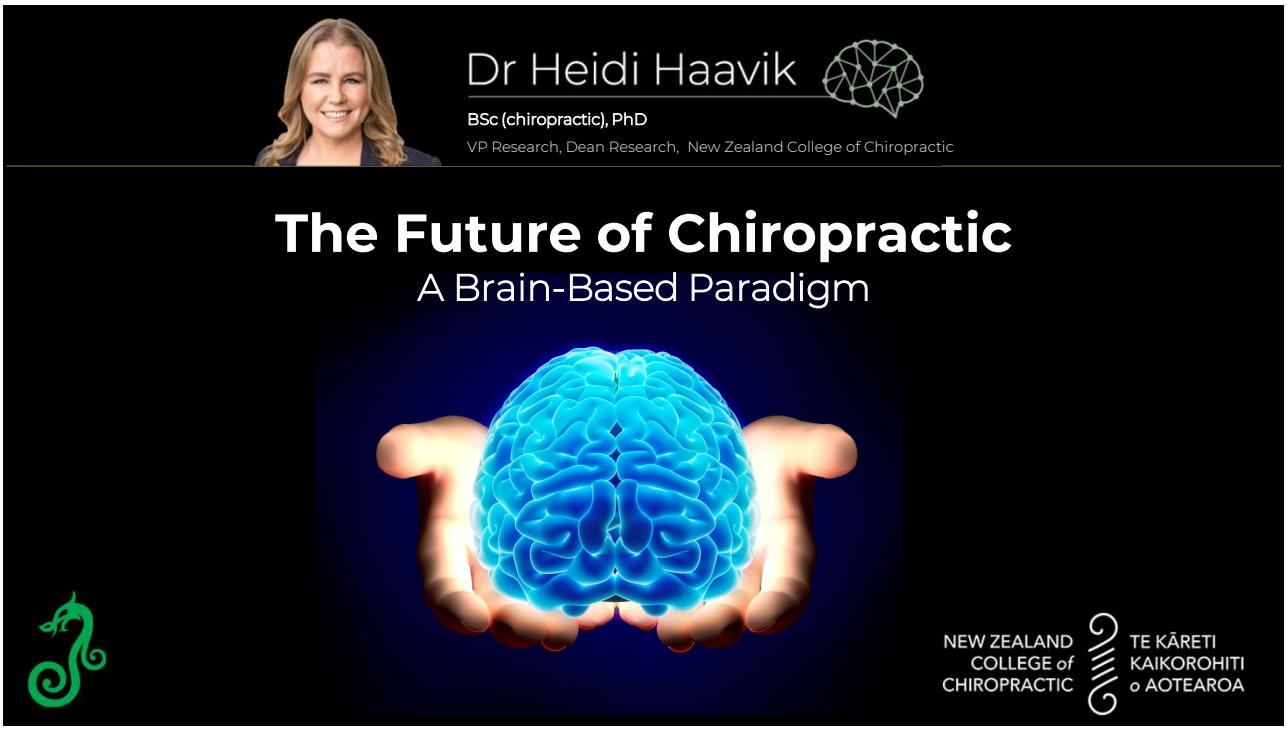
Dr Heidi Haavik
BSc (chiropractic), PhD
VP Research, Dean Research, New Zealand College of Chiropractic
The Future of Chiropractic
A Brain-Based Paradigm
NEW ZEALAND COLLEGE of CHIROPRACTIC
TE KĀRETI KAIKOROHITI o AOTEAROA

1


Dr Heidi Haavik
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The HANDOUT for today's Class (the slides)
Gift
Maintenance Care
Gift
THE CEREBELLUM

2

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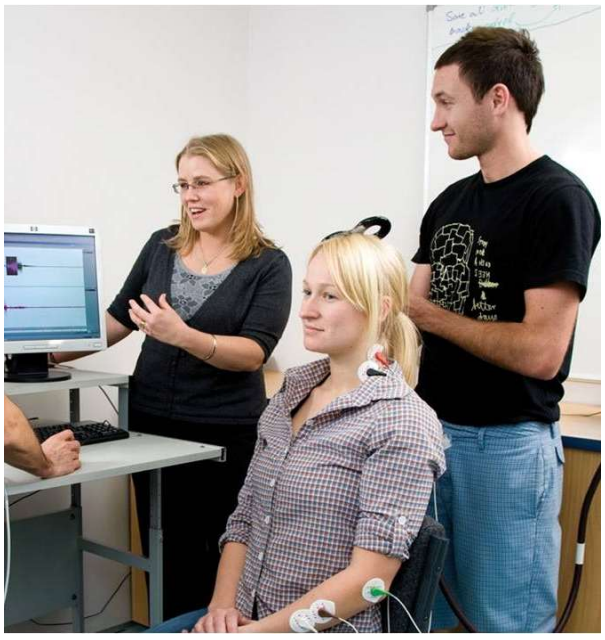
1999 Chiropractor

2008 PhD

THE UNIVERSITY OF AUCKLAND
NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

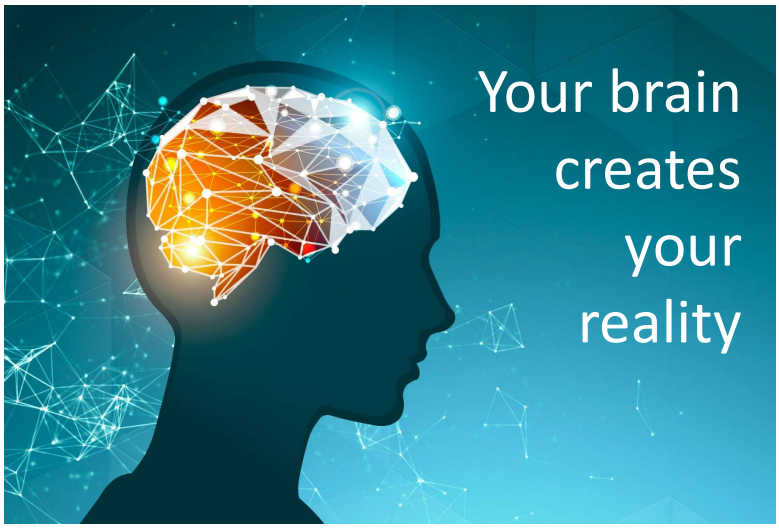
3



4

5

What do we now know about the BRAIN?



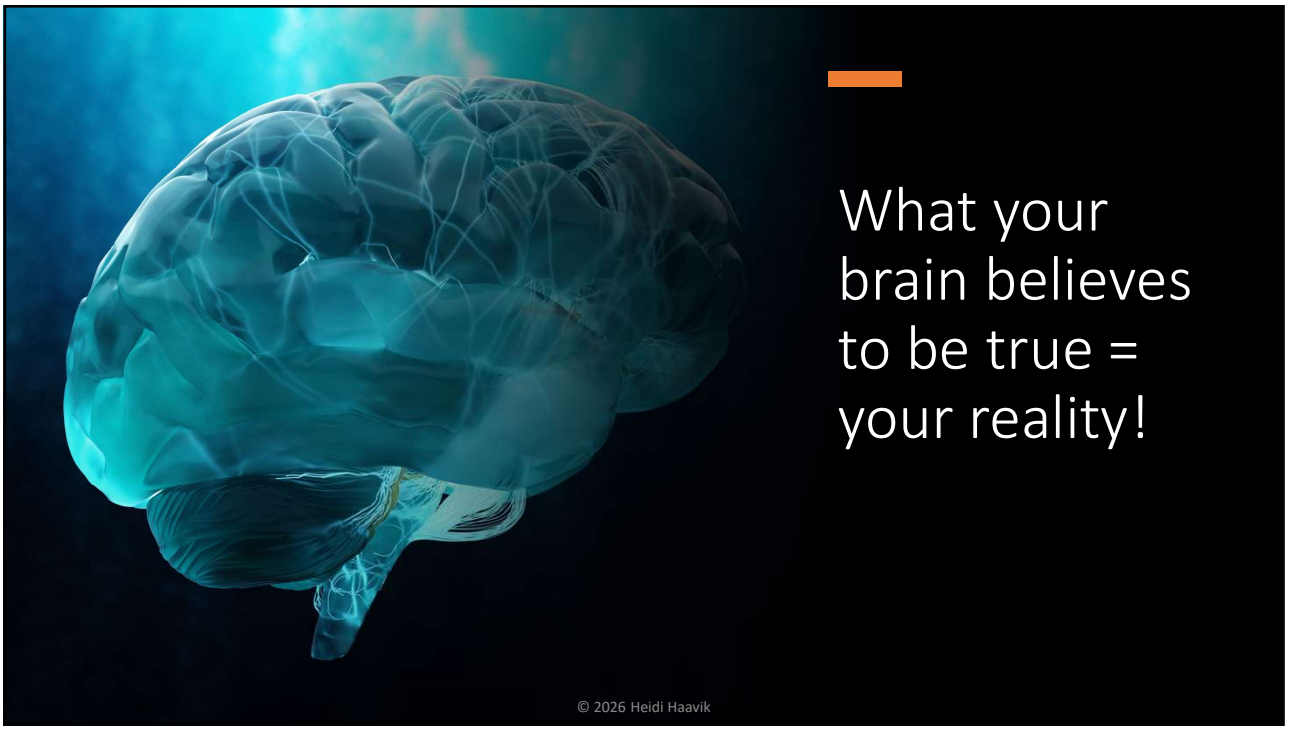
The predictive brain theory (or predictive processing) posits that the brain is an active prediction machine, not a passive receiver of sensory input. It continuously generates top-down models of the world to anticipate sensory data and minimize "prediction errors" (differences between expectation and reality), driving perception, cognition, decision-making, action, and learning.

(Sprevak & Smith 2023 Top Cogn Sci; Millidge et al 2021 arXiv preprint arXiv:2107.12979*)*

6

Pain

7



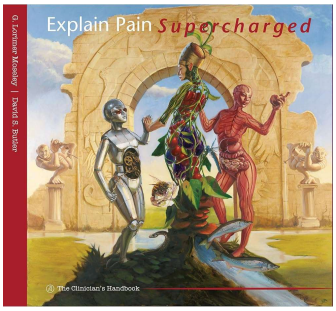
What your brain believes to be true = your reality!

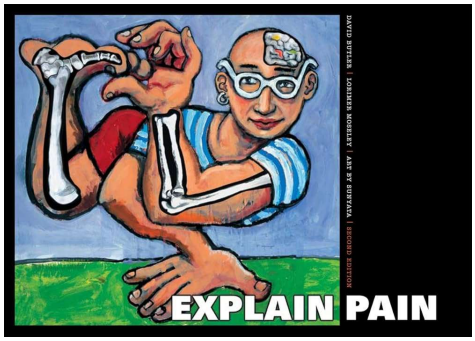
8

Pain is not a direct indicator of tissue damage, but rather a protective output of the brain

- Pain is not a measure of tissue damage but a protective mechanism
- Pain reflects the brain's evaluation of threat, not tissue state
- Pain can persist without ongoing tissue damage, driven by altered processing
- Chronic pain reflects maladaptive neuroplasticity in the brain (structural & functional changes)

*(Moseley 2007 Physical therapy reviews **12**(3): 169-178; Moseley & Butler 2015, The Journal of Pain; Moseley & Butler 2013; Apkarian et al 2011 Pain)*





9

Deep paraspinal muscles

Healthy

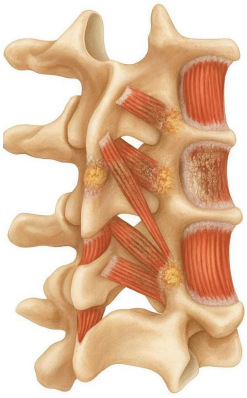
- Larger in size
- Slow-twitch fibre type
- Minimal fatty infiltration
- Move freely
- Healthy stretch receptors (muscle spindles)

Good

Dysfunction

over time become:

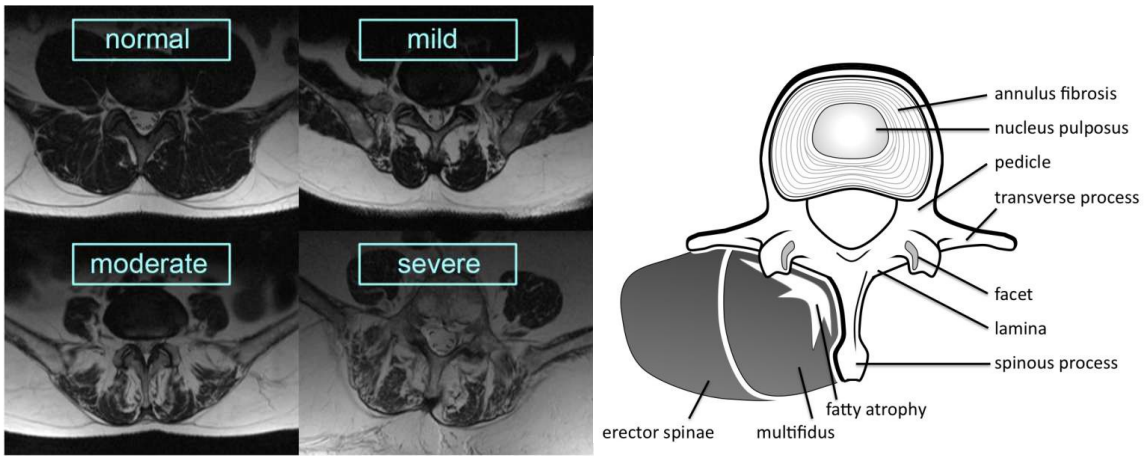
- Stiff and Fibrotic
- Atrophied (shrunk)
- Fatty infiltration
- Change fibre type
- Stretch receptors dysfunction



NOT Good

(James et al 2022 European Spine Journal)

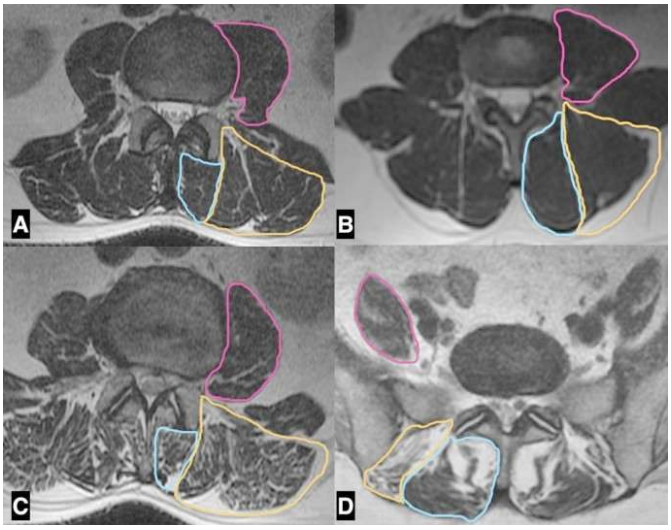
10



(Faur et al 2019, BMC musculoskeletal disorders)

11

"Recent studies revealed that paraspinal muscular atrophy and fatty infiltration were associated with not only the development of bone nonunion, pedicle screw loosening, and proximal junctional kyphosis but also adjacent segmental disease *with* lumbar fusion surgery [4–6]."



(Ikeda et al 2025, European Spine Journal)

12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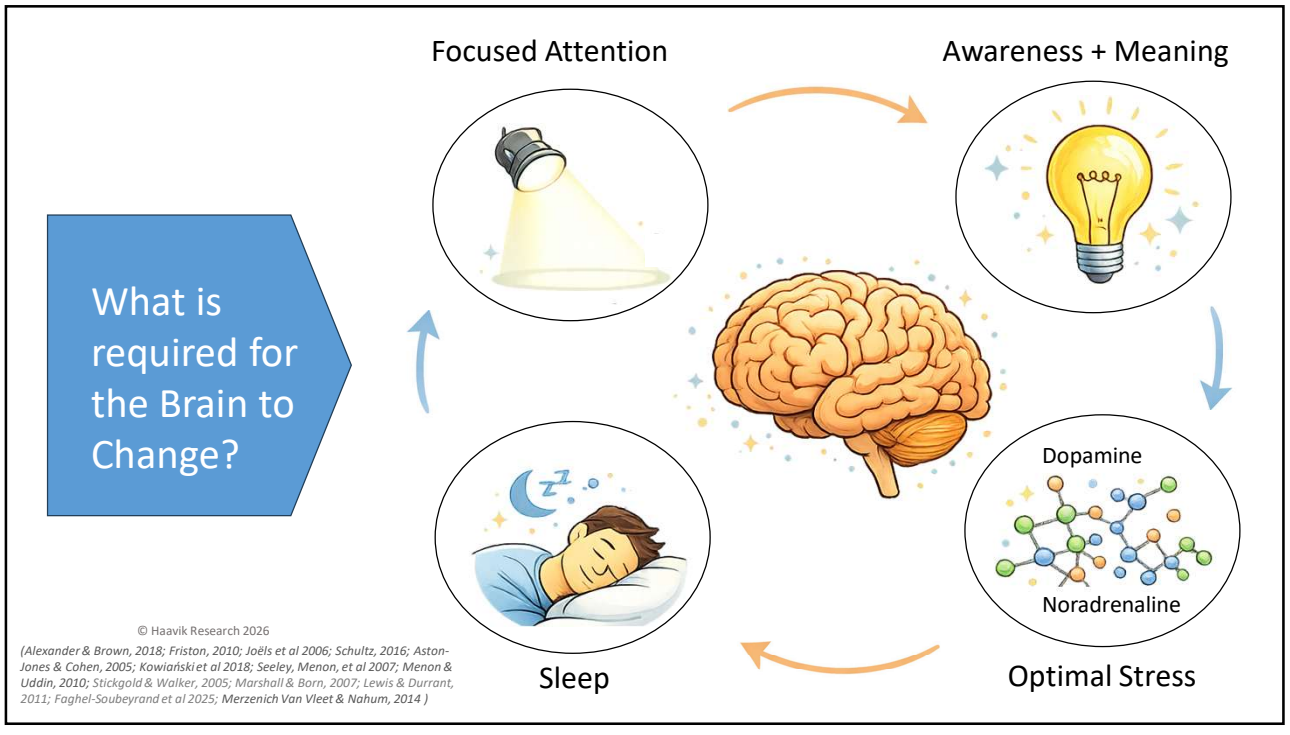
13


What is required for the Brain to Change?
Focused Attention
Awareness + Meaning
Dopamine
Noradrenaline
Sleep
Optimal Stress
© Haavik Research 2026
(Alexander & Brown, 2018; Friston, 2010; Joëls et al 2006; Schultz, 2016; Aston-Jones & Cohen, 2005; Kowiański et al 2018; Seeley, Menon, et al 2007; Menon & Uddin, 2010; Stickgold & Walker, 2005; Marshall & Born, 2007; Lewis & Durrant, 2011; Faghel-Soubeyrand et al 2025; Merzenich Van Vleet & Nahum, 2014)

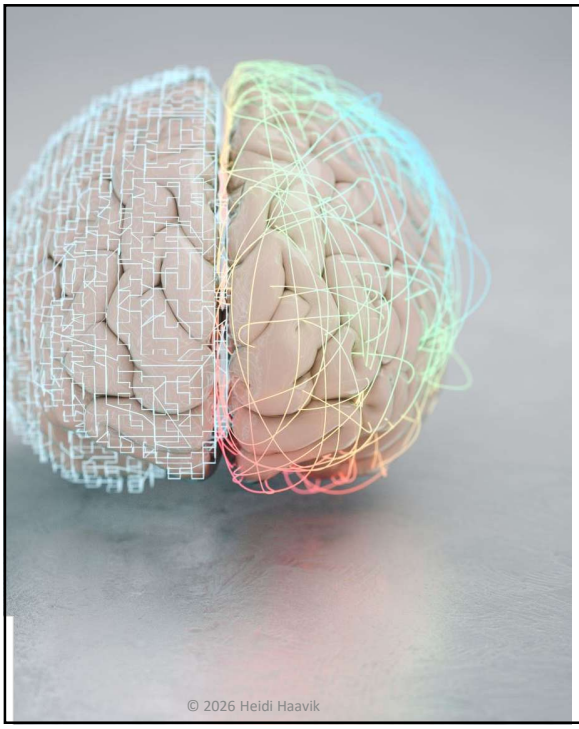
14

Lets think about the Adjustment

- Focused attention is first brought to the dysfunctional spinal segments through palpation and assessment
- The adjustment then delivers a novel, high-velocity sensory input
  → a strong burst of proprioceptive information to the brain
- This input represents a prediction error signal
  → particularly from areas that may have been underrepresented or misrepresented since first subluxated
- This is accompanied by known neurochemical responses
  → including changes in cortical excitability and neuromodulators
- We see associated changes in brain network function
  → including the Salience Network
- There is emerging evidence for changes in sleep and recovery
  → with improved sleep commonly reported clinically

(Haavik et al 2024 Brain Sciences ; Amjad et al 2025 PLoS One)

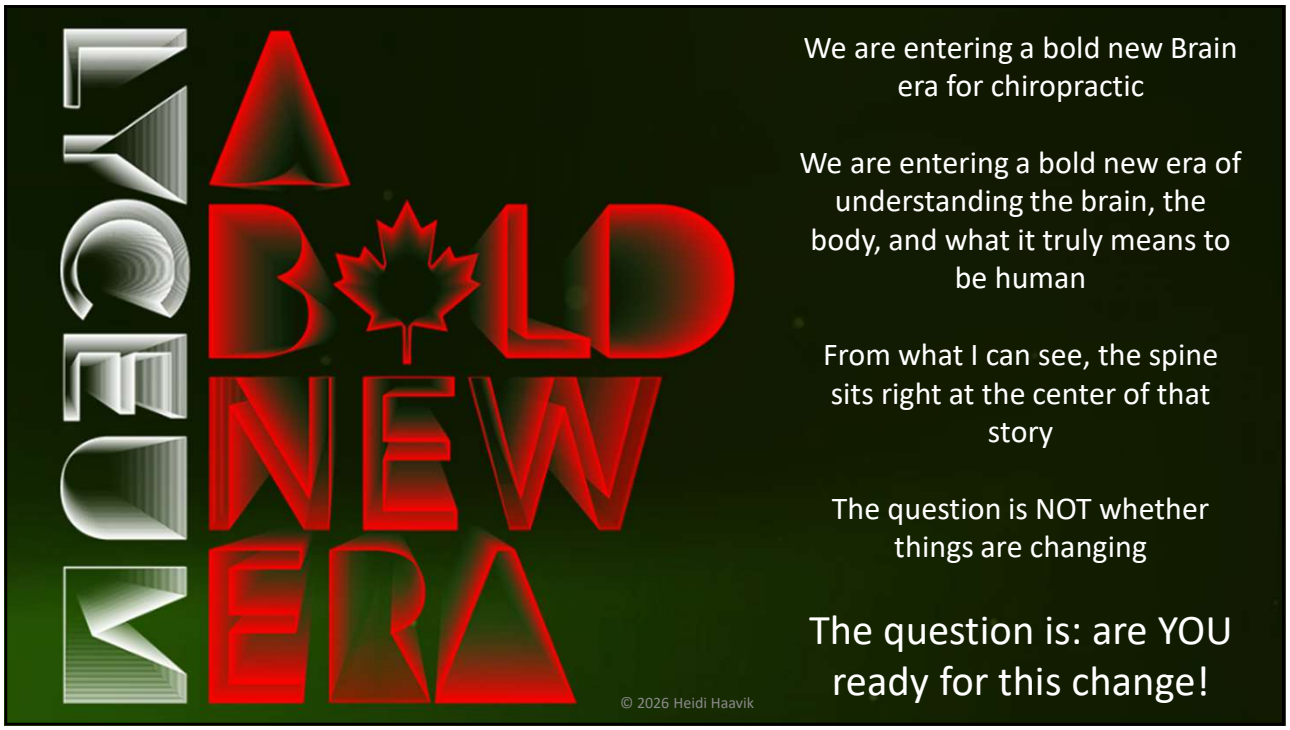
15



"Taken together, the current research support a model in which chiropractic care influences central neural processing through modulation of afferent sensory input, leading to systems-level neuroplasticity across large-scale brain networks involved in sensorimotor integration, cognitive control, and emotional regulation."

Heidi Haavik 2026

16


A BOLD NEW ERA
We are entering a bold new Brain era for chiropractic
We are entering a bold new era of understanding the brain, the body, and what it truly means to be human
From what I can see, the spine sits right at the center of that story
The question is NOT whether things are changing
The question is: are YOU ready for this change!
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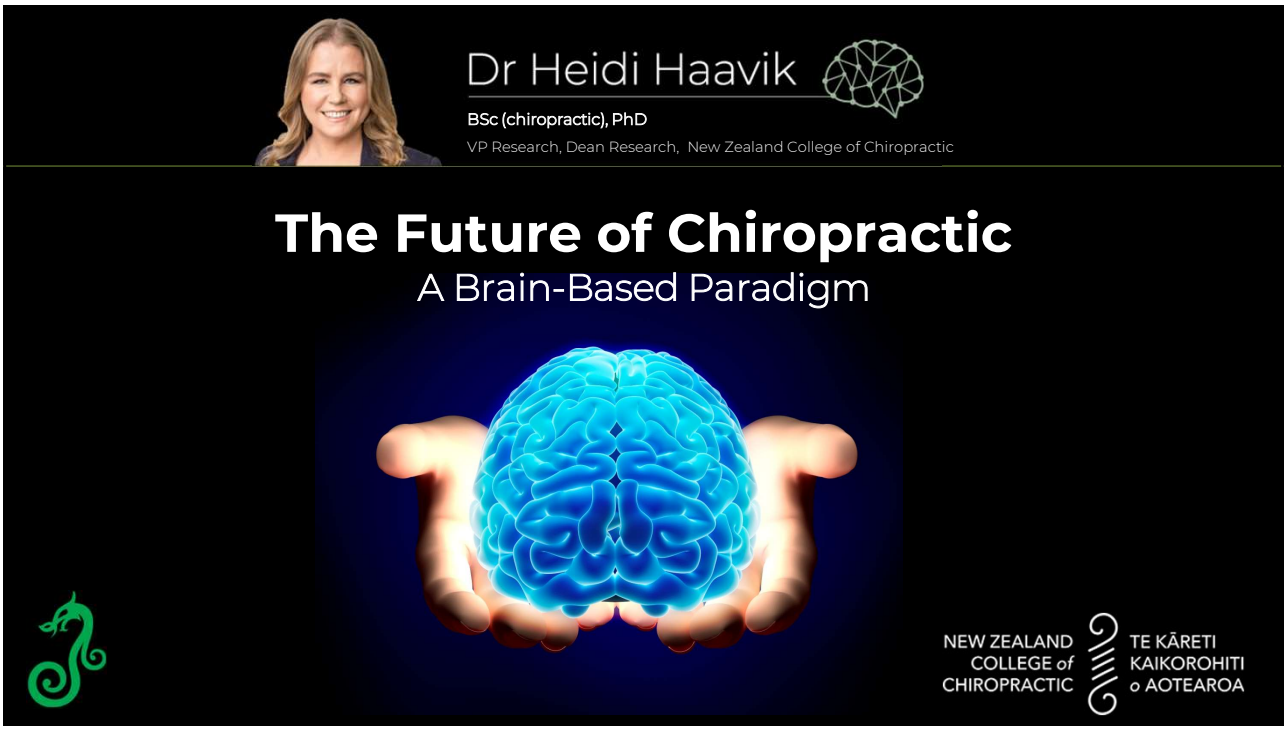
Dr Heidi Haavik
NEW ZEALAND COLLEGE of CHIROPRACTIC
TE KĀRETI KAIKOROHITI o AOTEAROA
TODAY'S HANDOUT & GIFTS
Maintenance Care
THE CEREBELLUM
THE REALITY CHECK
DR HEIDI HAAVIK
HeidiHaavik.com
Enlightening the world about the Science of the Spine & Brain

18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19


Dr Heidi Haavik
HeidiHaavik.com
The HANDOUT for today's Class (the slides)
Gift
Maintenance Care
Gift
THE CEREBELLUM

20

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TE KĀRETI KAIKOROHITI o AOTEAROA

1999 Chiropractor

2008 PhD

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NEW ZEALAND
Te Whare Wānanga o Tāmaki Makaurau

21

22

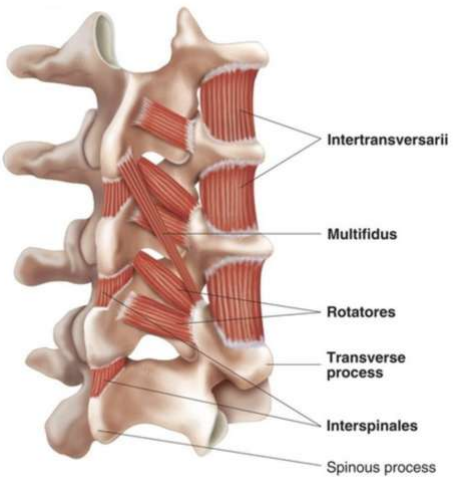
Do you have a spine model in your practice?

23

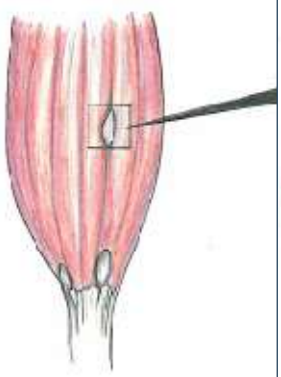
Do you have a brain model in your practice?

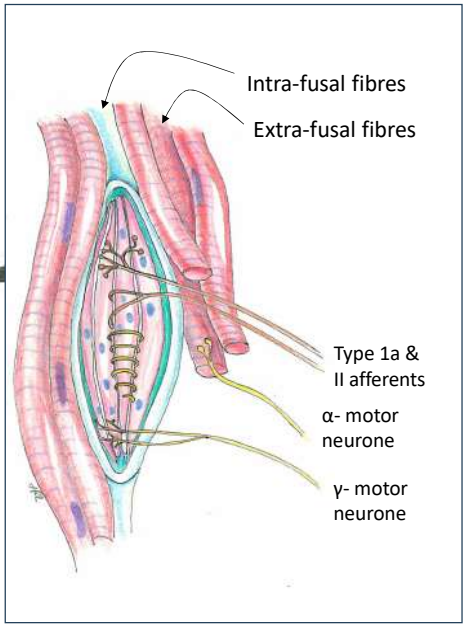
24

25



MUSCLE SPINDLES

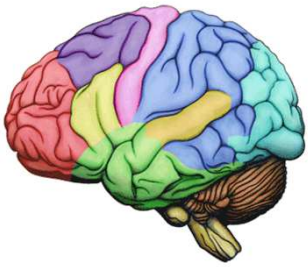


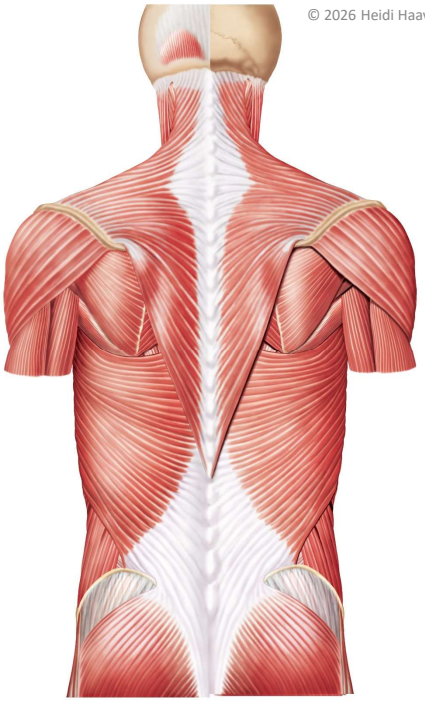


26

A healthy spine moves!

However, bones do not move themselves!

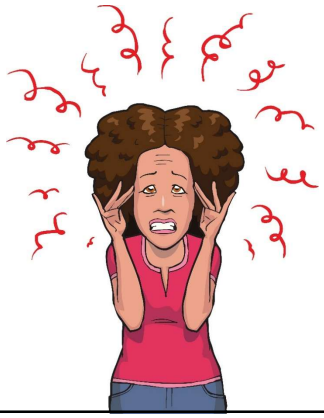


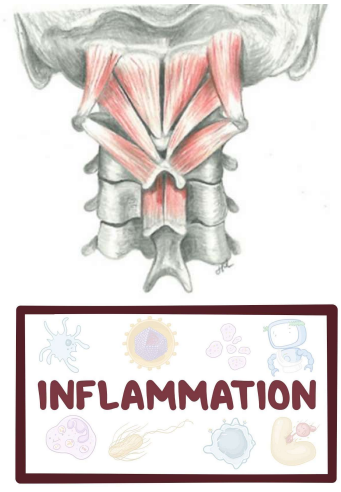


(Sun et al 2024, International Journal of Molecular Sciences; McGill et al 2024, Journal of electromyography and kinesiology; Suehiro et al 2025, BMC Musculoskelet Disord)

27

What can causes vertebral subluxations?



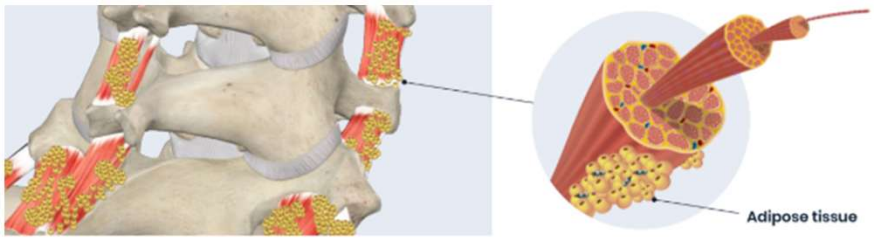


(Haavik et al 2021 EJAP)

28

HEALTHY

SUBLUXATED



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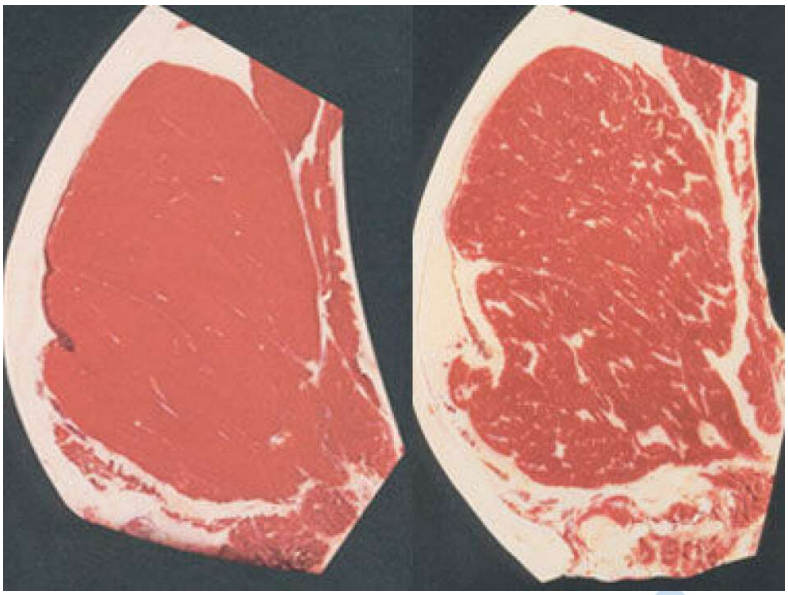
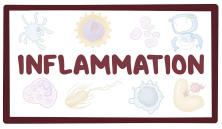


30

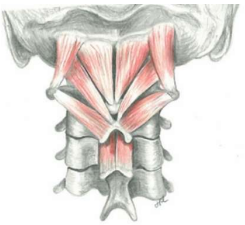


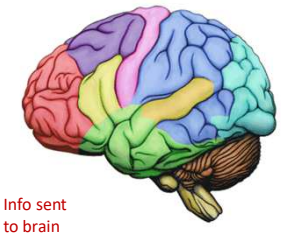
OR

Stress

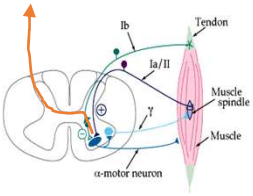
Injury

Small muscles closest to spine and skull go to sleep





Info sent to brain



Altered messages going to brain from spine

Poor body awareness
Poor body control
Poor function

So brain does NOT know accurately what is going on

Changes brains internal representations about what is going on inside and outside body

Haavik et al 2021 EJAP

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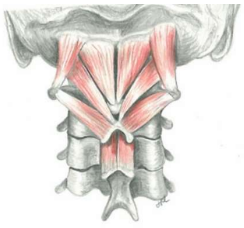
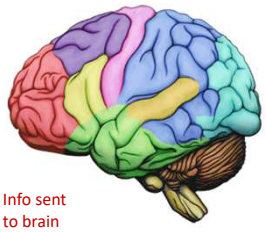
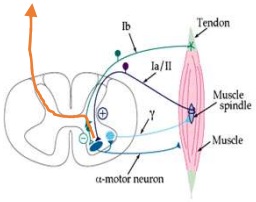
Adjustment

Stretches small muscles closest to spine and scull



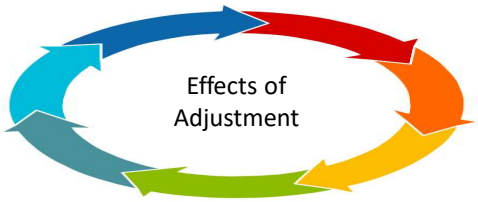


Info sent to brain



Bombards brain with mechanoreceptor input

Improved body awareness
Improved body control
Improved function



So brain knows MORE accurately what is going on

Changes brains internal representations about what is going on inside and outside body

Haavik et al 2021 EJAP

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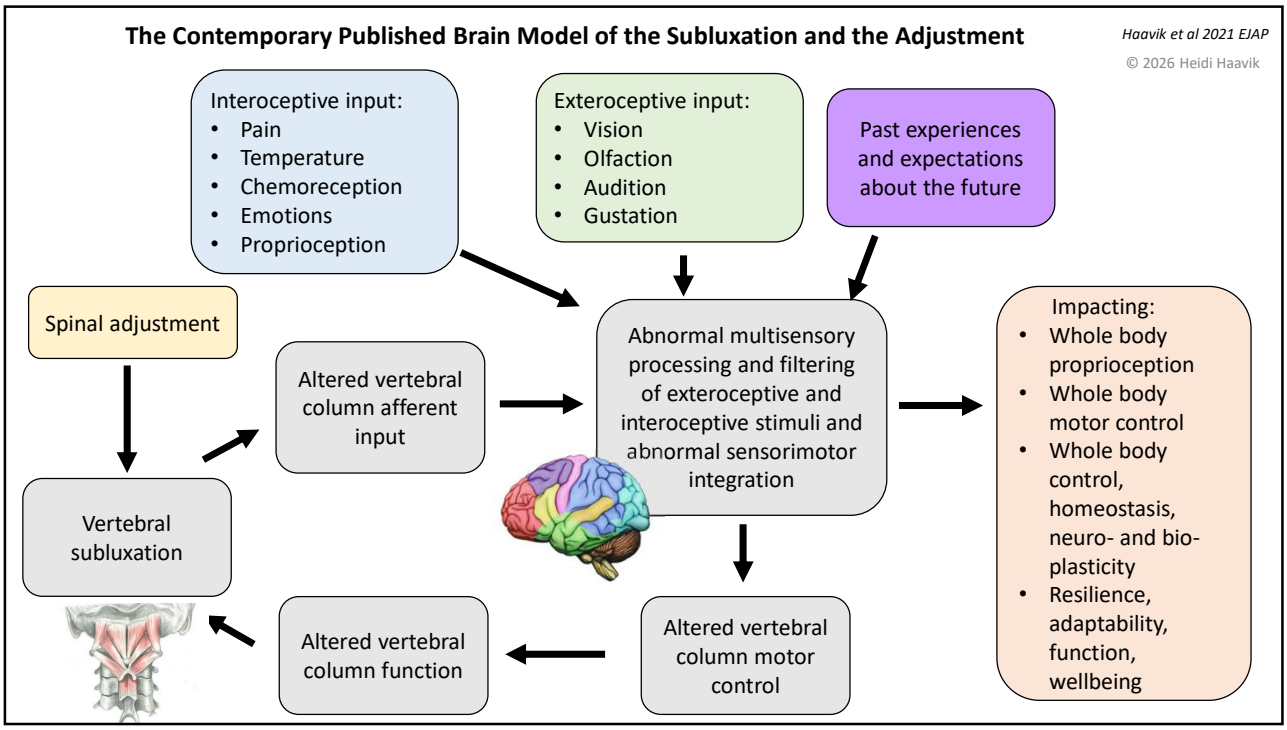
The Contemporary Published Brain Model of the Subluxation and the Adjustment
Haavik et al 2021 EJAP
© 2026 Heidi Haavik
Interoceptive input:
• Pain
• Temperature
• Chemoreception
• Emotions
• Proprioception
Exteroceptive input:
• Vision
• Olfaction
• Audition
• Gustation
Past experiences and expectations about the future
Spinal adjustment
Altered vertebral column afferent input
Abnormal multisensory processing and filtering of exteroceptive and interoceptive stimuli and abnormal sensorimotor integration
Impacting:
• Whole body proprioception
• Whole body motor control
• Whole body control, homeostasis, neuro- and bio-plasticity
• Resilience, adaptability, function, wellbeing
Vertebral subluxation
Altered vertebral column function
Altered vertebral column motor control

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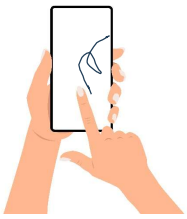
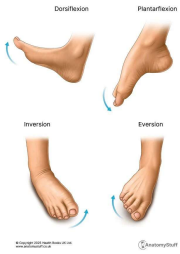
Affects
Changes
Altering Brain Reality
Exercising Paraspinal Tissues Back into Proper Function
Symptoms, Diseases & Disorders

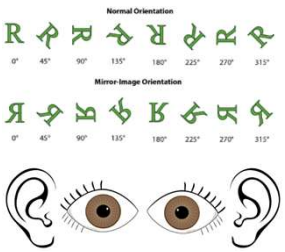
34

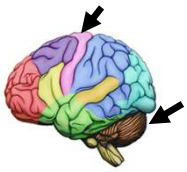
Chiropractic care can improve accurate perception and function





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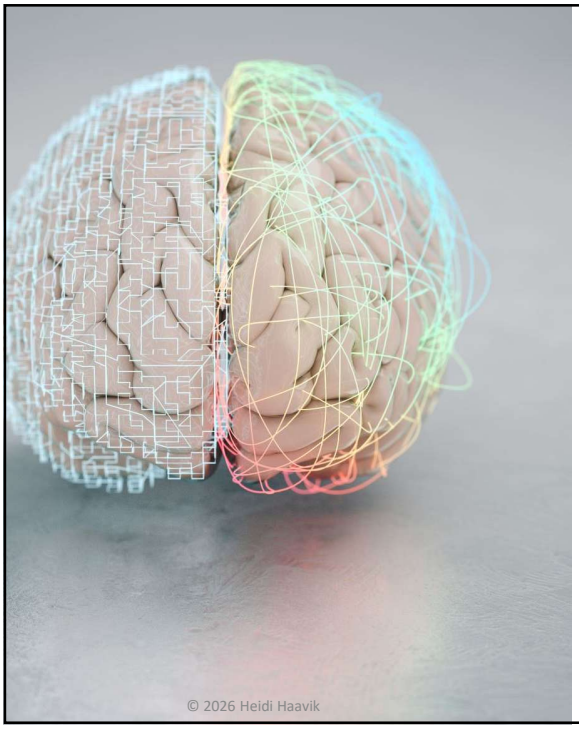

Chiropractic Care

"Research indicates that chiropractic care, that includes the adjustment of vertebral subluxations, enhances brain-body communication, allowing your brain to more accurately interpret internal and external signals. This improved perception of what is happening inside you and around you enables your brain to optimize bodily functions and adapt more effectively to your environment."

Heidi Haavik

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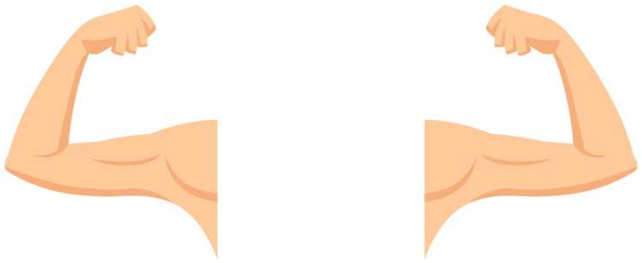
Chiropractic Care is all about exercising the small, deep paraspinal muscles back into proper function to enable the brain to more and more accurately perceive the internal and external environment so it can respond, adapt and heal better

Heidi Haavik

37

It takes more than two to four weeks of exercise before you alter the size (morphology) of the muscle



The first few weeks are mainly neural changes!!

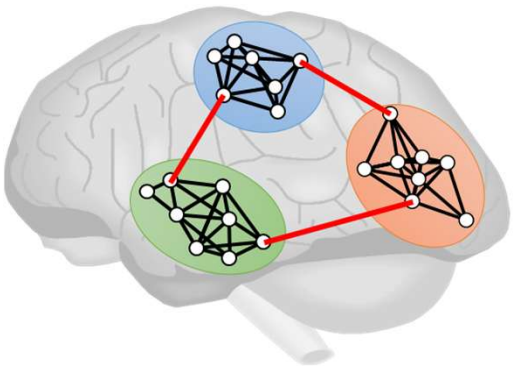
(Moritani & DeVries 1979)

38

39

Biological Networks in the Brain (and Hubs)

- A biological neural network in the brain is a complex network of neurons that are chemically connected by synapses.
- Neurons send and receive electrochemical signals to each other, and the brain uses these signals to process information.

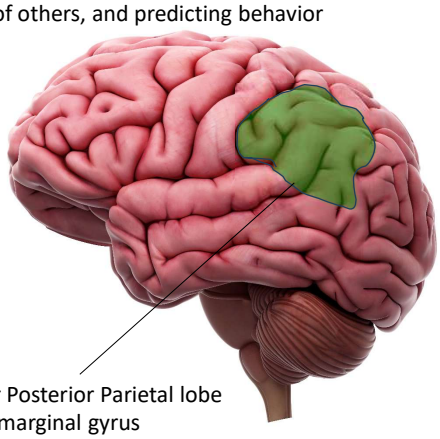


40

Default Mode Network

Constructing sense of self

Understanding thoughts, intentions and feelings of others, and predicting behavior

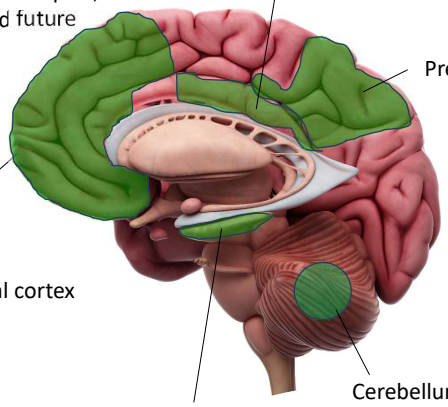


Inferior Posterior Parietal lobe
- Supramarginal gyrus
- Angular Gyrus

Emotional understanding & regulation of past, present and future

PCC

Precuneus



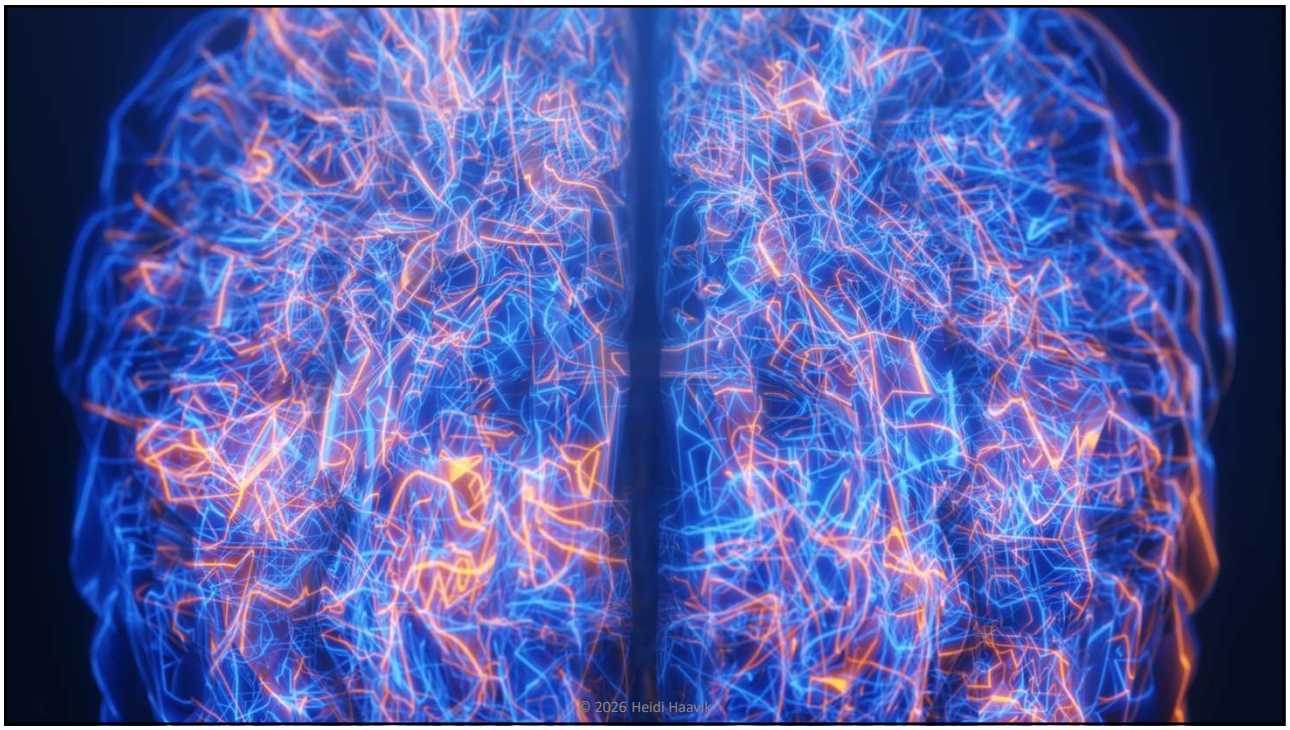
Medial PFC
- vm PFC
- Orbitofrontal cortex
- Ventral ACC

Cerebellum

Hippocampus and parahippocampal cortex

(Dohmatob, Dumas & Bzdok 2017)

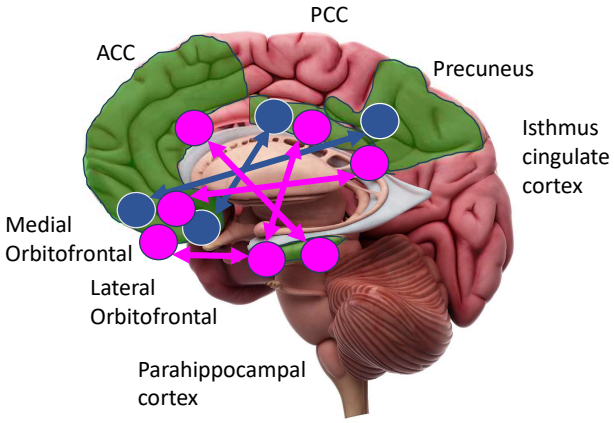
41



42

Default Mode Network changes after Chiro Care

Pre and Post first session



(Haavik et al 2024, Brain Sciences)

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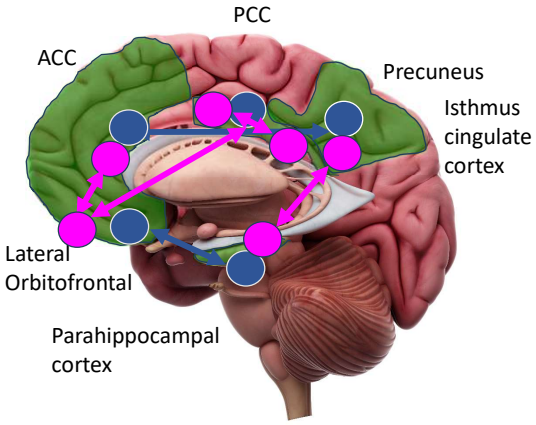
Default Mode Network changes after Chiro Care

Pre and Post 4 weeks



(Haavik et al 2024, Brain Sciences)

44

Unmedicated depressed people have significantly increased functional connectivity between the Precuneus and the prefrontal cortex

Increased functional connectivity of the posterior cingulate cortex with the lateral orbitofrontal cortex in depression (Cheng, Rolls et al. 2018B)

4 weeks of chiropractic care:
Improved QOL overall
Improved Physical function
Less Depression
Less Anxiety
Less Fatigue
Less pain interference
Less pain intensity

"The increased connectivity of the precuneus and/or PCC with the prefrontal cortex short-term memory system may contribute to the rumination about low self-esteem in depression."

(Cheng, et al 2018A; Cheng, Rolls et al. 2018B*)*

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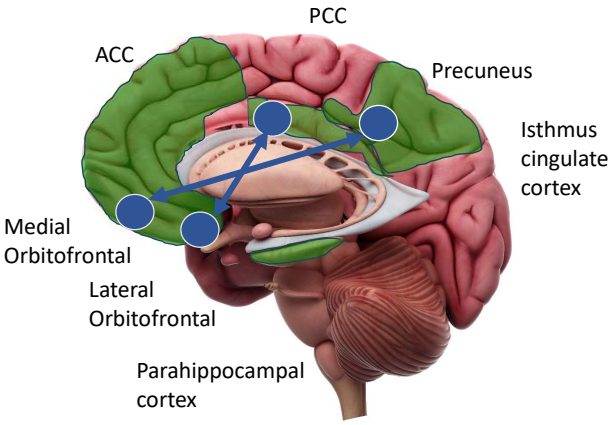
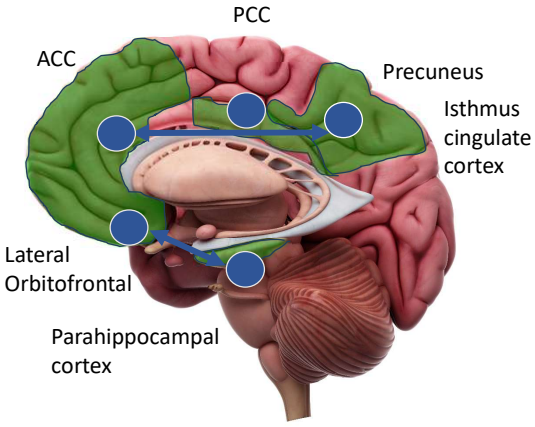
Pre and Post Chiro



Pre and Post 4 weeks Chiro



DMN changes after Chiro Care

(Haavik et al 2024, Brain Sciences)

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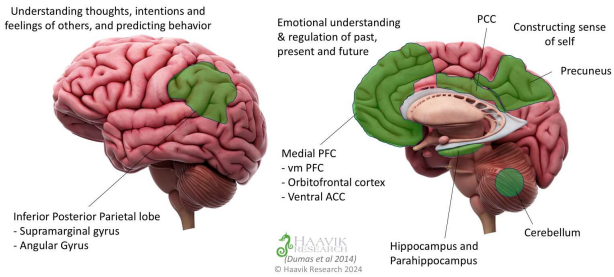
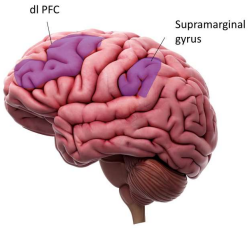
Default Mode Network

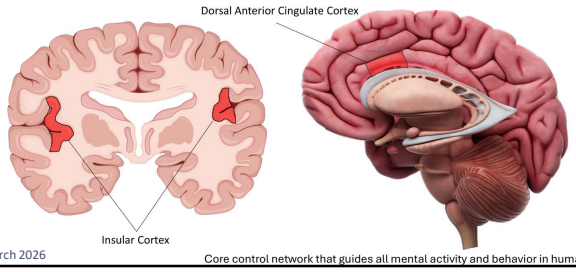


Fronto-parietal (Executive Control) Network

- It is Goal and Task oriented
- When you are actively engaged in a task
- Actively paying attention (and not judging)
- Capable of recruiting a wide variety of brain systems
- Multiple FP / EC networks
- Key Regions
  - Dorsolateral PFC
  - Posterior parietal cortex (supramarginal gyrus)



Salience Network



(Witt, van Ettinger-Veenstra et al. 2021; Menon and D'Esposito 2022; Menon and D'Esposito 2022)

Core control network that guides all mental activity and behavior in humans

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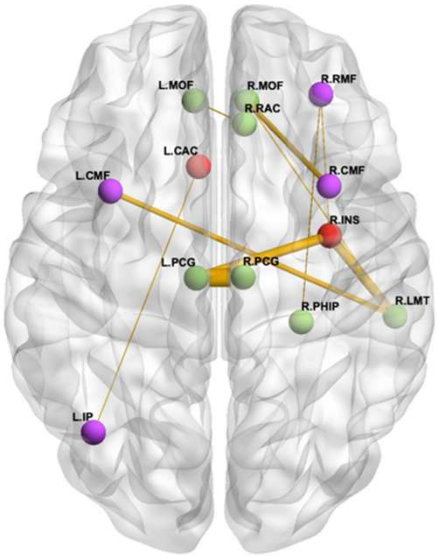
After first Adjustment session Chiro Group



Preliminary Results NOT published yet

Alpha

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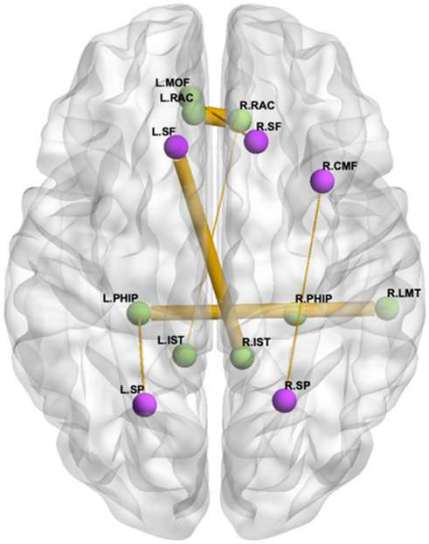
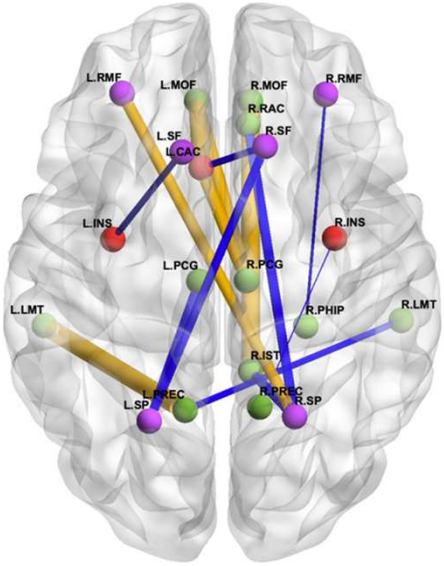
Preliminary Results NOT published yet

After 4 weeks Chiro Group Brain changes





Alpha

Beta

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Two More RCTs with 12 weeks of Chiro Care

- 106 SCSP participants
- 12 weeks of chiro care
- 4 week follow up
- EEG + Lots of clinical outcomes related to PFC
  - Immune
  - Emotions
  - Sleep
  - executive functions
  - And more

Measurements taken at baseline, at 12 weeks and at 16 weeks

(Amjad et al 2025)

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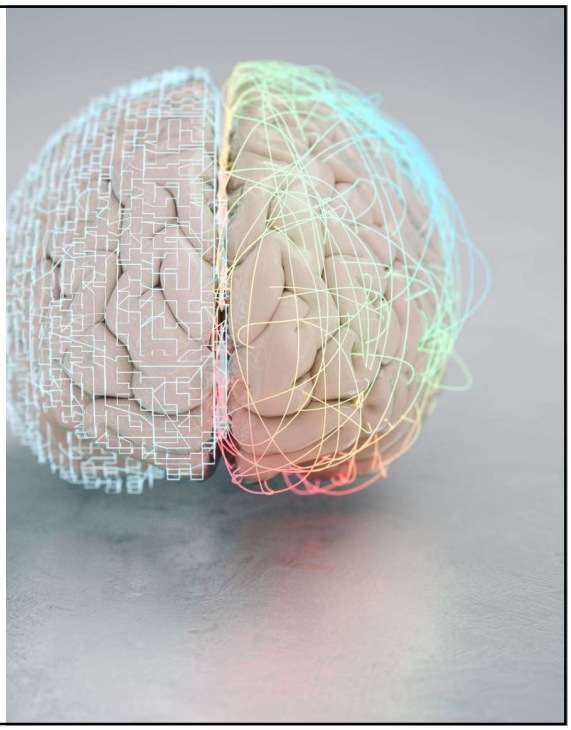
BDNF

- Brain-Derived Neurotrophic Factor (BDNF)
- Key supporter of neuroplasticity
- Helps neurons survive, grow, and adapt
- Linked to learning, memory, mood, and pain modulation

Amjad et al 2025 *PLoS One*



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Cortisol

(Stress System – Hair, Blood, Saliva)

- Cortisol = main stress hormone (HPA axis)
- Short term: helps manage acute stress & inflammation
- Long term: chronically high cortisol can be harmful
- Measured in:
  - Blood & saliva → acute/short-term levels
  - Hair → longer-term, chronic stress load

Amjad et al 2025 *PLoS One*

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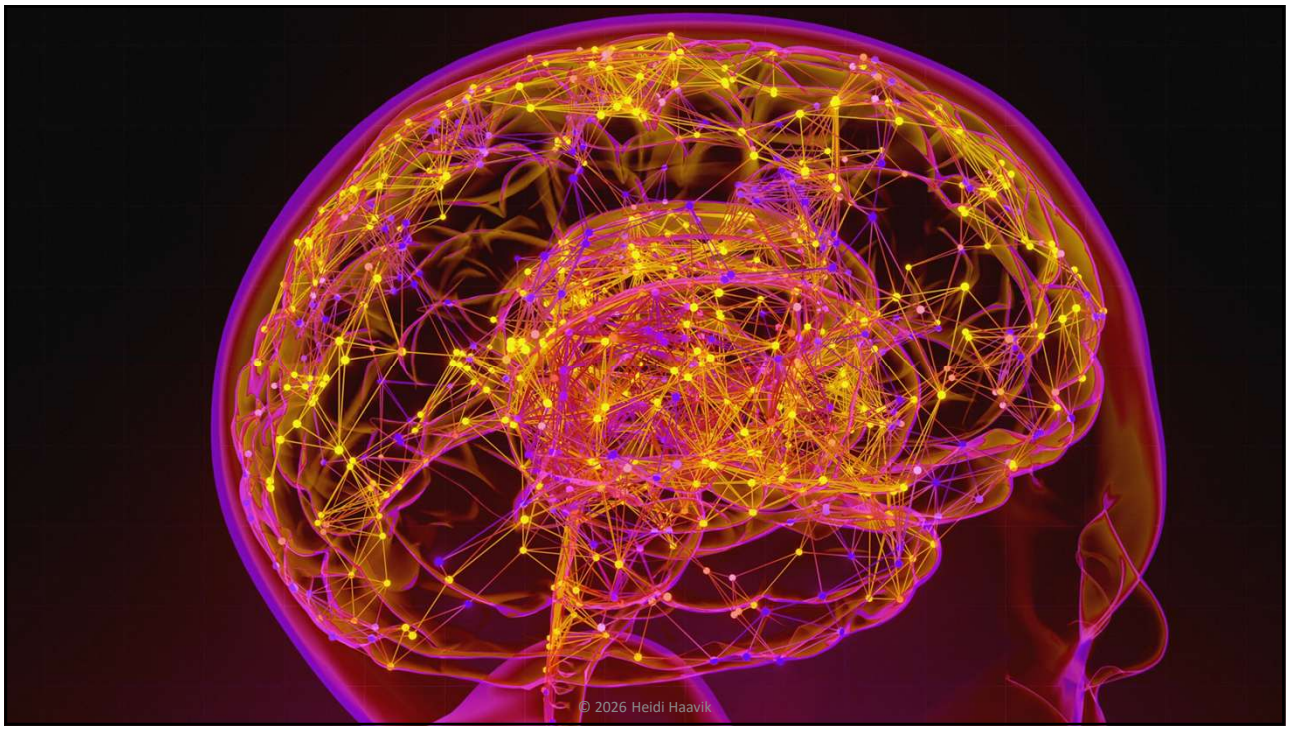
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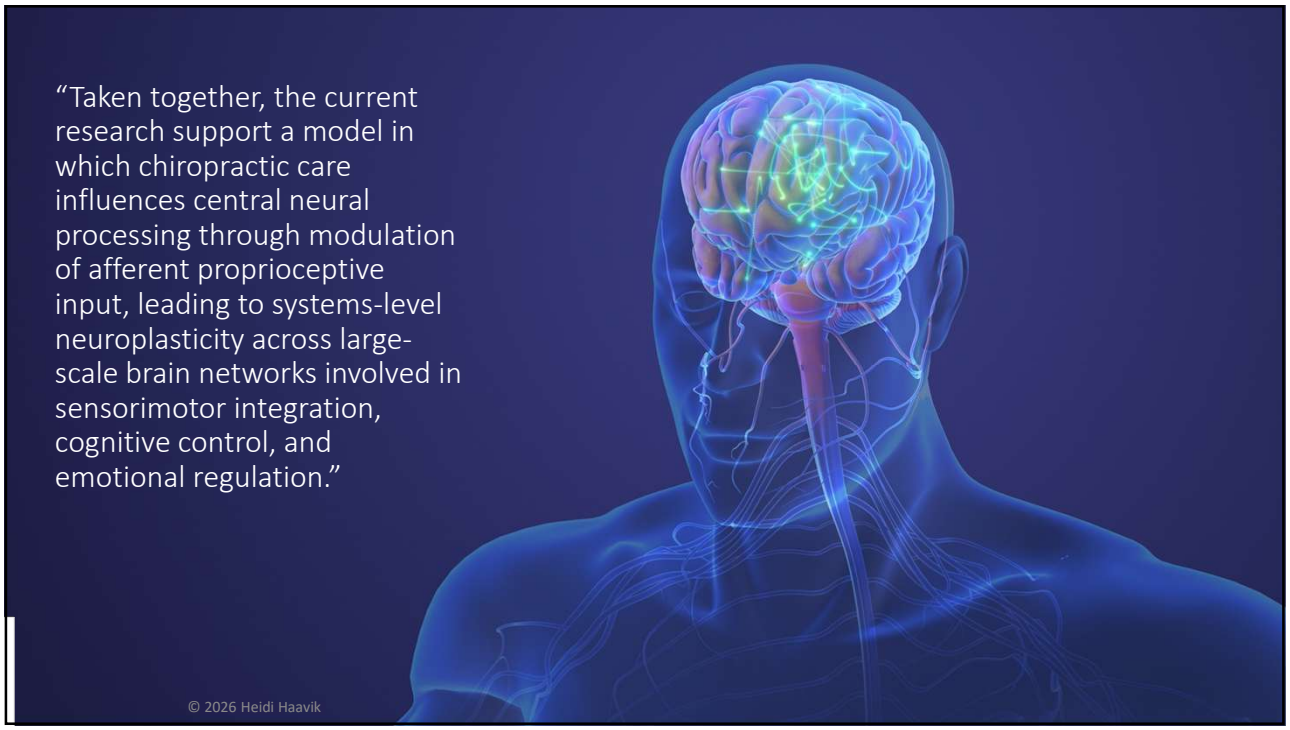
“Taken together, the current research support a model in which chiropractic care influences central neural processing through modulation of afferent proprioceptive input, leading to systems-level neuroplasticity across large-scale brain networks involved in sensorimotor integration, cognitive control, and emotional regulation.”
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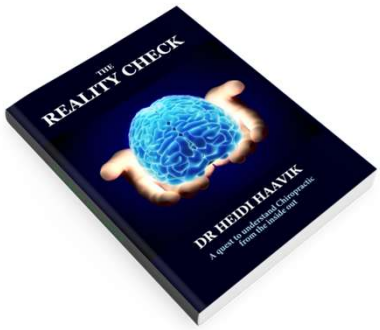
TODAY'S HANDOUT & GIFTS



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