilton S. The clinical application of teaching people about pain. *Physiotherapy Theory and Practice.* Jul 2016;32(5):385-395.

"Despite the pain..."



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.

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PNE+

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Louw A, Zimney K, Puentedura EJ, Diener I. The efficacy of pain neuroscience education on musculoskeletal pain: A systematic review of the literature. Physiotherapy Theory and Practice. Jul 2016;32(5):332-355.

- ❑ Manual therapy
- ❑ Soft tissue treatment
- ❑ Aquatic therapy
- ❑ Modalities
- ❑ Diet
- ❑ Meditation
- ❑ Relaxation
- ❑ Mindfulness
- ❑ Breathing
- ❑ Pilates
- ❑ Yoga
- ❑ Social interaction
- ❑ Humor
- ❑ Spirituality
- ❑ Other…

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End-Result

- Teach people about pain
- Exercise
- Modalities
- Manual therapy
- Relaxation/Meditation
- Breathing
- Sleep hygiene
- Safe, healing environment
- Coping skills
- Pacing and graded exposure
- Goal setting
- More….

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Gifford L. *Aches and Pain*. Cornwall: Wordpress; 2014.

Louis Gifford

Patients want to know…

1. What is wrong with me?
2. How long will it take?
3. What can I (the patient) do for it?
4. What can you (the clinician) do for it?
5. How much will it cost? (I added this one)

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