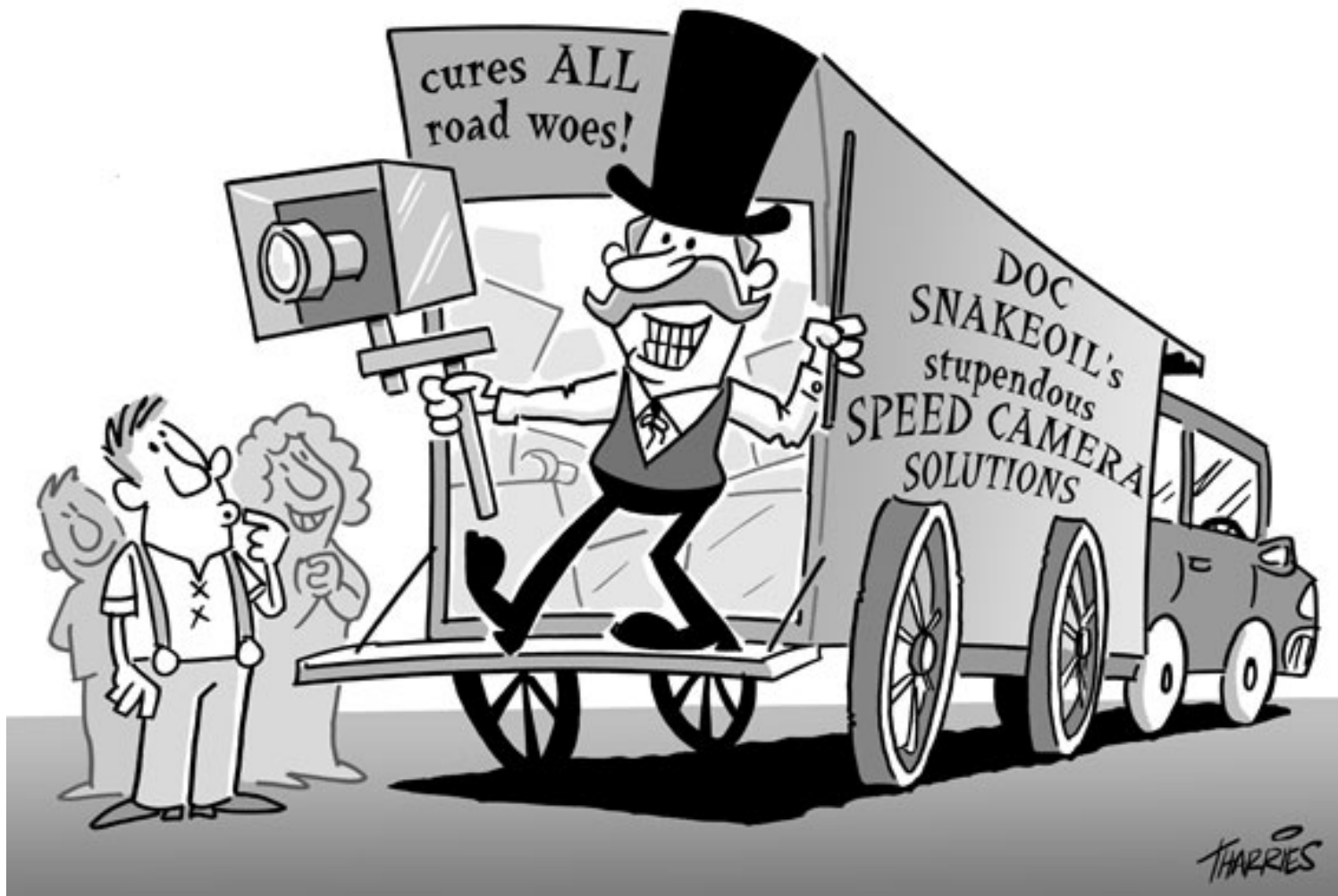


Psychosocial Influences on Pain

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We want to understand how not to go from

- Apparently minor but perhaps frightening injury

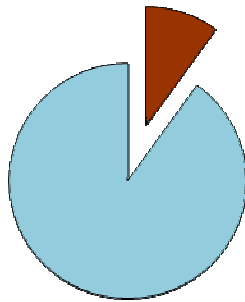
To

- Persistent pain and disability with little physical evidence of tissue damage 12 months (or 24 or 36 or 120 months) later

What are we trying to explain?

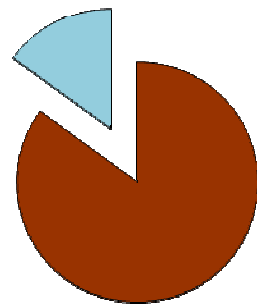
- Why for some people pain conditions persist and become chronic
- Why some individuals are more disabled than others with similar pain conditions

Pain versus psychosocial issues



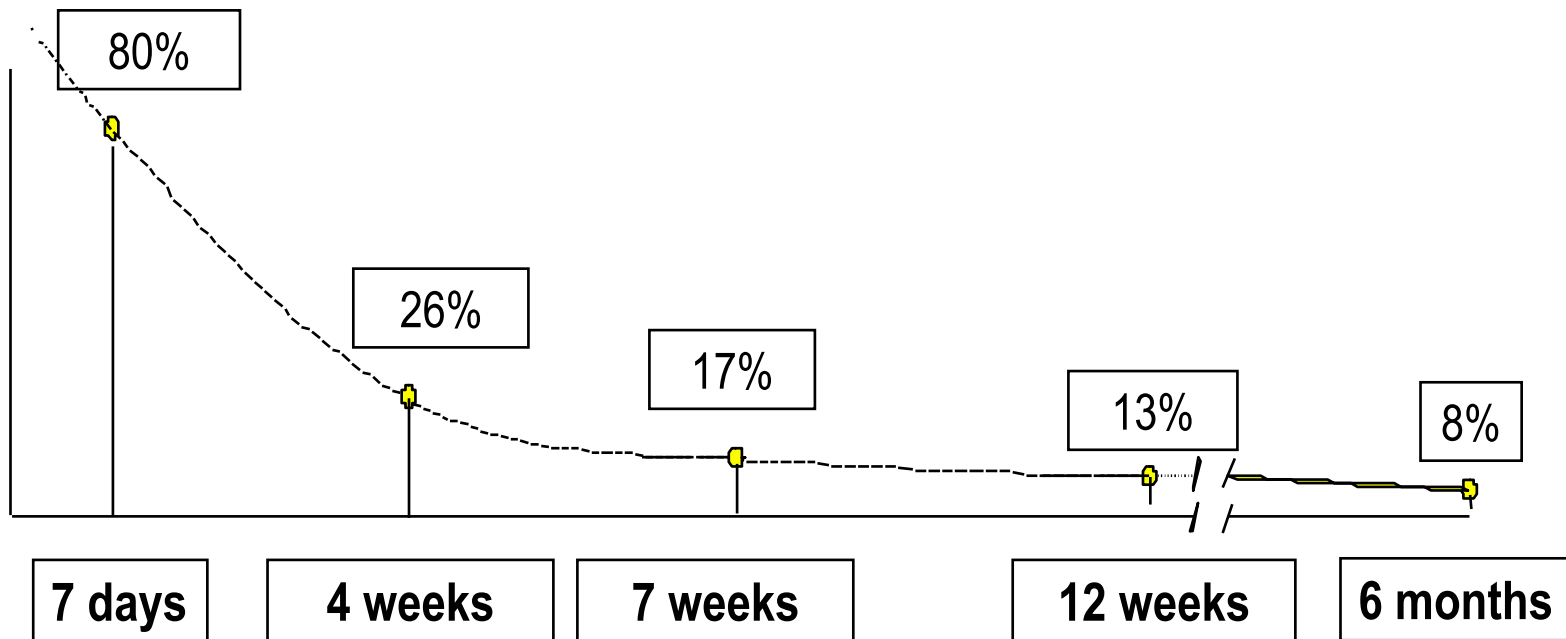
- Pain explains 10% of variance (disability)

- But

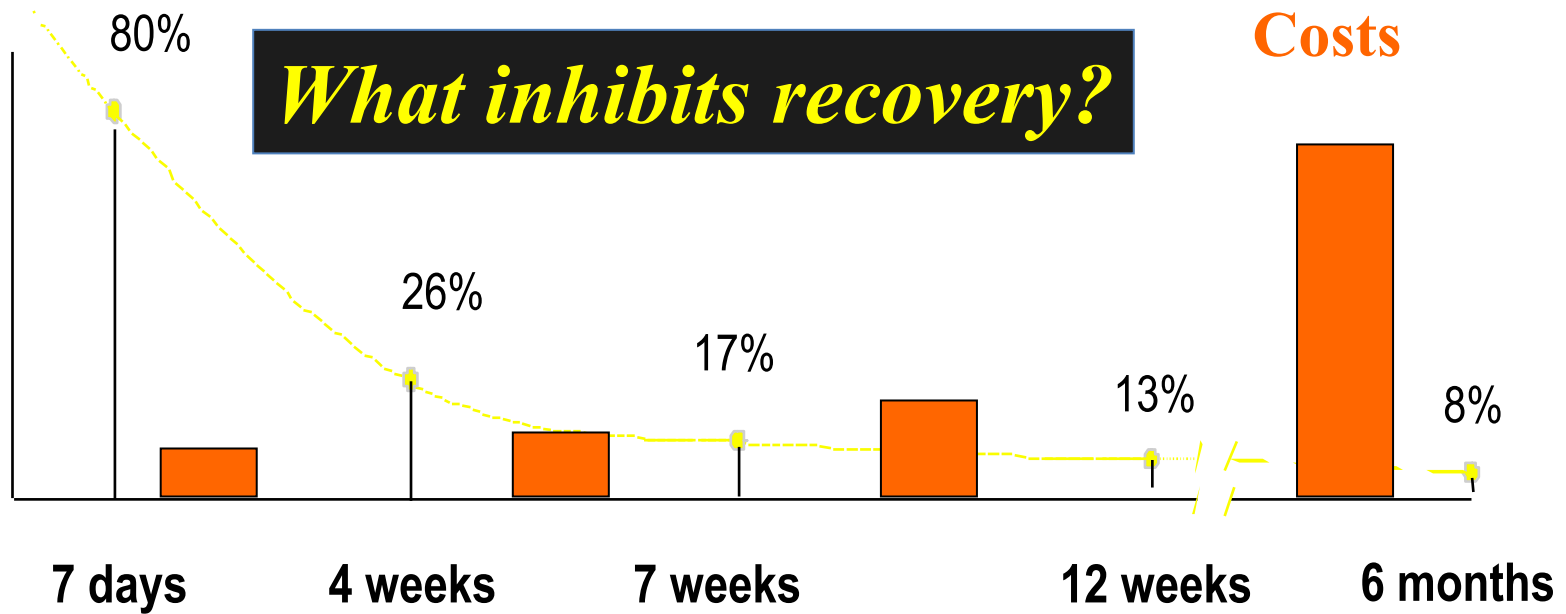


- >85% of resources go to treat pain symptom

Natural History of Low Back Pain



Natural History of Low Back Pain





Sometimes it feels like the whole world's on your back.

Overview

- A little history
- Processes
 - Learning
 - Attention
 - Beliefs
 - Emotion
 - Sleep
- Some predictors

A brief (recent) history

- Around the same time (swinging 60s)
 - Melzack and Wall - wrote about the gate control theory of pain. Described the possibility of descending inhibitory control by things like attention
 - Fordyce argued that we only know another's pain through their pain behaviour which is subject to the laws of learning, rewards and punishment like any other behaviour. Fordyce also suggested that avoidance learning was important

- Central to both is the idea that pain is able to be modified by psychological processes
- Learning and conditioning and attentional processes are still central to our understanding of the action of psychological variables

A little later

- It was shown that placebo analgesia was blocked by the administration of naloxone suggesting that the effect was mediated by endogenous opioids - the endorphins Levine et al. Lancet 1978;2:654-657.
- So, believing (expecting) you might experience a reduction in pain produced a biologically mediated reduction in pain. Beliefs are biologically active!

Placebo Analgesia is:

- A somatotopically specific response that is physiologically mediated by opioid and other pathways, including both expected and not expected effects
- These effects are psychologically mediated by expectancy and conditioning processes

Fordyce suggested:

- We only know about other's pain through their behaviours
- These behaviours are subject to the same laws as other behaviours – if rewarded (reinforced) they will increase in probability
- So the pain behaviours we observe; moaning, limping, grimacing, complaining, seeking a cure, etc. are dependent on their consequences as well as the original injury



CRAIG SWANSON © WWW.PERSPICUITY.COM

Learning and pain

- Chronic back pain (CBP) patients and controls both report higher pain when reinforced for doing so
- CBPs somatosensory evoked potential was higher and SEP and report extinguished more slowly while EMG responses remained elevated for longer (Flor H. et al. Pain 2002;95:111-118)

Classical Conditioning and reinforcement

- Chronic pain patients respond to physical and psychosocial stressors with increased muscle tension and slowed return to baseline (e.g. Flor H et al. J Consult Clin Psychol. 1985;53:354-364).
- Chronic Pain Patients have facilitated aversive conditioning and slowed extinction of muscle activity Schneider C et al. Pain 2004;112:239-247.
-
- Pain SEPs are reduced by muscle tension in CLBP and subchronic CLBP patients Knost B. et al. Psychophysiology 1999;36:755-764.

Solicitousness

- Pain behaviour is increased, pain threshold and tolerance are reduced in the presence of solicitous significant others.
-
- Sensory Evoked Potential is increased when CLBP patients receive painful back stimulation in the presence of solicitous spouses (Knost, Flor & Birbaumer, 1999).
- Patient's perceptions of solicitousness more important than significant other perceptions.

But

- Solicitousness does improve marital satisfaction
- The behaviours described by the term solicitousness are inconsistent across studies.
- Punishing significant other responses may reduce pain behaviour but also reduces marital satisfaction and affect.

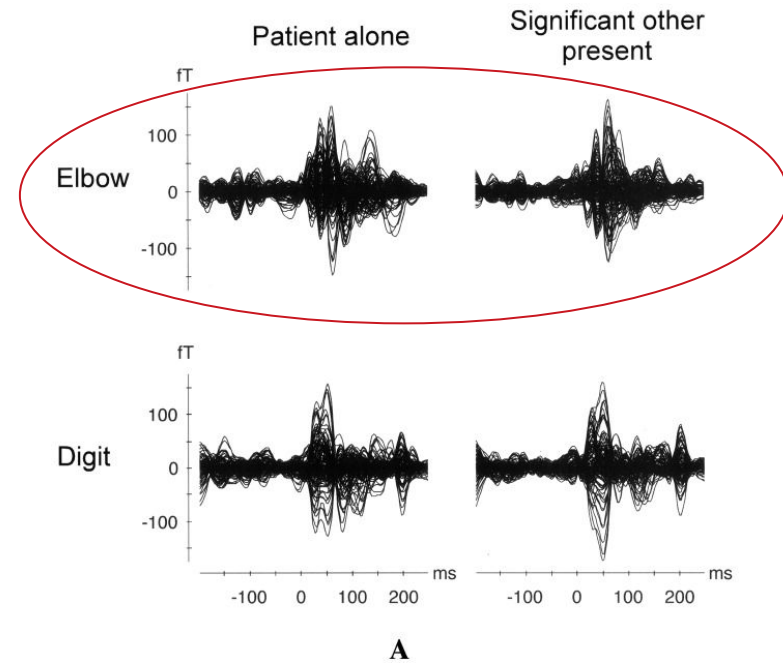
- Review: Newton-John T.R.O. Pain Rev. 2002;9:7-27

Significant other effects

- These contradictions are probably explained by two (or more) opposing processes
 - The reinforcement effects
 - Interpersonal effects of intimacy
 - Intimacy develops when self-disclosure is met with empathy and validation which might improve emotional regulation
 - (Cano & Williams, Pain, 2010, 149, 9-11)

Imaging social support in fibromyalgia

- FM patients showed reduced pain sensitivity and pain ratings when their significant others were present.
- Brain activity produced by stimulation was also reduced when SO was present.
- These effects occurred for FM patients but not migraine sufferers.
- Image on the right shows what not to do with your head
- Montoya P. et al. Arthritis Rheum. 2004; 50: 4035-4044.



B

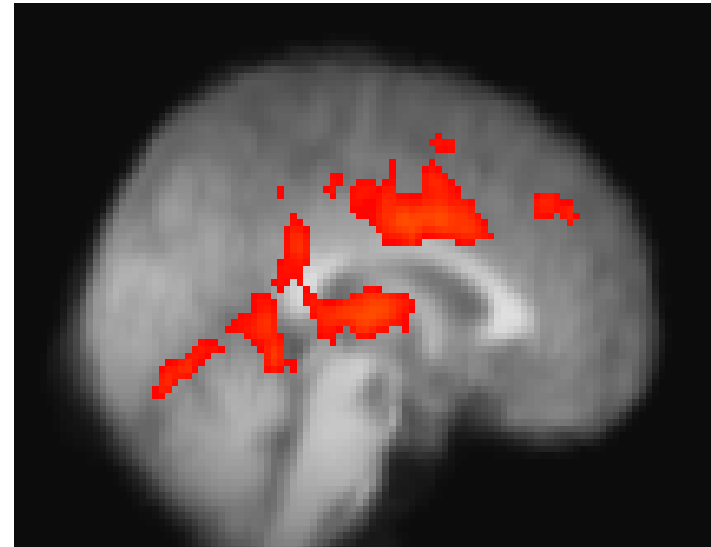
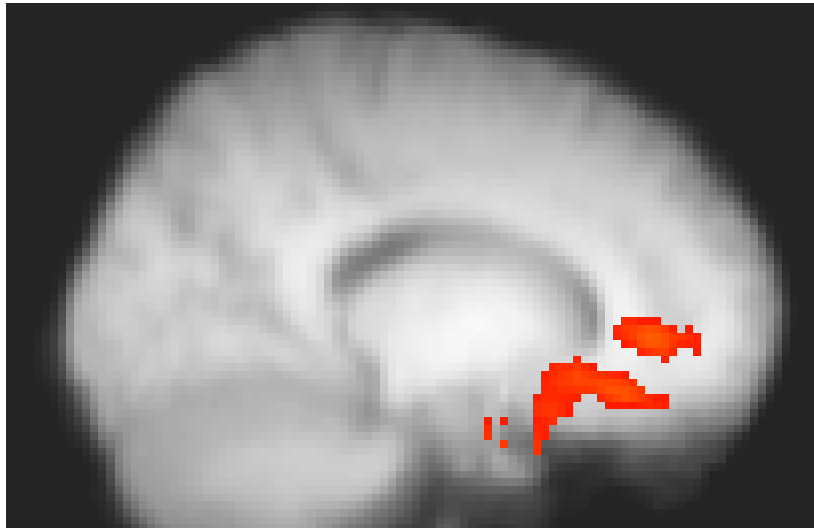
Reinforcement effects

- As well as influencing the probability of the behaviour that it follows reinforcement increases attention to the stimulus that signals the behaviour.
- So reinforcement of pain behaviour is also likely to increase attention to pain.

The influence of attention



Modulation of pain by cognitive state

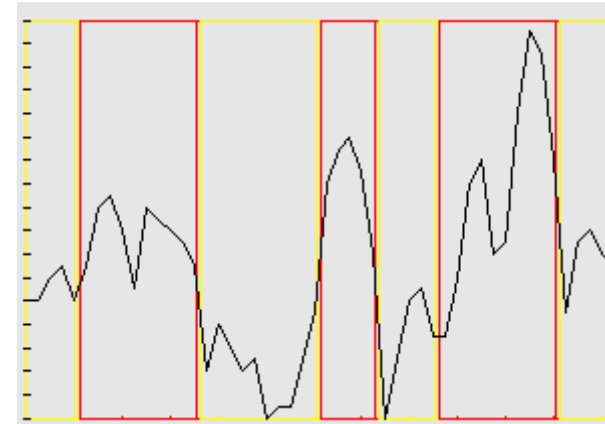


Distraction reduces pain responses in the brain.

A. areas that are more active when pain and distractor are both occurring (affective division of the ACC and orbitofrontal region) and B. areas that are less active when pain and distractor are occurring together (thalamus, insula, cognitive division of the ACC).

Bantick et al. 2002

Dynamic modulation of activity in the periaqueductal grey-brainstem “gating” for central pain responses



Time course

Activation in the PAG is dependent upon attention. Activation was related to changes in perceived intensity of pain

Attention and Distraction: Traditional perspective

- Resource or capacity theory (Kahneman, 1973; McCaul & Mallott 1984)
 - Used to explain why distraction might reduce pain.
 - Argues that we have limited attentional resources.
 - Attention allocated to distractor reduces available attention for pain = reduced pain.
 - Multiple resource theory suggests the more similar information processing requirements are, the more they will influence capacity availability

Attention: Pain as a distractor

- Eccleston and Crombez (1999) pointed out that pain is designed to interrupt ongoing activity and attract attention to deal with threats to the organism.
- In a series of studies they showed pain interrupts ongoing activity (simple reaction task) and identified variables that affected interruption.
- pain onset, more severe (or threat of more severe) pain, unpredictability, individuals fearful of pain, high in pain catastrophising.

So, in distraction

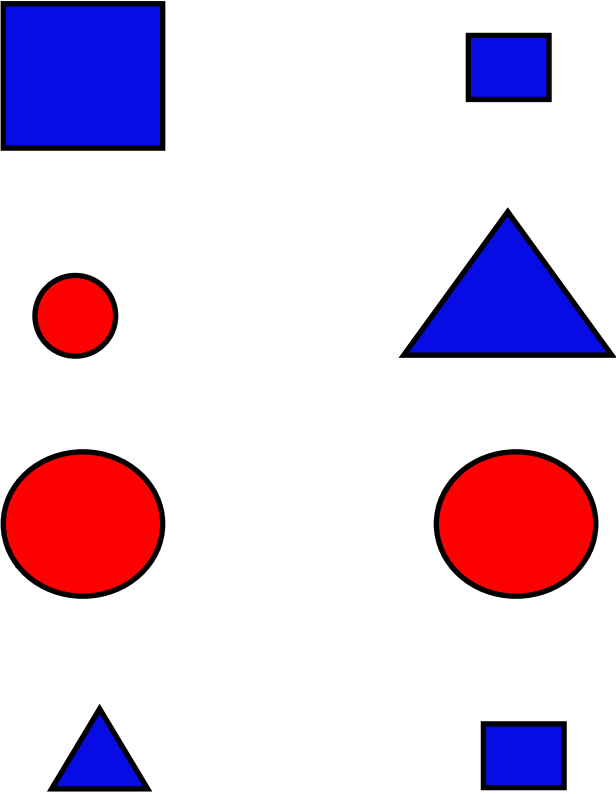
- Perception of a highly salient stimulus (pain) is suppressed by consciously focussed attention to a non-pain stimulus or stimuli.
- The efficacy of distraction will be affected by the qualities of the pain, the qualities of the distractor and individual differences.
- Factors that influence the top down or bottom up control are of interest.

Tasks that appear insensitive to the effects of pain

How many ways are these pairs of stimuli different

- *Stimuli were on the screen for*
- *3.4 sec. every 5 sec.*

Response times and errors were not altered by pain



Similarly, Seminowicz & Davis (2007) showed:

imaging three levels of difficulty of cognitive task and two levels of pain intensity

- 1) more intense pain-evoked activity was more sensitive to attenuation by a cognitive task;
- 2) the greatest interaction occurred between the higher pain intensity and the easy task;
- 3) pain did not affect activity in cognitive-related areas of activation except when cognitive load is minimal (simple tapping task)

Hypervigilance

- Attention to pain is enhanced by unpredictability and threat value of pain in both pain sufferers and controls
- Hypervigilance seems to comprise enhanced engagement to pain and slowed disengagement
- We do not know the effects of extended hypervigilance to pain

Van Damme S. et al. J Pain 2006;7:346-357.

Beliefs

- We respond to what we believe to be the case, not what is the case

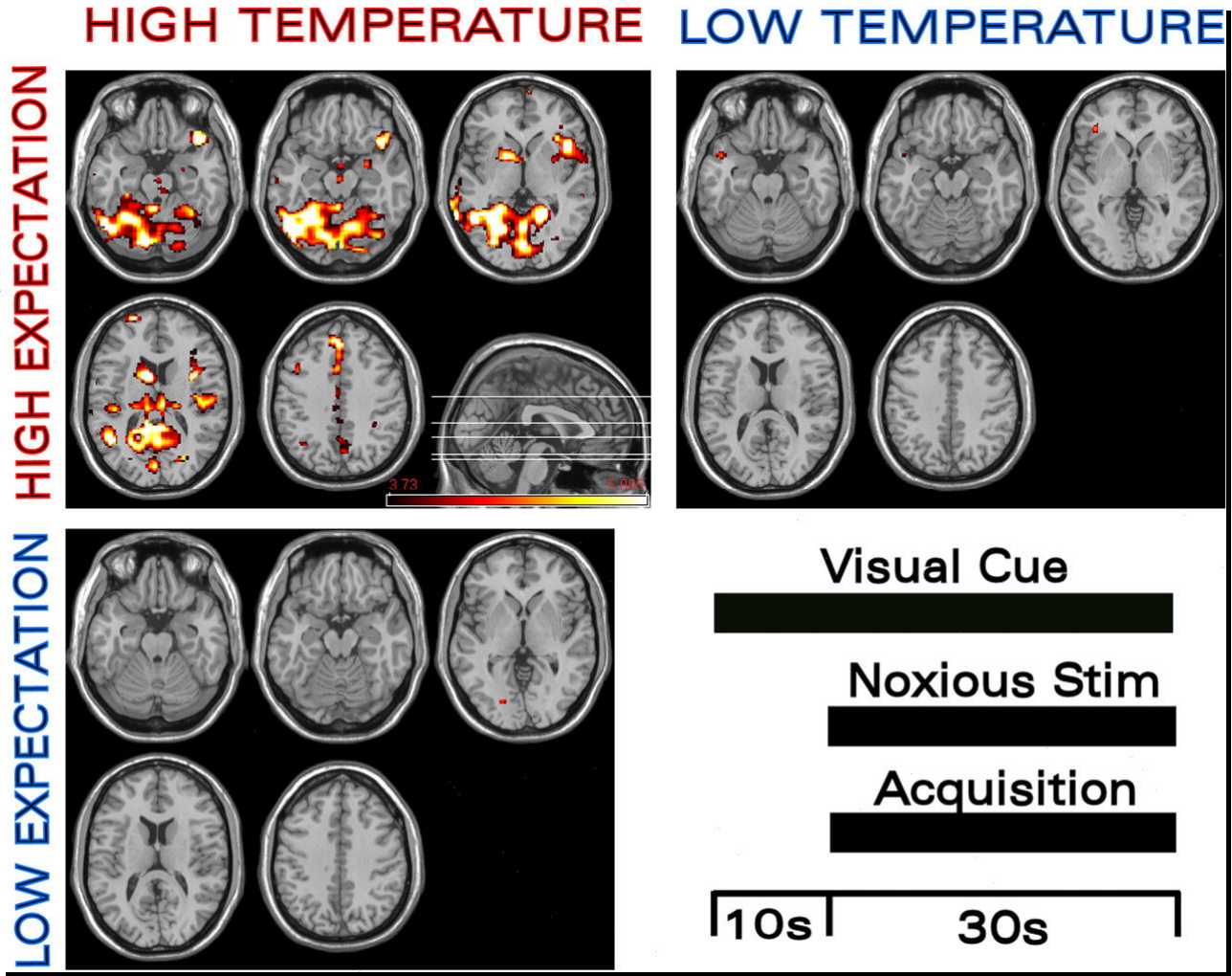


Expectation

Keltner, J. R. et al. *J. Neurosci.* 2006;26:4437-4443

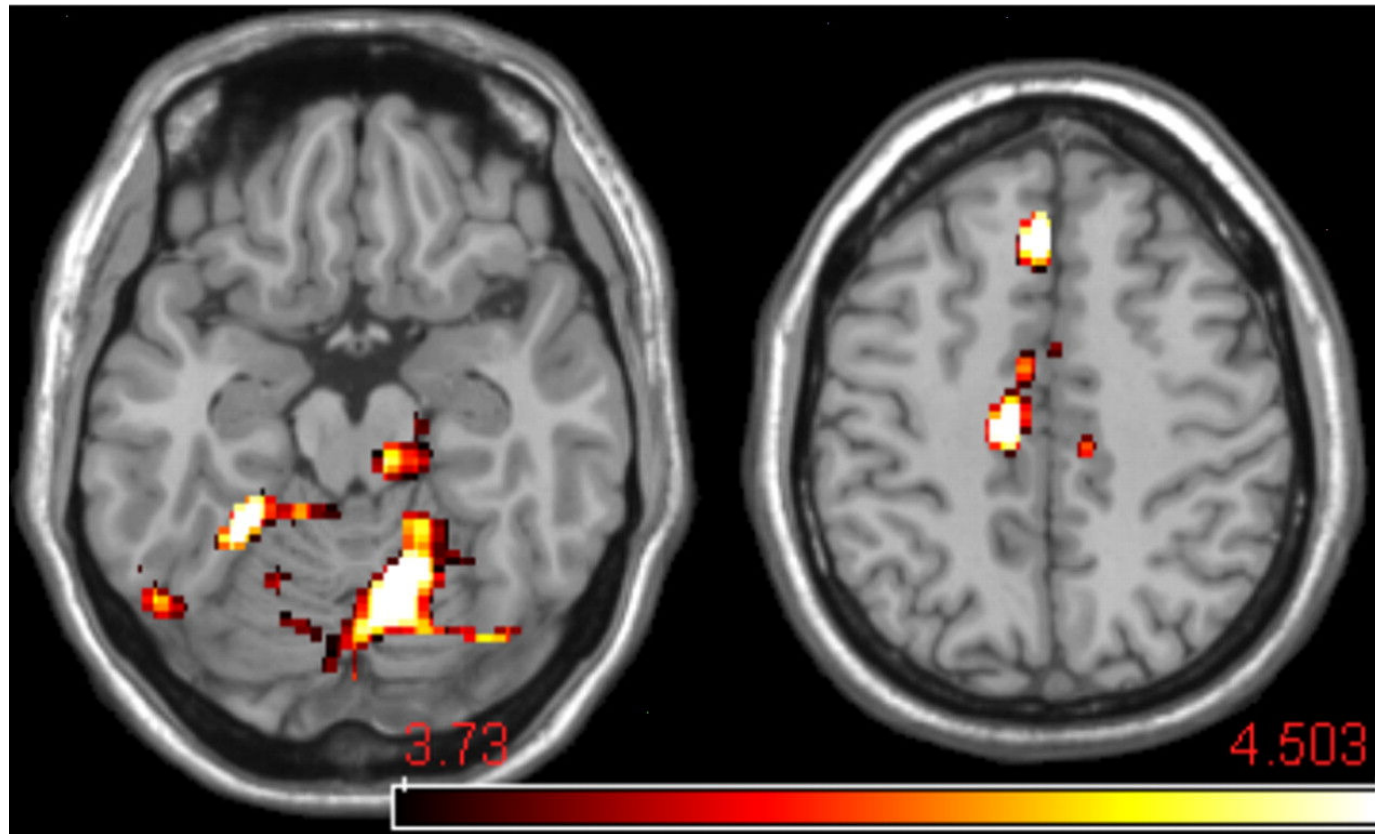
- Two cues, one presented just before and during 47° and one before and during 48°
- After conditioning participants reported higher pain with 48° cue.
- And showed greater activation in the pain areas of the brain with the cue associated with the 48° cue independently of the stimulus

Figure 1. Maximum BOLD activation is observed when high-temperature noxious stimulation (Noxious Stim) occurs in the presence of high expectation. fMRI BOLD activation in a variety of regions was modulated by changes in both expectation ("HIGH EXPECTATION" and "LOW EXPECTATION") and the intensity of the noxious thermal stimulus ("HIGH TEMPERATURE" and "LOW TEMPERATURE")



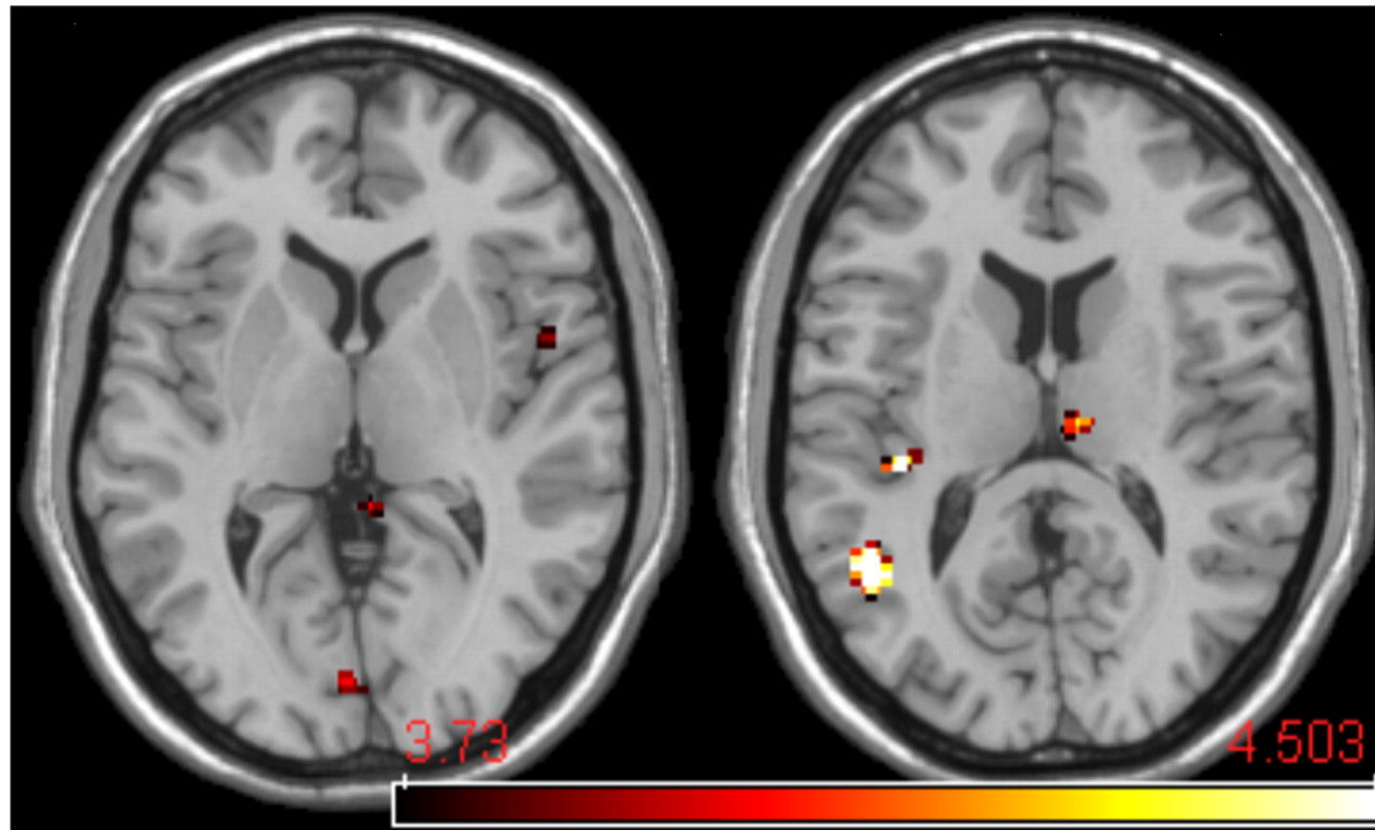
Keltner, J. R. et al. J. Neurosci. 2006;26:4437-4443

Figure 2. Expectation-associated BOLD activation



Keltner, J. R. et al. *J. Neurosci.* 2006;26:4437-4443

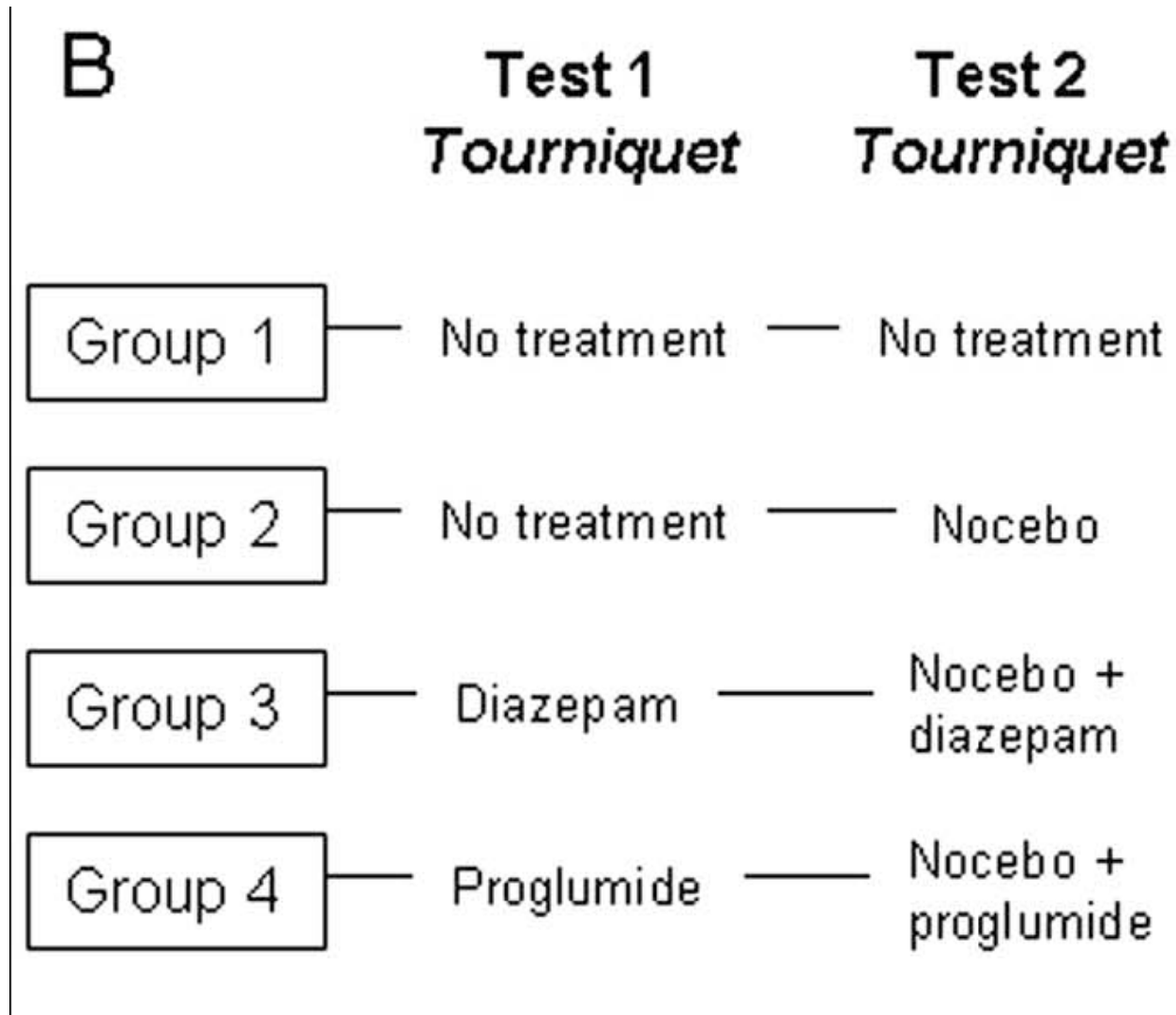
Figure 3. Thermal stimulus intensity-associated BOLD activation



Keltner, J. R. et al. J. Neurosci. 2006;26:4437-4443

Nocebo Expectancy

Benedetti, F. et al. J. Neurosci. 2006;26:12014-12022

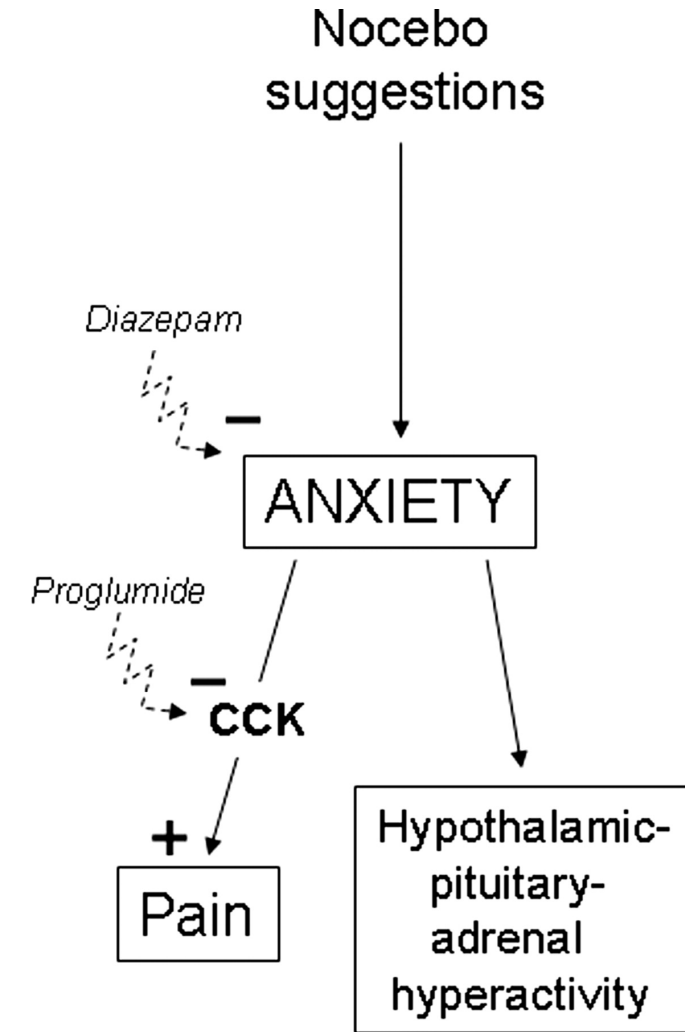


Nocebo Expectancy

Benedetti, F. et al. J. Neurosci. 2006;26:12014-12022

- Expectation of severe pain produced
 - Increase in pain report
 - Increases in ACTH
 - Increases in cortisol
- Administration of diazepam
 - Blocked increased pain report
 - Blocked increase in ACTH & cortisol
- Administration of progumide
 - Blocked increased pain report
 - Did not block increase in HPA axis response

Figure 6. Model to explain the findings of the present study

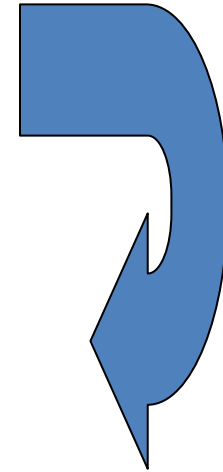
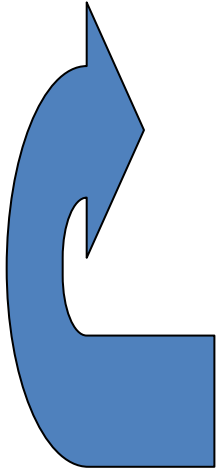


Benedetti, F. et al. J. Neurosci. 2006;26:12014-12022

So

Expectation of severe pain

Increased pain



Catastrophising

- A negative cognitive response to pain or anticipated pain, characterized by a tendency to fixate on the pain stimulus, magnify its threat value, and adopt a helpless outlook regarding managing the pain
- Sullivan, Thorne, Haythornthwaite, Keefe, Martin, Bradley & Lefebvre – *Clinical Journal of Pain*, 2001

The original catastrophising items

Its terrible and I feel it's never going to get better

Its awful and I feel that it overwhelms me

I feel my life isn't worth living

I worry all of the time about whether it will end

I feel I can't stand it anymore

I feel like I can't go on

Rosenstiel and Keefe Pain,1983, p33-44

Catastrophising

I worry all the time about whether the pain will end.
I feel I can't go on.
It's terrible and I think it's never going to get any better
It's awful and I feel that it overwhelms me.
I feel I can't stand it anymore
I become afraid that the pain will get worse.
I keep thinking of other painful events
I anxiously want the pain to go away
I can't seem to keep it out of my mind
I keep thinking about how much it hurts.
I keep thinking about how badly I want the pain to stop
There's nothing I can do to reduce the intensity of the pain
I wonder whether something serious may happen.

Catastrophising

- Catastrophising has consistently been shown to be associated with disability in pain patients (e.g. Peters M et al. Pain 2005;113:45-50).
- Catastrophising produces retarded disengagement from pain signals Van Damme S. et al Pain 2002;100:111-118.
- Catastrophising does not alter pain experience by engaging descending modulatory systems. Rhudy, Maynard & Russell J of Pain 2007, 8, 325-333.
- Catastrophisers experience the pain reducing qualities of distraction more slowly than non-distractors – in the real world might give up on helpful strategies because they are slower to experience the benefits. Campbell et al. Pain 2010 doi 10.1016.

Why Do People Catastrophise?

- Catastrophising as a coping mechanism
 - Catastrophising serves a social function (Severeijns et al, 2004)
 - Characteristics of catastrophising such as rumination, magnification and helplessness elicit attention and support through the individual displaying distress, pain behaviours and helplessness.
 - Seen as being part of a wider interpersonal coping style
 - Interpersonal relationships seen as more important goal over pain reduction

Example: Keefe et al (2003) found that catastrophising in cancer patients yielded higher perceived instrumental support from their caregivers

Catastrophising & Pain

- Mechanisms not fully understood
 - catastrophising can increase the subjective experience of pain
 - Sullivan and Bishop studies – clinical and nonclinical samples.
 - catastrophising may cause an attentional shift in which the negative aspects of the pain experience are focussed on which may increase fear related to pain (Gracely, et al, 2004)

Catastrophising & Pain

- Linked to Fear-avoidance Model
 - behaviours and cognitions associated with catastrophising, such as helplessness, magnification & fear of movement impact pain experience and may contribute to the development of chronic pain
 - Fear of re-injury may motivate the individual to adopt a catastrophic disposition, where by the risk of further damage is reduced through the cognitions and behaviours associated with helplessness, rumination and magnification.

Other predictive beliefs

Self-efficacy

“ Efficacy expectations determine how much effort people will expend and how long they will persist in the face of obstacles and aversive experiences”

p.194 Bandura 1977

- Self-efficacy in relation to chronic pain has been assessed as either the:
 - confidence in the ability to perform specific tasks
 - confidence in performing more generalised constructs such as coping with pain.
- Chronic pain self-efficacy is not just the expectation that the person can perform a particular task or behaviour but is also the person's confidence in being able to do it despite the pain.

Other predictive beliefs

Locus of Control- The belief that outcomes are under your control, rather than being attributable to chance or others such as doctors.

Most common assessment instrument in health is the Multidimensional Health Locus of control scale (Walston and Walston) but pain specific LOC scales have also been developed.

Emotions

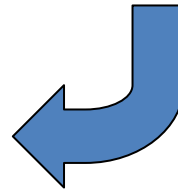
- Fear is the most investigated emotion in relation to pain although anger and even positive emotions like happiness have also been looked at.
- The 'fear avoidance' model has been the subject of much investigation.

Fear Avoidance Model

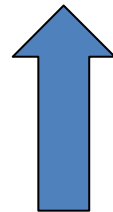
Injury



Pain experience

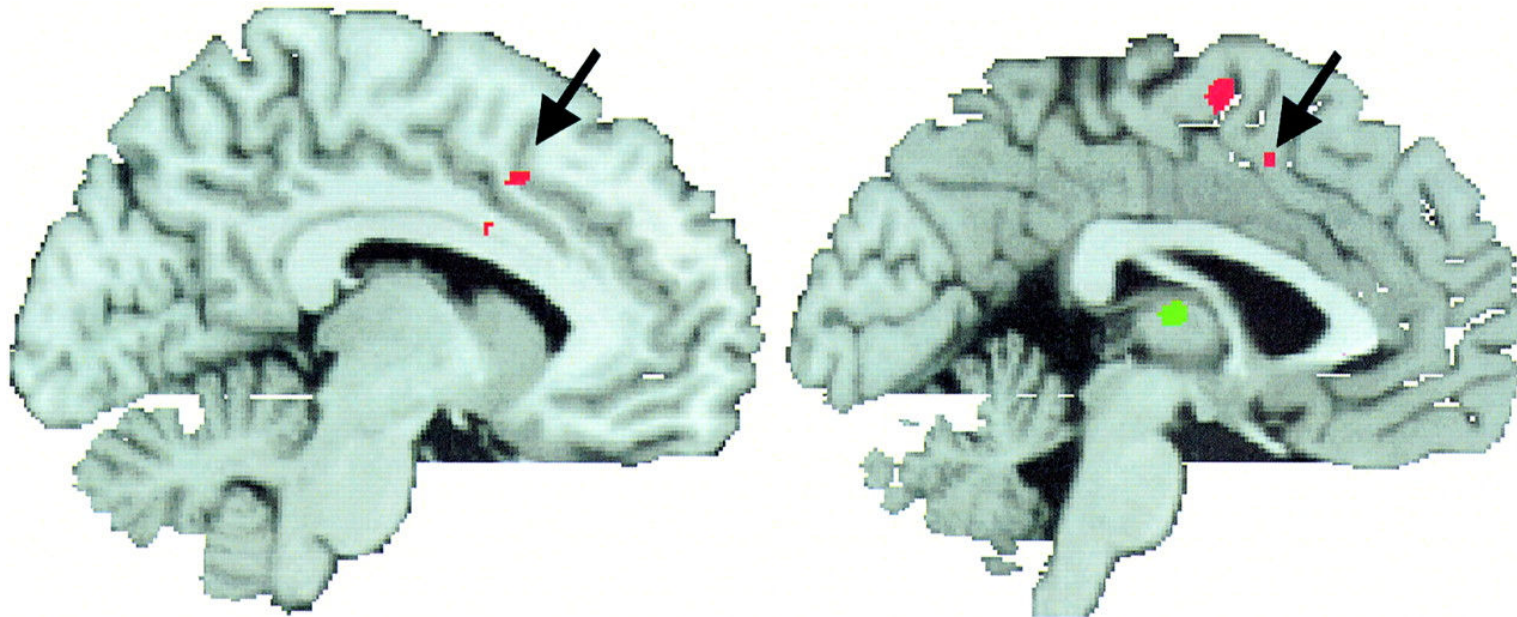


Pain catastrophizing



Negative affectivity
Threatening illness information

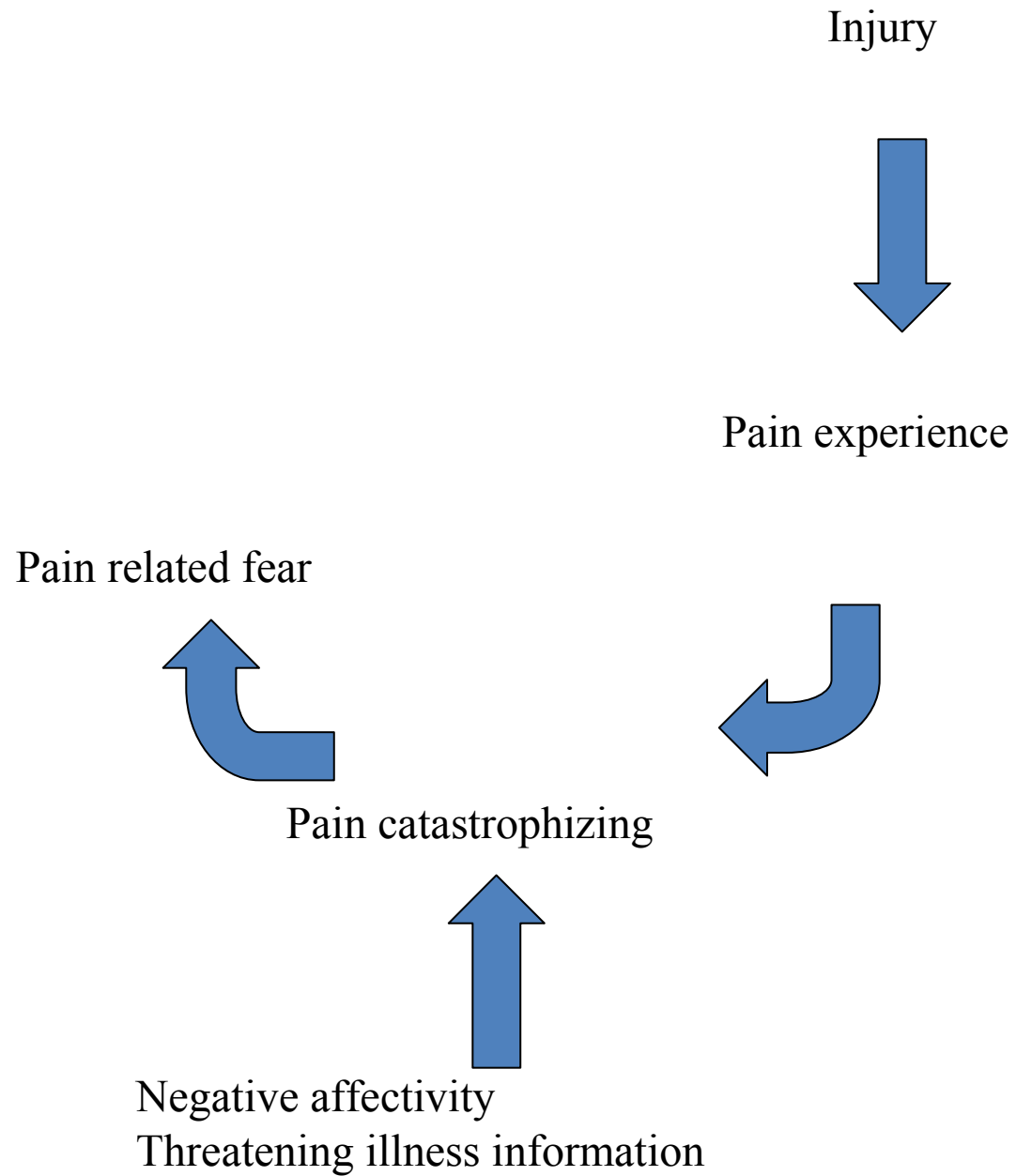
Catastrophising in fibromyalgia



Gracely, R. H. et al. *Brain* 2004 127:835-843

Findings support the idea that catastrophising influences pain through altering attention and anticipation and increasing emotional responses to pain

Fear Avoidance Model



Kinesiophobia

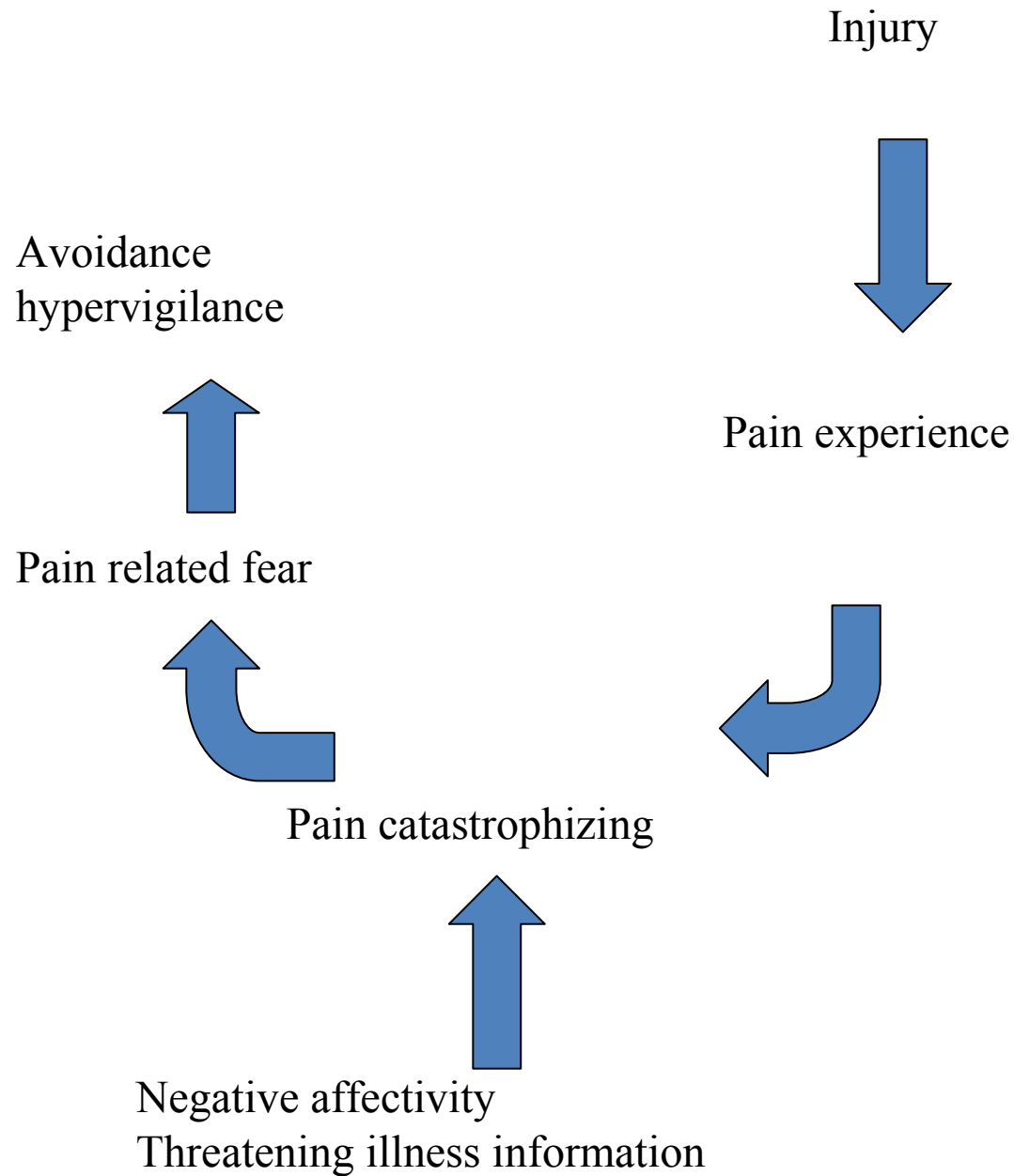
An excessive, irrational and debilitating fear of physical movement and activity resulting from a feeling of vulnerability to painful injury or re-injury.

Kori,S.H. et al. Pain Management 1990;3:35-43

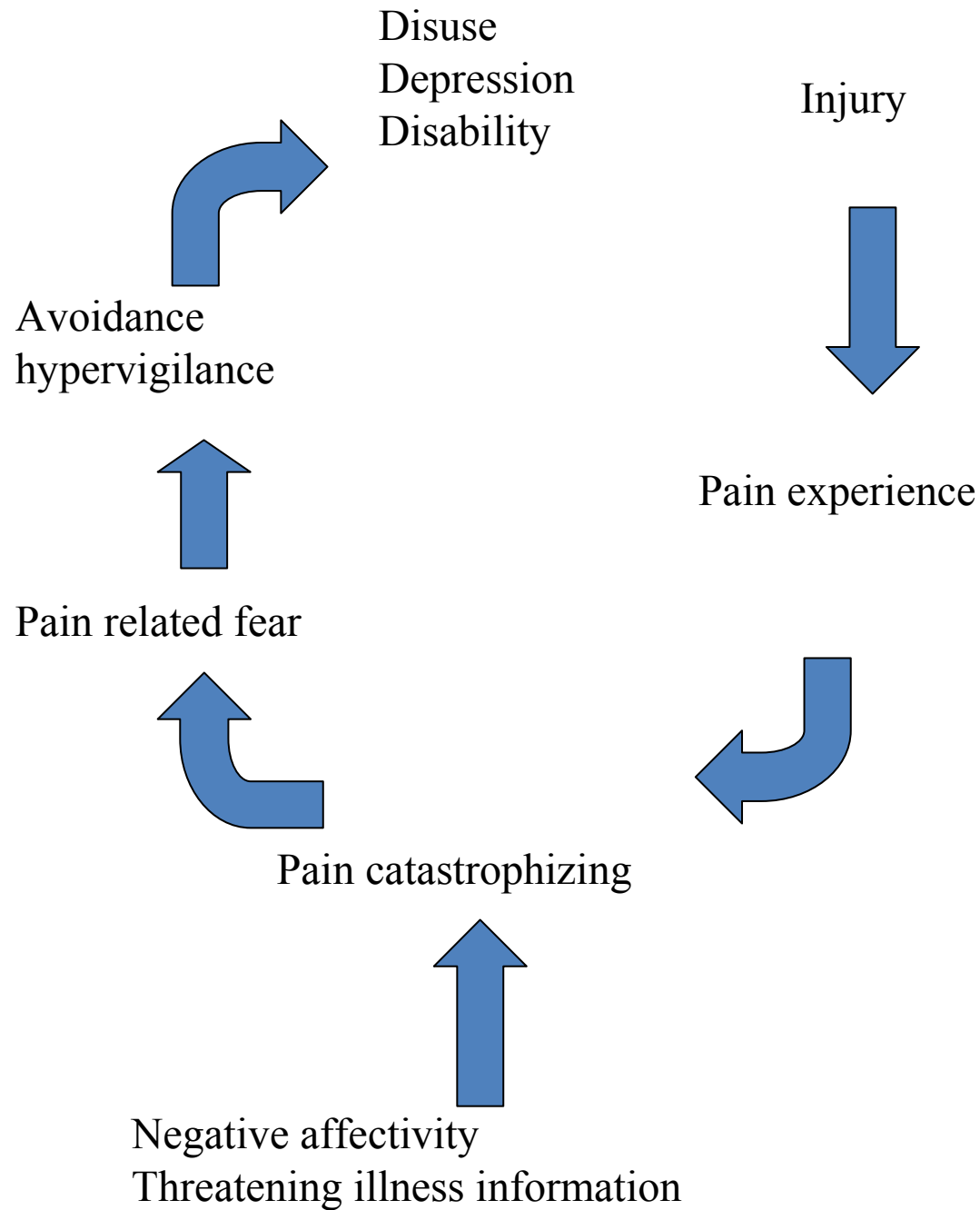
Tampa Scale for Kinesiophobia

1. I'm afraid that I might injure myself if I exercise.
2. If I were to try to overcome it, my pain would increase.
3. My body is telling me I have something dangerously wrong.
4. My pain would probably be relieved if I were to exercise.
5. People aren't taking my medical condition seriously enough.
6. My accident has put my body at risk for the rest of my life.
7. Pain always means I have injured my body.
8. Just because something aggravates my pain does not mean it is dangerous.
9. I am afraid that I might injure myself accidentally.
10. Simply being careful that I do not make any unnecessary movements is the safest thing I can do to prevent my pain from worsening.
11. I wouldn't have this much pain if there weren't something potentially dangerous going on in my body.
12. Although my condition is painful, I would be better off if I were physically active.
13. Pain lets me know when to stop exercising so that I don't injure myself.
14. It's really not safe for a person with a condition like mine to be physically active.
15. I can't do all the things normal people do because it's too easy for me to get injured.
16. Even though something is causing me a lot of pain, I don't think it's actually dangerous.
17. No one should have to exercise when he/she is in pain.

Fear Avoidance Model



Fear Avoidance Model



Pain-related fear affects performance and disability

- Range of motion and performance on a lifting task were both limited in people with higher pain-related fear (McCracken et al. 1992; Vlaeyen et al. 1995)
- Disability in LBP patients has been shown to be predicted better by fear of pain than by pain itself (e.g. Crombez et al. 1999)
- Klenerman et al (1995), Linton (1999), Fritz et al. (2001), Boersma & Linton (2006) all showed that pain-related fear predicts future disability in prospective studies of acute back pain sufferers
- Fear-avoidance beliefs and catastrophising in the general population can increase the risk of a new episode of back pain (Buer & Linton, 2002)
- Fear avoidance beliefs and catastrophic beliefs might reduce the efficacy of treatment approaches if not accounted for (Al-Obaidi et al. 2005; Jellema et al. 2006).

Pain-related fear affects performance and disability

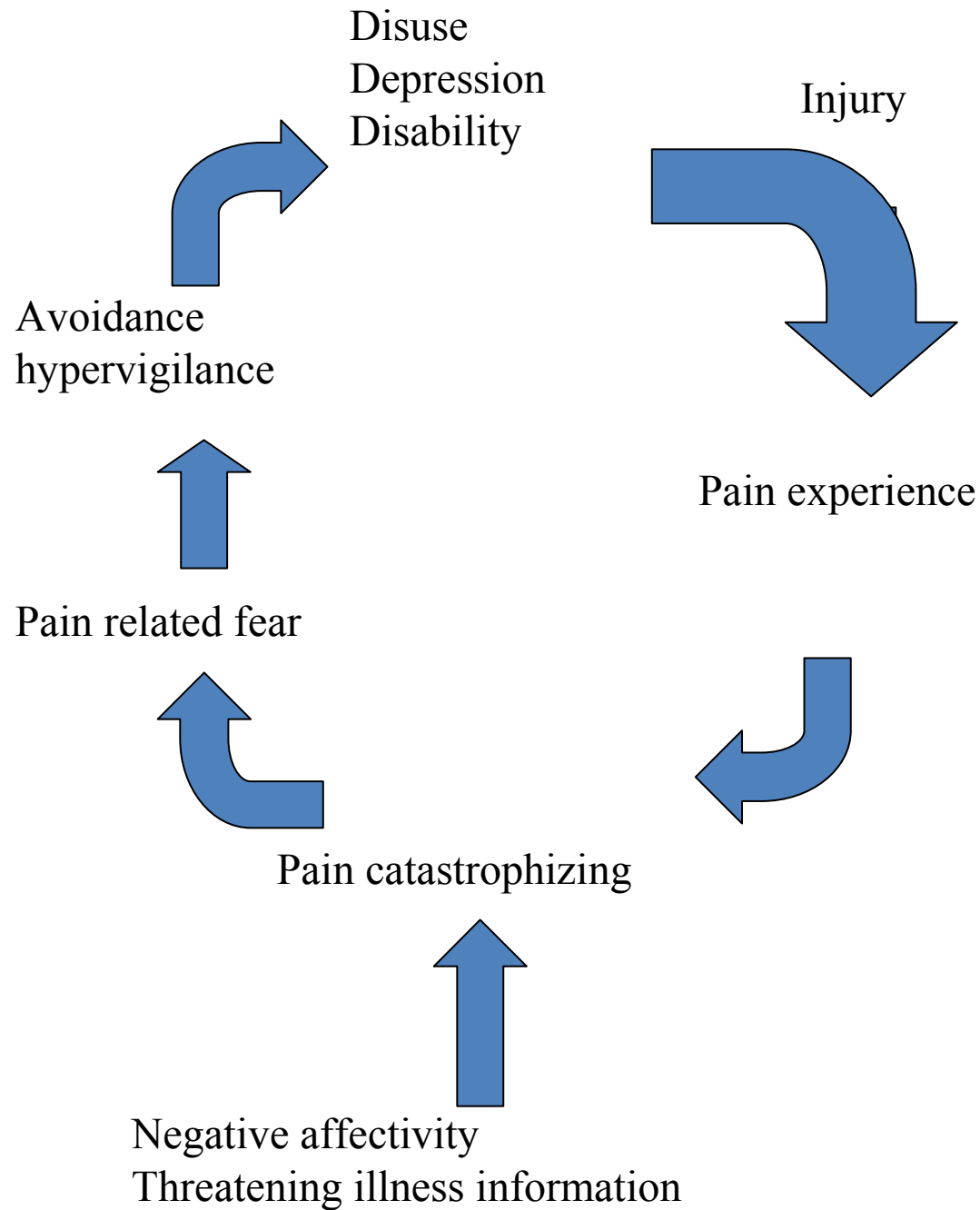
However

- Fear avoidance appears to have a greater effect on function the longer pain has persisted (Boersma & Linton, 2005)
- Rising fear in the first two weeks of an acute LBP is associated with increased disability at one year (Sieben et al. 2002)
- Pain outcomes 12-40 months after acute episode predicted by pain intensity during the acute incident, negative affect and previous LBP history, not pain related fear or catastrophising (Sieben et al. 2005)
- See review Leeuw, M. et al. J. Behav. Med. 2007;30:77-94

But

- Over a year, LBP patients identified 4-7 weeks after onset did not become deconditioned and only a small subgroup with negative affect and perceived physical activity decline reduced their physical activity levels. (Boersma et al., 2007).
- Physical reconditioning treatments do not appear to be more effective than other treatments (Smeets et al 2006a).
- Exercise/activity based treatment improvements, as well as CBT appear to be mediated by reductions in pain catastrophising (Smeets et al., 2006b).
- So: Deconditioning, although plausible, is not yet an evidence based explanation for chronicity of LBP

Fear Avoidance Model



The first law of holes

Popularized by Dennis Healey

Bill Clinton

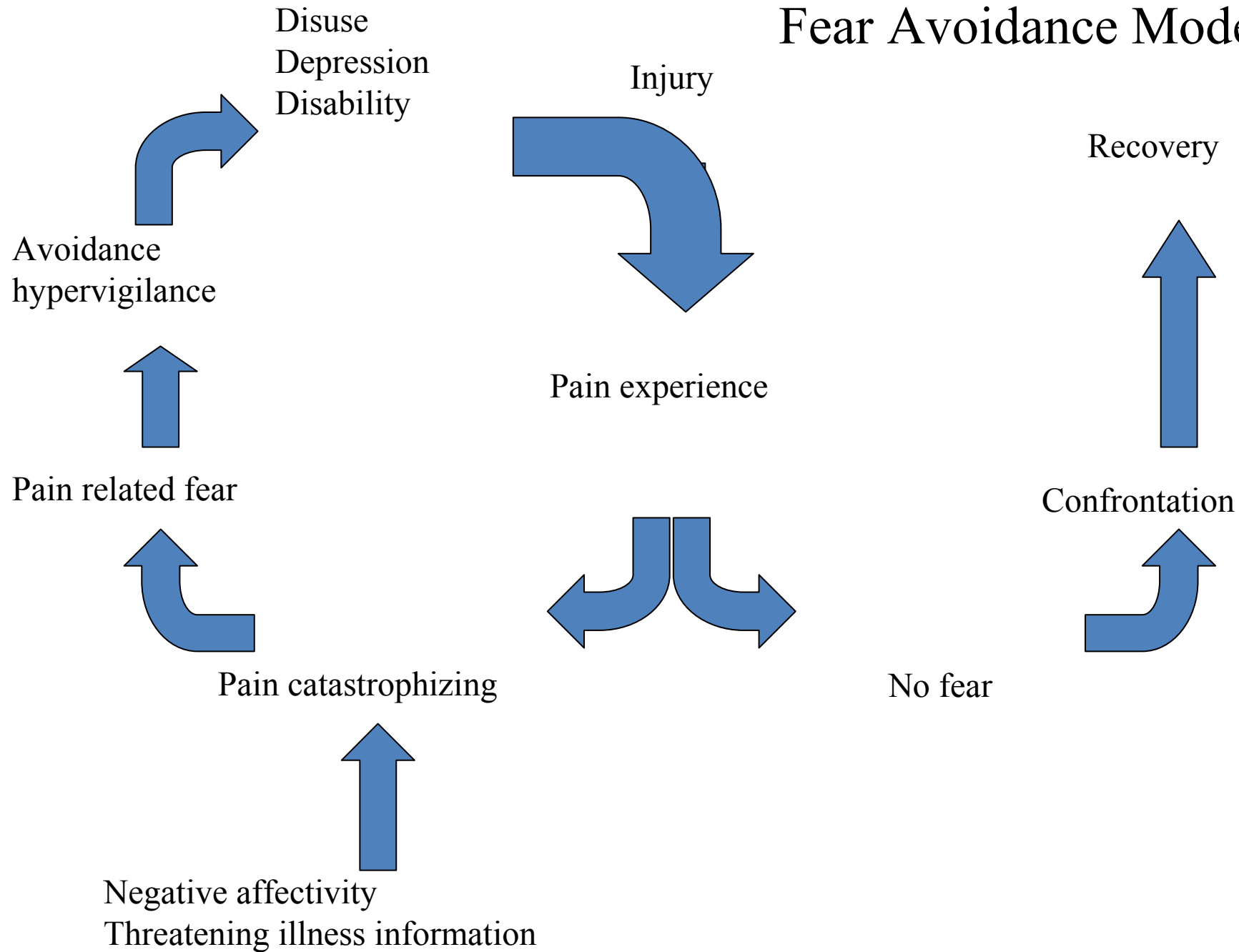
Kevin Rudd

When you're in one.....

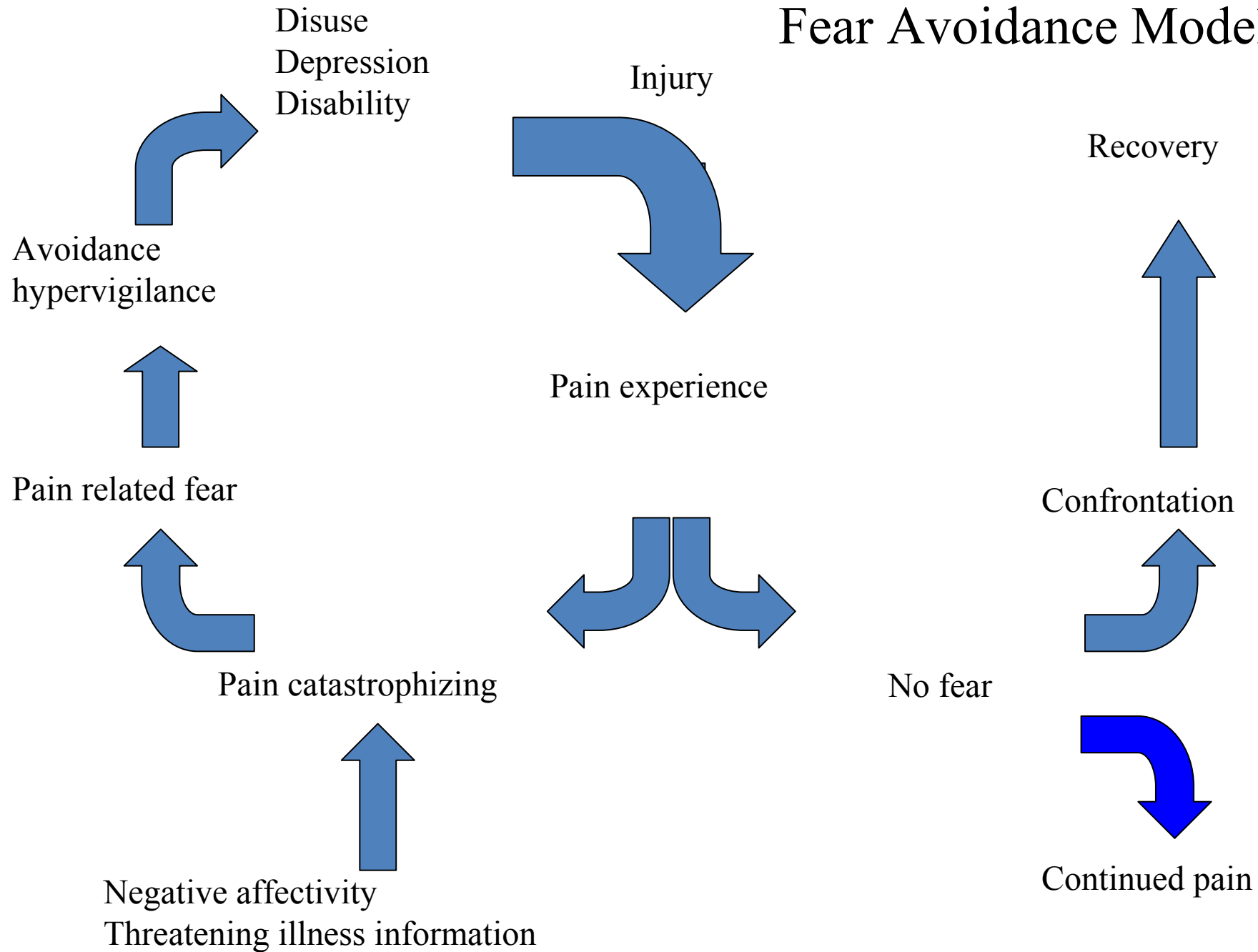


stop digging!

Fear Avoidance Model



Fear Avoidance Model



Pain and sleep



Sleep and Pain

- In the general population, hours of reported sleep predict next day's pain with a weaker relationship between daily pain and that night's sleep. (Edwards et al., 2008, *Pain*, 137, 202-207)
- 75% of burn pain patients report sleep disturbance and sleep disturbance increases next day pain, but days in which pain is more severe did not predict poorer night's sleep (Raymond et al., 2001, *Pain* 92, 381-388).
- A number of experimental studies in pain-free individuals have shown that sleep restriction produces enhanced responding to painful stimuli (hyperalgesia) the next day.
- Even after 8 hours sleep pain-free individuals that describe themselves as sleepy have lowered pain tolerance. Chhangani et al., 2009, *Sleep*, 32, 1011-1017.

Sleep and Pain

- There is considerable evidence that arousal and pain neural networks overlap, suggesting arousal is an adaptive response to pain (Nofzinger and Derbyshire 2007).
- A large proportion (50-70%) of persistent pain patients report poor sleep, either limited in length, or non-restorative (Lavigne et al. 2007).
- Although sleep appears to suppress sensory input, including noxious input at the level of the thalamus, this seems to only apply to brief and (presumably) innocuous noxious input.
- Pain interferes with sleep over all sleep stages but more readily in stage 2 sleep.
- In chronic back pain, insomnia severity was best predicted by affective pain ratings independent of present pain intensity, depression and anxiety. (Tang et al., (2007), J Sleep Res. 16 85-95).
- In persistent pain there appears to be a reciprocal relationship between sleep and pain: bad sleep = more intense pain and more intense pain = bad sleep. Patients have shorter sleep duration and reduced sleep efficiency (Okura et al. 2008, Sleep Medicine 9 352-361)

Sleep and pain, possible mechanisms

- Partial sleep deprivation impairs diffuse noxious inhibitory control (DNIC) and is associated with spontaneous pain in pain-free women (Smith et al., 2007, *Sleep*, 30, 494-505).
- Patients with temporomandibular disorder also show impaired DNIC associated with sleep impairment (Edwards et al., 2009, *Eur J Pain*, 13, 1043-1047)
- DNIC appear to be largely independent of attention (Van Wijk & Veldhuijzen 2010 *J Pain* (published online Jan 2010))
- Sleep loss initiates changes in immune markers associated with inflammation (see Smith et al., 2009, *Current Pain and Headache Reports*, 13, 447-454).

Sleep and Fibromyalgia

- Sleep problems, often non-restorative sleep, are reported by 60-80% of FM sufferers
- Sleep studies of FM sufferers have shown several different sleep problems such as:
 - Indications of reduced stage 3 and 4 sleep (alpha delta sleep).
 - More microarousals
- Pain free individuals deprived of slow wave sleep appear to experience increased pain and tenderness.

Predicting chronicity:

Yellow Flags

- These are psychosocial factors that have been related to the development of chronic pain.
- Based on this it has been suggested if the critical factors are able to be modified it might either prevent the development of chronic pain or allow more effective treatment
- There is evidence that modifying some of these variables, such as catastrophising, can alter the trajectory of pain-related disability. However for others of the variables evidence is limited that they can be altered or that altering them improves outcomes.

BELIEFS

- catastrophising, thinking the worst
- misinterpreting bodily symptoms
- belief that pain is uncontrollable
- poor compliance with exercise
- expectation of "techno-fix" for pain
- low educational background

BEHAVIOURS

- passive attitude to rehabilitation
- use of extended rest
- reduced activity with significant withdrawal from activities of daily living or
- 'boom and busting' alternating between over and underactivity
- avoidance of normal activity
- impaired sleep because of pain
- increased intake of alcohol or similar substances since the onset of pain

AFFECTIVE/EMOTIONAL

- Depression
- feeling useless and not needed
- Irritability
- anxiety about heightened body sensations
- disinterest in social activity
- over-protective partner/spouse
- socially punitive partner/spouse
- lack of support to talk about problems

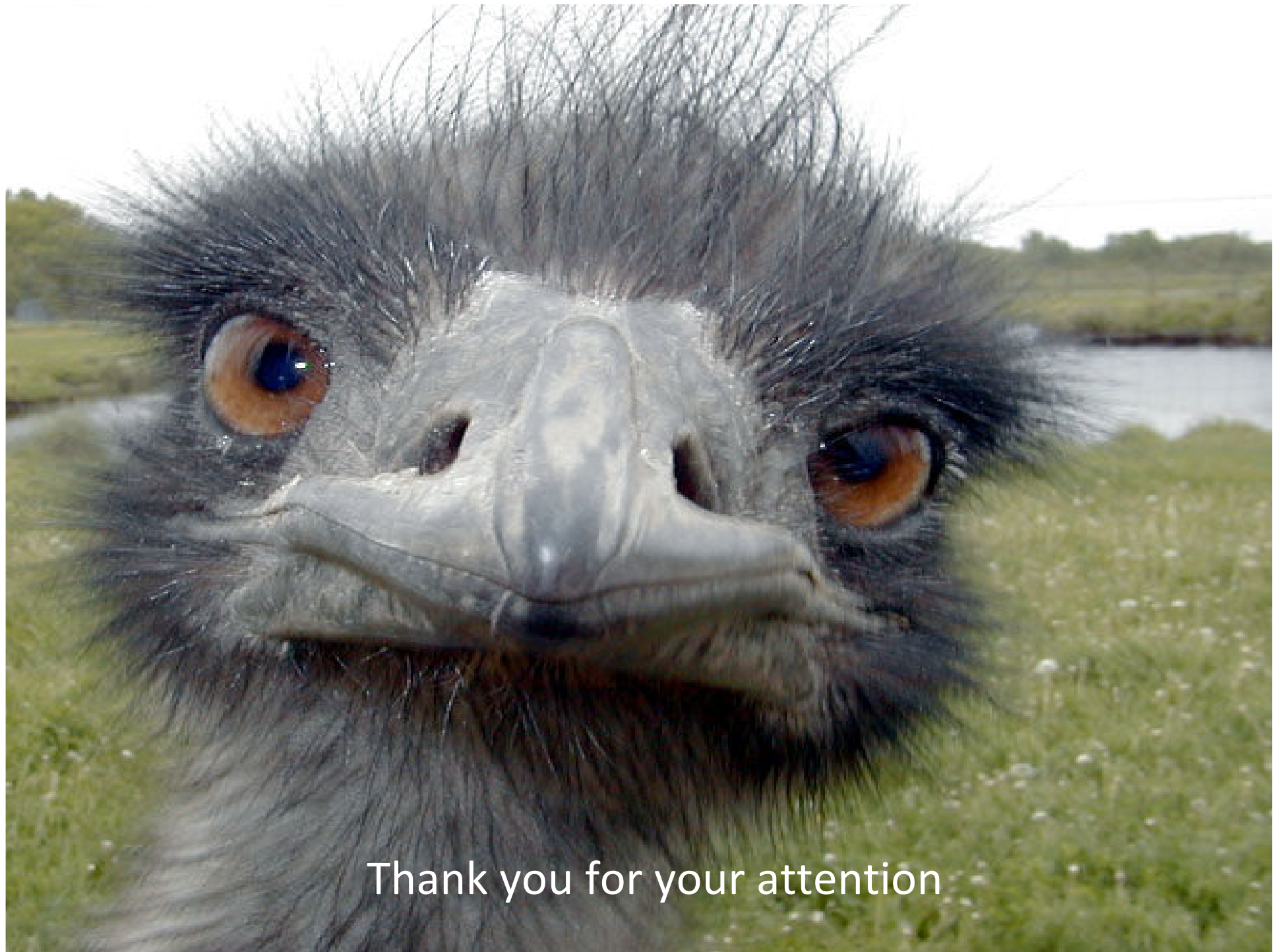
WORK

- belief that pain is harmful, resulting in fear avoidance behaviour
- belief that all pain must be abolished before attempting to return to work or normal activity
- expectation of increased pain with activity or work
- fear of increased pain with activity or work
- belief that work is harmful
- poor work history
- unsupportive work environment?

Workplace

- Job dissatisfaction
- Monotonous, fast, stressful work
- Poor social support
- Lack of control
- Belief that work is dangerous
- Emotional effort at work
- High physical demands
- Lack of modified duty





Thank you for your attention