

# Hypnotic Analgesia: Clinical Implications of Recent Research Findings

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## Disclosures

Portions of the content of this talk come  
from two books:

Jensen, M.P. (2011). *Hypnosis for chronic pain management:  
Therapist guide*. New York: Oxford University Press.

Jensen, M.P. (2011). *Hypnosis for chronic pain management:  
A patient guide*. New York: Oxford University Press.

I receive royalties from the sales of these  
books.

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## Acknowledgement

The idea: Use our understanding of  
neurophysiology to develop more  
effective hypnotic suggestions: To  
“target” suggestions to specific processes.

Source(s) of idea: Daniel Handel, Sheryll  
Daniel, others

First step for application to pain: Understand  
pain neurophysiology

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## Goals

Review neurophysiology of pain

Review research findings on the effects of hypnotic analgesia on:

- Different brain areas and processes, and
- Short- and long-term outcomes in patients with chronic pain

Discuss the implications of these findings for enhancing the efficacy of hypnotic treatments

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## Specificity theory of pain

Proposed by René Descartes, in 1664.

“Fast moving particles of fire ..the disturbance passes along the nerve filament until it reaches the brain...”



Primary (western) model of pain until the mid-1900s

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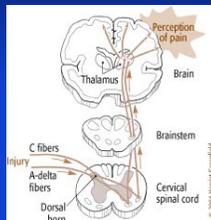
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## Gate control theory of pain

First proposed by Ron Melzack and Patrick Wall in 1962.

Activation of nerves that do NOT transmit pain can interfere with the transmission of signals that signify damage



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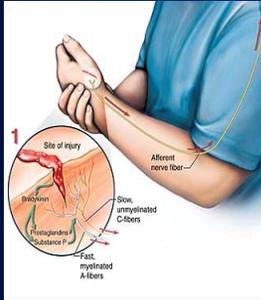
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## Peripheral processes: Pain



Signals from the periphery are influenced by a number of chemicals and neurotransmitters:

- Bradykinin [hypersensitivity] (↑)
- Prostaglandins [inflammation] (↑)
- Substance P [communicates noci] (↑)

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## Spinal Cord and Thalamus: Pain



Nociceptive signals travel to the spinal cord, synapse at the dorsal horn, and (may) travel up the STT to the thalamus.

- Signals modified in the dorsal horn
- Modification influenced by ascending and descending input.

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## Supraspinal (above the neck) Mechanisms

Activity in nerves in the periphery and spinal cord is neither necessary nor sufficient for pain.

Pain is perceived when complex integrated cortical (supraspinal) systems are engaged.

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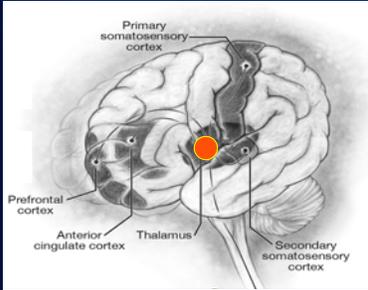
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## Supraspinal Sites and Mechanisms



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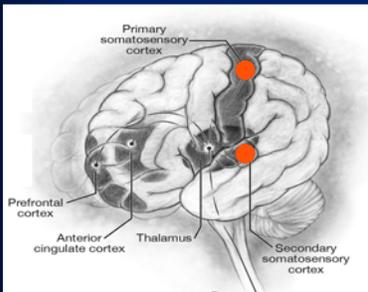
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## Supraspinal Sites and Mechanisms



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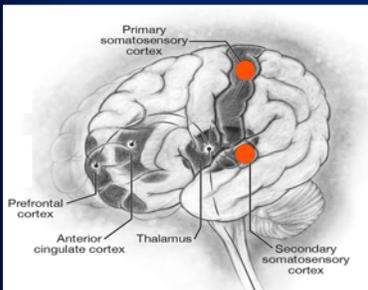
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## Supraspinal Sites and Mechanisms



Pain intensity  
Pain location  
Pain quality

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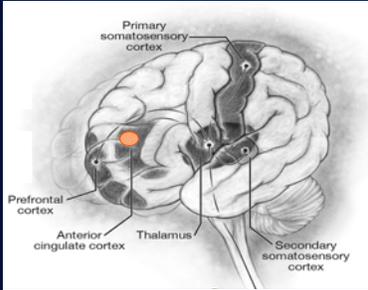
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## Supraspinal Sites and Mechanisms



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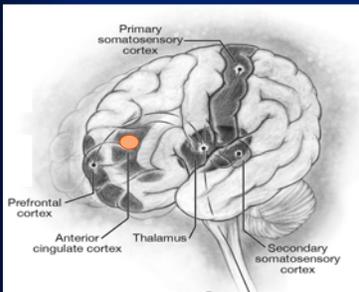
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## Supraspinal Sites and Mechanisms



Affective response

- Suffering
- Panic
- Distress
- Need to *do something about pain*

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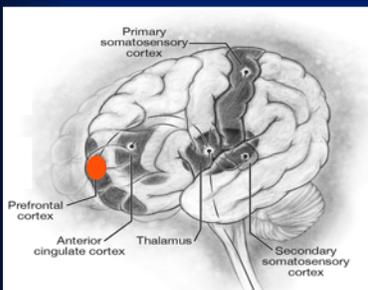
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## Supraspinal Sites and Mechanisms



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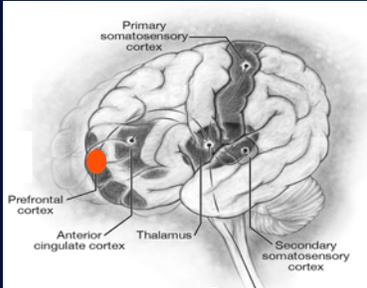
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## Supraspinal Sites and Mechanisms



- Cognitive domain
- Meaning
  - Past/Future
  - Self-concept
  - Coping response

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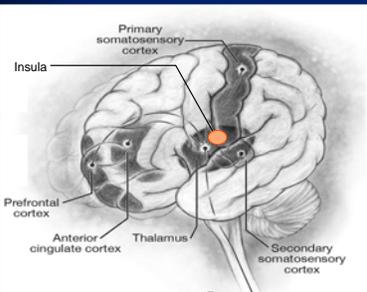
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## Supraspinal Sites and Mechanisms



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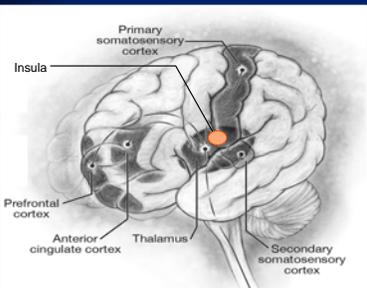
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## Supraspinal Sites and Mechanisms



- Physical well-being thermostat
- Hungry?
  - Thirsty?
  - Oxygen?
  - Damaged?

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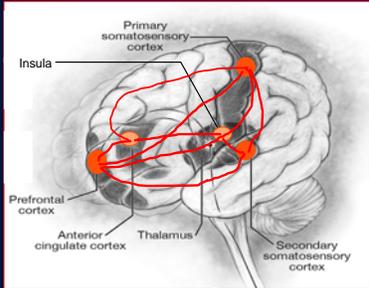
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## Supraspinal Sites and Mechanisms



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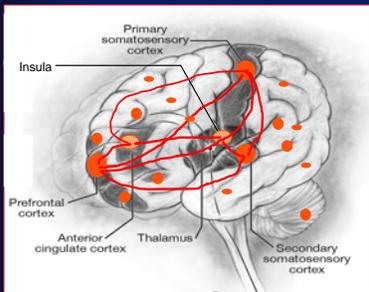
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## Supraspinal Sites and Mechanisms



Global activation  
- Active vs.  
calm brain

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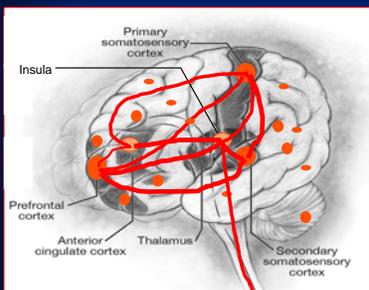
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## Supraspinal Sites and Mechanisms



Neuroplasticity  
- Pain → More  
pain sensitivity

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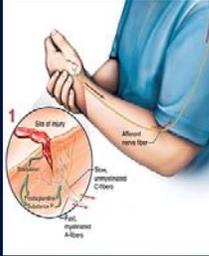
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## Peripheral processes: Hypnosis



Hypnosis/peripheral activity  
(Chapman et al., 1959)

- “Normal” vs. “Numb/Wooden” arm suggestions
- Exposed arms to noxious heat

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## Peripheral processes: Hypnosis

Hypnosis effects vascular activity  
(Casiglia et al., 1997; Klapow et al., 1996).

Hypnosis effects objective measures of wound healing (Ginandes, Brooks, Sando, Jones, and Aker, 2003).

→ *Peripheral processes can be influenced by hypnotic suggestions.*

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## Peripheral processes: Suggestions

Suggestions for quieting activity at the site of perceived discomfort

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## Peripheral processes: Suggestions

“The area of pain and discomfort is being engulfed in a psychological anesthesia....” (Crasilneck, 1995, p. 260).

You can “... begin to reduce the oversensitivity by pour[ing] a ... soothing, healing fluid [on] ... the affected nerves to help them.” (Williamson, 2004, p. 148).

“Gently place your arm into a soothing bath of healing water ...”

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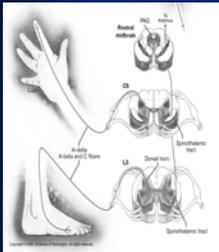
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## Spinal Cord and Thalamus: Hypnosis



Hypnotic analgesia can reduce (Kiernan et al., 1995) and also increase (Danziger et al., 1998) spinal cord nociceptive reflexes.

Spinal reflexes are not subject to voluntary control.

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## Spinal Cord and Thalamus: Suggestions

“Your brain is now sending messages to the gate-control stations to tune down the intensity and quality of the pain signals, so that you will feel less and less discomfort...” (Sacerdote, 1978, p. 20).

“... Your brain can easily and automatically ‘filter out’ any uncomfortable sensations, and allow in [warm, cool] comfortable sensations”

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## Somatosensory cortex: Hypnosis

Hofbauer et al. (2001). Cortical representation of the sensory dimension of pain. *Journal of Neurophysiology*, 86, 402-411.

Goal: Examine the roles of cortex in the modulation of the sensory components of pain.

PET scans conducted during (1) alert, (2) hypnosis, and (3) hypnotic suggestion for increased or decreased *intensity* of stimuli (hand dipped in painfully hot water).

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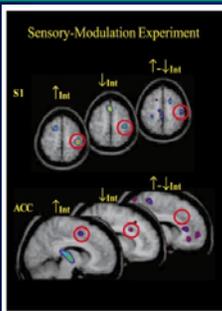
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## Somatosensory cortex: Hypnosis



Hypnotic suggestions for increased or decreased pain intensity altered perception of pain intensity (70/100 → 33/100) and activation in *sensory* cortex but *not* ACC.

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## Somatosensory cortex: Suggestions

Suggestions for decreasing intensity or altering pain quality

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## Somatosensory cortex: Suggestions

“Now the pain in your right hand is beginning to lessen, the pain is decreasing. With every breath you take, the pain in your right hand is diminishing; less pain...Lessening, decreasing, and almost gone” (Crasilneck, 1999, p. 259).

“This short, cutting, stabbing, blinding pain of yours, could you make that into a dull, heavy pain?” [and then transform this into a feeling of relaxation] (Erickson, 1980, p. 318).

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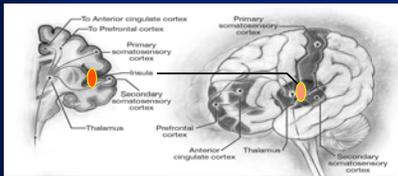
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## Insula: Pain



Homeostatic control: One's sense of physical condition (hunger, pain, itch, thirst, need for air versus satisfied and physically comfortable).

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## Insula: Hypnosis

Derbyshire et al. (2004). Cerebral activation during hypnotically induced and imagined pain. *Neuroimage*, 23, 392-401.

Goal: Examine cortical areas associated with pain versus hypnotically induced and imagined pain.

→ During physical stimulation and hypnotically-induced pain, but not imagined pain *all* of the areas linked with pain experience, including the insula, became more active (measured via fMRI).

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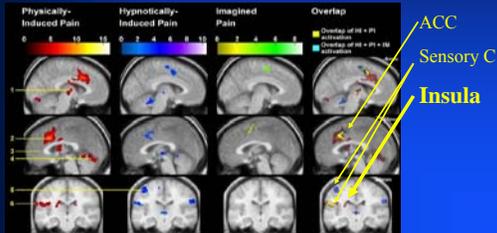
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Derbyshire et al. (2004). Cerebral activation during hypnotically induced and imagined pain. *Neuroimage*, 23, 392-401.



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## Insula: Suggestions

Suggestions for feeling  
physically *good*;  
physically content;  
physically whole

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## Insula: Suggestions

“As you move into your special place,  
your place of *healing*, you notice how  
*good* you feel... strong, healthy, the  
body has everything it needs to heal.  
And you can allow the healing to  
happen, as your breathe deeply, easily,  
and comfortably...”

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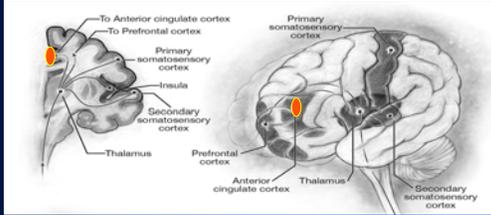
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## Anterior cingulate cortex: Pain



Emotional reaction (to pain); panic, and the perceived need to *do something*.

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## ACC: Hypnosis

Rainville et al. (1997). Pain affect encoded in human anterior cingulate but not somatosensory cortex. *Science*, 277, 968-971.

Painful heat stimulation in alert and hypnosis conditions resulted in CBF increases in:

- Sensory cortex 1 [S1] and 2 [S2]; and
- Anterior cingulate gyrus [ACC].

Hypnotic suggestions for increased or decreased *unpleasantness* altered

- Perception of pain affect (81/100 → 45/100);
- Activation in ACC only

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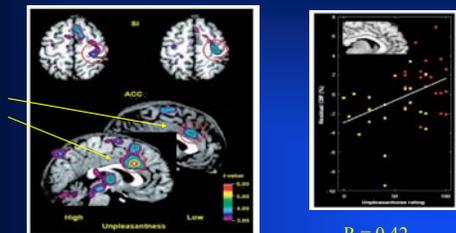
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## ACC: Hypnosis



→ The ACC is involved in processing of the affective component of pain; *different suggestions impact different cortical areas*.

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## ACC: Suggestions

Suggestions for calm acceptance of all sensations as they are when they occur; without a need to *do* anything about them

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## ACC: Suggestions

“... And know that you and your body are safe... the body knows ... what to do to heal itself... there is no need for you to *do* anything more, other than what any person requires to maintain their health and comfort... you can just relax and accept that you will feel more and more comfortable.”

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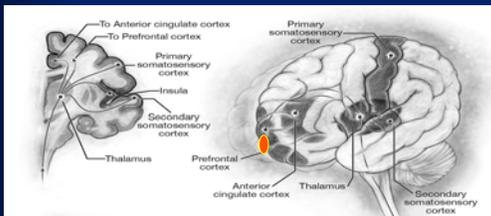
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## Prefrontal cortex: Pain



Cognitive reaction (to pain); the implications of sensations for one's well-being now and in the future.

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## Prefrontal cortex: Pain

Ehde, D.M., & Jensen, M.P. (2004). Feasibility of a cognitive restructuring intervention for treatment of chronic pain in persons with disabilities. *Rehabilitation Psychology, 49*, 254-258.

Decreasing “catastrophizing” cognitions alters the intensity of chronic pain.

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## Prefrontal cortex: Pain

Jensen et al. (2011). Effects of self-hypnosis training and cognitive restructuring on daily pain intensity and catastrophizing in individuals with multiple sclerosis and chronic pain. *International Journal of Clinical and Experimental Hypnosis, 59*, 45-63.

Three conditions:

- Cognitive therapy targeting pain beliefs
- Hypnotic analgesia targeting pain intensity
- Hypnotic cognitive therapy targeting pain beliefs

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## Prefrontal cortex: Pain

Jensen et al. (2011).

- Cognitive therapy: Reduced catastrophizing cognitions mostly
- Hypnotic analgesia: Reduced pain intensity some, but also catastrophizing
- Hyp. cognitive therapy: Reduced pain intensity, catastrophizing, and pain interference more than either CT or HYP

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## Prefrontal cortex: Pain

The meaning of the pain impacts its severity.

Cognitive therapy and hypnotic analgesia can reduce maladaptive pain beliefs

Targeting *more* than just pain sensations with hypnosis can increase efficacy

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## Prefrontal cortex: Suggestions

### Suggestions for altering the meaning of pain

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## Prefrontal cortex: Suggestions

“Pain...is no cause for undue alarm...it [can] reasonably be put into the background, much as noisy children are invited to play in a room with the door closed where they can be responded to if necessary, but otherwise ignored.” (Dane, 1996, p. 233).

“While you’re thinking about this or that particular happy thing, you won’t have enough energy left over with which to feel the pain of your cancer, because all of your energy is going to go into this matter of thinking over all the nice things...” (Erickson, 1983, p. 318).

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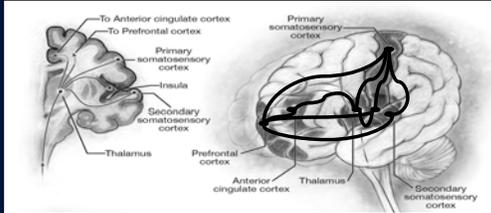
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## Cortical connectivity: Pain



Direct connections exist between all of the primary areas involved in pain processing.

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## Cortical connectivity: Hypnosis

Faymonville, M. E., Roediger, L., Del Fiore, G., Delguedre, C., Phillips, C., Lamy, M., Luxen, A., Maquet, P., & Laureys, S. (2003). Increased cerebral functional connectivity underlying the antinociceptive effects of hypnosis. *Cognitive Brain Research*, 17, 255-262.

Hypnotic suggestion to re-live a pleasurable autobiographical event that also decreased experimental pain *increased* connectivity between the ACC and a number of other areas of the cortex.

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## Cortical connectivity: Hypnosis

Hypnotic suggestions for decreased pain *decreased* connectivity between a number of cortical sites (Finglekurts et al., 2007).

Hypnosis resulted in a decrease in connectivity frontal and lateral cortical areas during a laboratory (Stroop) task (Egner et al., 2005).

→ *Hypnosis can increase or decrease connectivity, depending on the specific suggestions made.*

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### Cortical connectivity: Suggestions

Suggestions for *associations* (activate the “pleasure matrix”) or *dissociation* (split awareness from pain processing)

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### Cortical connectivity: Association

“And you can think back...back to a time when you felt good...a real sense of calm acceptance...or perhaps a very happy time...and go back to that time...now. You are really there, and can feel the good feelings you have...”

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### Cortical connectivity: Dissociation

“The body is so relaxed...you even lose awareness of some parts...as if you could start to see through them, or disappearing altogether...and as the body disappears, perhaps you experience yourself as a point of consciousness...floating...just floating in space.”

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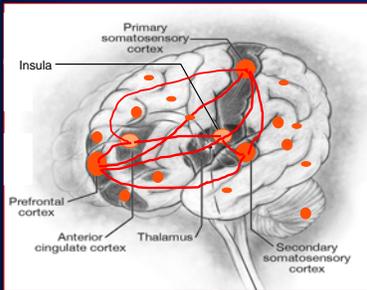
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## Cortical Activation



Ongoing study:  
- Hypnosis → Less beta and more alpha over sensory cortex and prefrontal cortex  
→ Hypnosis "calms" the brain

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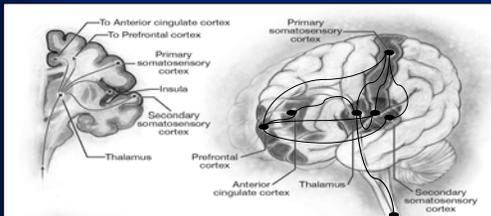
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## Neural plasticity: Pain



Chronic pain alters nociception, such that it takes smaller stimulus to elicit higher levels of pain.

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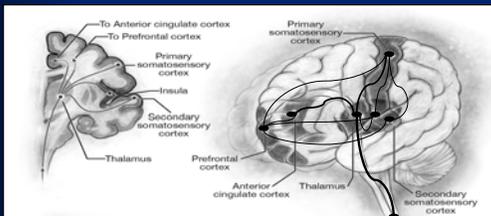
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## Neural plasticity: Pain



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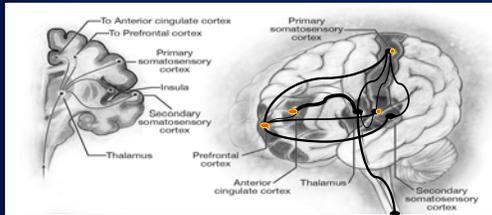
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## Neural plasticity: Pain



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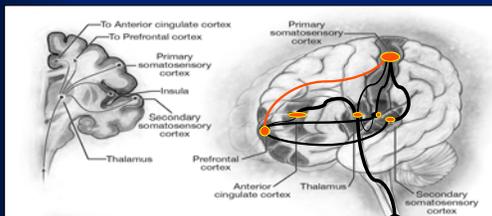
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## Neural plasticity: Pain



Chronic pain alters nociception, such that it takes smaller stimulus to elicit higher levels of pain.

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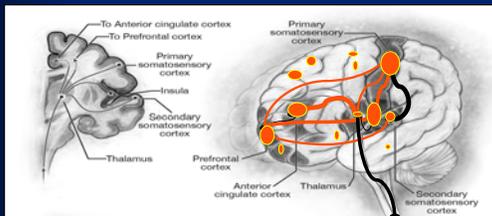
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## Neural plasticity: Pain



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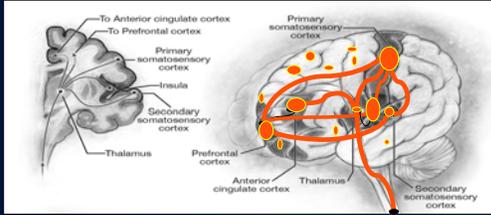
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## Neural plasticity: Pain



Chronic pain alters nociception, such that it takes smaller stimulus to elicit higher levels of pain.

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## Neuroplasticity: Suggestions

Suggestions for “getting back to” previous brain states; and/or for making benefits permanent

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## Neuroplasticity: Suggestions

For phantom pain: “And as you experience yourself in this comfortable place, you can also observe your arm moving, naturally, and easily... the arm in bending...comfortably and easily ... the fingers are moving...and now, lifting that weight...feeling the arm move...making it move...getting stronger and stronger...”

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## Neuroplasticity: Suggestions

Posthypnotic suggestions: “All benefits that you have obtained from the session today, ... those benefits can become permanent... a permanent part of how your brain works... the brain can automatically and easily... without you even having to think about it... move itself into a state that allows for comfort, and relaxation... more and more a permanent part of who you are... of how your brain works.”

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## Imagine a fire in a city at night. . .

Fire in a neighborhood (periphery)  
People start calling 911 to report the fire (STT)  
Switchboard determines fire's location / severity (S1/S2)  
Alarms go off at all fire stations (insula)  
News shows start reporting fire (global activation)  
People worry; some panic (ACC)  
Fire stations determine what to do about this fire (PFC)  
Fire stations, alarm systems, switchboard, news professionals, all in close communication (connectivity)  
Telephone company builds special phone lines to facilitate communication about future fires, specifically, people sensitized and prone to panic about future fires (plasticity)

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## Implications from brain activity research

Rather, make suggestions that address each of the many pain systems involved:

Periphery → Site-specific comfort and healing  
STT → Filtering pain sensations  
S1 and S2 → ↓ Intensity, Δ quality  
Insula → Physical safety and health  
ACC → ↓ Bothersomeness, ↑ Acceptance  
PFC → Meaning of pain (adaptive thoughts)  
Activation → Global calm  
Connectivity → Association/Dissociation  
Plasticity → “Back to normal”

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## Implications from brain activity research

### Anxiety:

- Periphery → Peripheral relaxation
- STT →
- S1 and S2 → Physical Comfort
- Insula → Physical safety and health
- ACC → ↑ Acceptance of events
- PFC → Meaning of events (adaptive thoughts)
- Activation → Global calm
- Connectivity → Dissociation in “anxiety” matrix  
Associations in “calmness” matrix
- Plasticity → “Back to ...” or “Forward to...a time”

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## What can we learn?

- Efficacy: Is hypnosis *specifically effective* beyond outcome expectancy?
- Responder rates: *How many* patients benefit?
- Maintenance of gains: *How long* do any benefits last?
- Side effects: *What* (and *how many*) adverse effects are associated with hypnosis treatment? Other benefits?

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## Clinical trial

RCT of Self-Hypnosis Training versus EMG-biofeedback for SCI-related chronic pain

Funded by NIH, NICHD, NCMRR

### Questions:

- Is self-hypnosis training more effective than a viable alternative treatment?
- What percent of patients benefit?
- Do benefits last beyond the sessions?
- Adverse events/side effects?

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## Procedures

N = 37 patients with SCI and chronic pain assigned to hypnosis (HYP) or EMG-assisted relaxation (BIO).

10 sessions of treatment

Outcome assessed before and after treatment, and at 3-month follow-up

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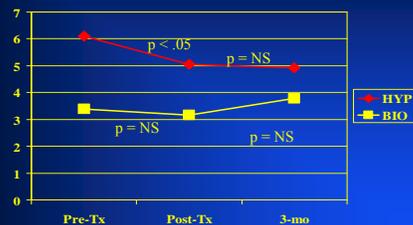
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## Results: Usual pain intensity



Responders: 22% HYP; 10% BIO

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## Results: Practice frequency and effects

Of the HYP participants @ 3 -mo:

60% still listened to the audio recording  
(Range, 2-25 days)

80% used skills w/o recording (range, 2-30 days)

Average relief w/ recording: 3.58; w/o: 3.44

Average hours of relief w/ recording: 3.07;  
w/o: 1.42

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## “Side effects” of hypnotic analgesia

Asked 30 patients who had received the HYP protocol about the “other effects” of treatment:

- 40 effects listed
- 9 (23%) pain-related benefits
- 23 (58%) nonpain-related benefits
- 5 (13%) ‘neutral’ effects
- 3 (8%) ‘negative’ effects

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## Pain-related benefits

Pain reduction (40%)

Increased control over pain (40%)

“I have a new tool for managing pain” (30%)

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## Nonpain-related benefits

General positive comments (e.g., “It helped”, “I liked it”): 37%

Increased well-being: 33%

Increased relaxation: 23%

Decreased stress: 17%

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## Negative effects

“It did not work” (3%)

“It was not as effective as I hoped it would be” (3%)

“The effects did not last as long as I hoped they would” (3%)

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## Conclusions

HYP more effective than BIO for daily average pain

Improvements in usual daily pain with HYP maintain for at least 3 months

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## Conclusions (continued)

Treatment outcome on average daily pain is variable (22% responders):  
Not all benefit on this outcome

But, 80% continue to use skills taught at 3 months, and report pain relief that lasts 1.5 – 3.5 hours

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## Conclusions (continued)

The “side effects” of hypnotic chronic pain treatment are overwhelmingly positive, and extend beyond pain reduction

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## MS trial (HYP vs. PMR; N = 22)



Responders: 47% HYP; 14% PMR

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## Clinical implications

You can trust that the treatment is specifically effective, and that benefits generally maintain (you can tell third party payers that the evidence supports its efficacy)

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### Clinical implications (continued)

Two outcomes on pain: Provide treatment so as to influence both “permanent” effects and self-hypnosis skills

Different diagnoses may respond to treatment differently (e.g., SCI < MS)

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### Clinical implications (continued)

Patients get much more out of hypnosis treatment than pain reduction (improved sleep, increased well-being, increased energy)

→ *Provide suggestions to address these and other outcomes*

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### Future research

What is an ideal “dose” of hypnosis treatment?

What are the effects/benefits of practice recordings? Practice w/o recordings?

How can we enhance the efficacy of treatment?

Can hypnosis increase the efficacy of other treatments (CBT, neurofeedback)?

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## Imagine...

### A drug

- That produces a substantial decrease in usual pain intensity in patients with chronic refractory pain
- Whose “side effects” are overwhelmingly positive,
- That continues to be effective (no tolerance) and that most patients (80%) continue to use...

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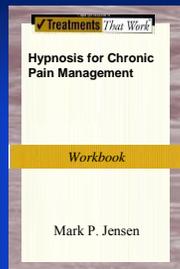
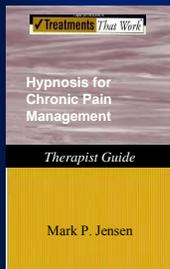
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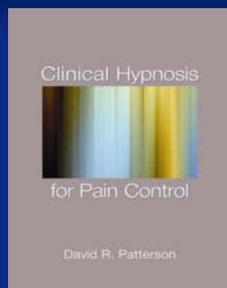
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Thank You!



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