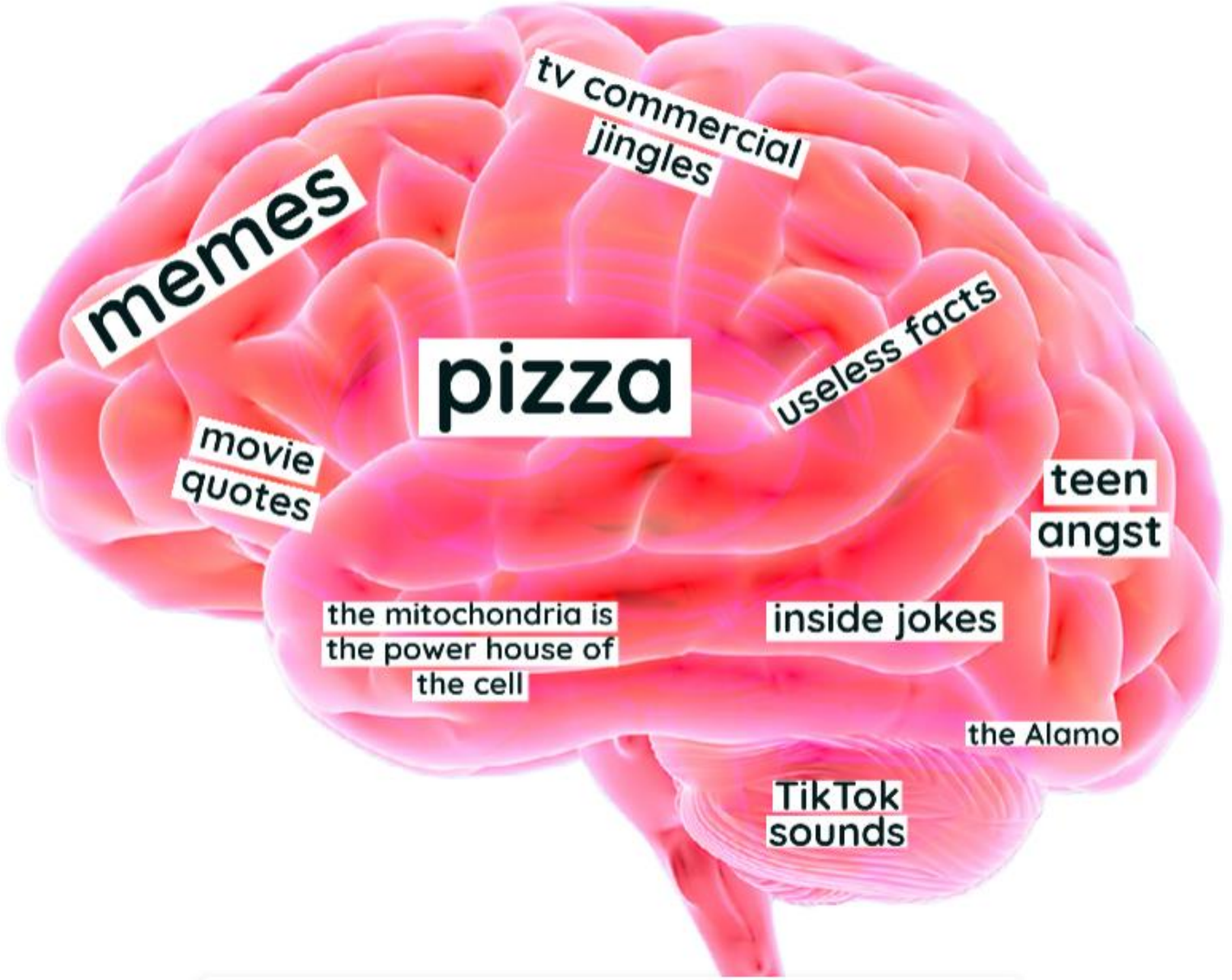
# NEUROFEEDBACK AS A TOOL FOR PAIN AND ANXIETY


Dr. Irene Luc
Mind Door, LLC - owner

Therapeutic Pain Specialist
Doctor of Physical Therapy
Neurofeedback Practitioner- Myndlift

# actual image of the inside of my brain

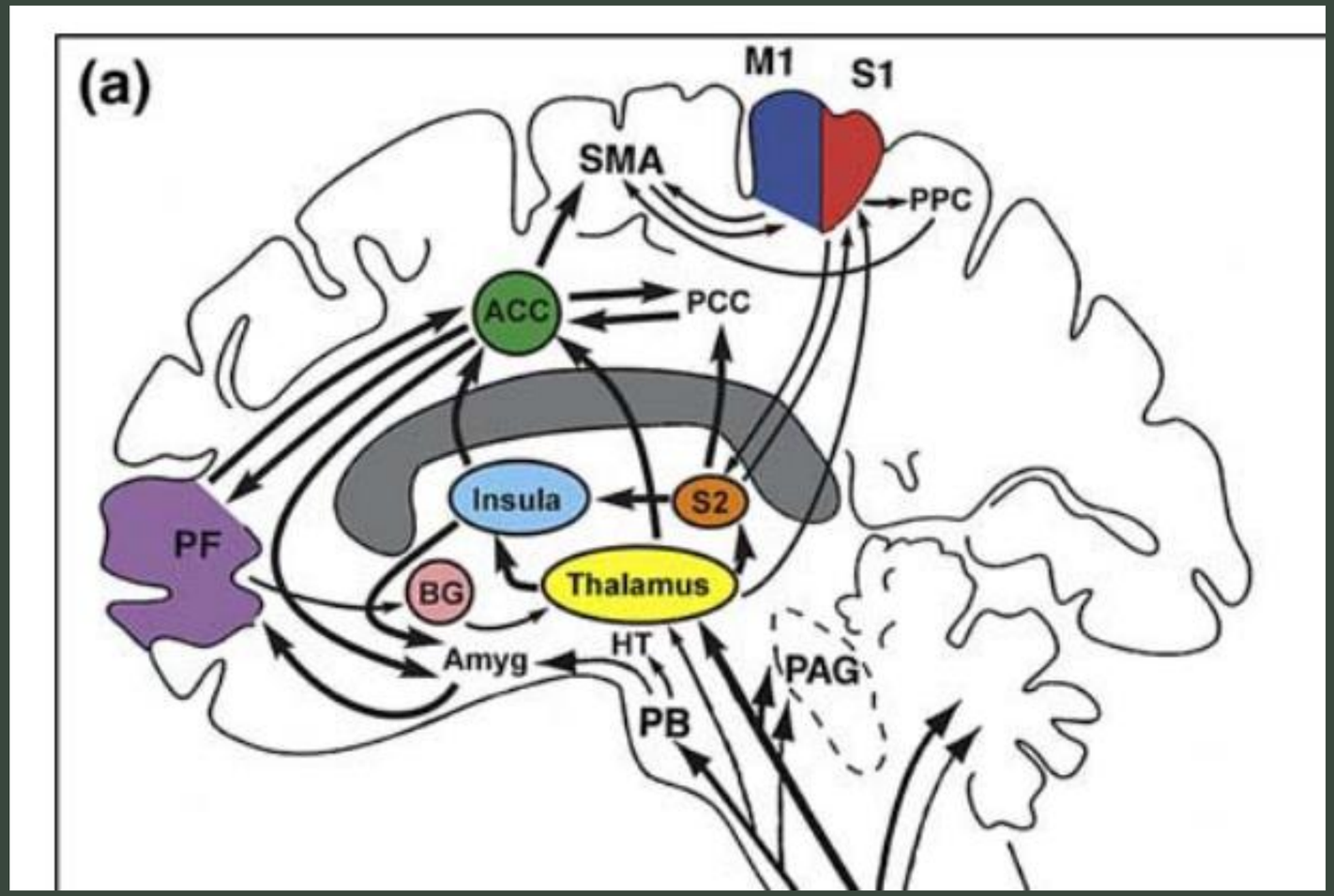


# OBJECTIVES

- **Learn about the neurophyisology of pain and the brain**
- **Examine the relationship between pain, anxiety, and PTSD**
- **Understand the evidence based approach to neurofeedback for pain, headaches, fibromyalgia.**
- **Discover applications and protocols of neurofeedback and new advances in technology.**

**I have no financial interests or relationships to disclose.**

# WHAT OUR PATIENTS WITH CHRONIC CONDITIONS FEEL




ACC= Anterior Cingulate Cortex
S1= Primary Sematosensory Cortex
S2= Secondary Sematosensory Cortex
PF- Prefrontal cortex
M1- Motor Cortex

(Garcia-Larrea L. et al, 2013,2018)

1.Nociceptive Matrix : ascending spinothalamic tract= body signals
2.Attentional Matrix: posterior parietal, prefrontal and insula areas= conscious perception and cognitive control
3.Emotional matrix: orbitofrontal, limbic system-amygdala, hippocampus

# PAIN AND PTSD


Adapted from Bosco et al, 2013

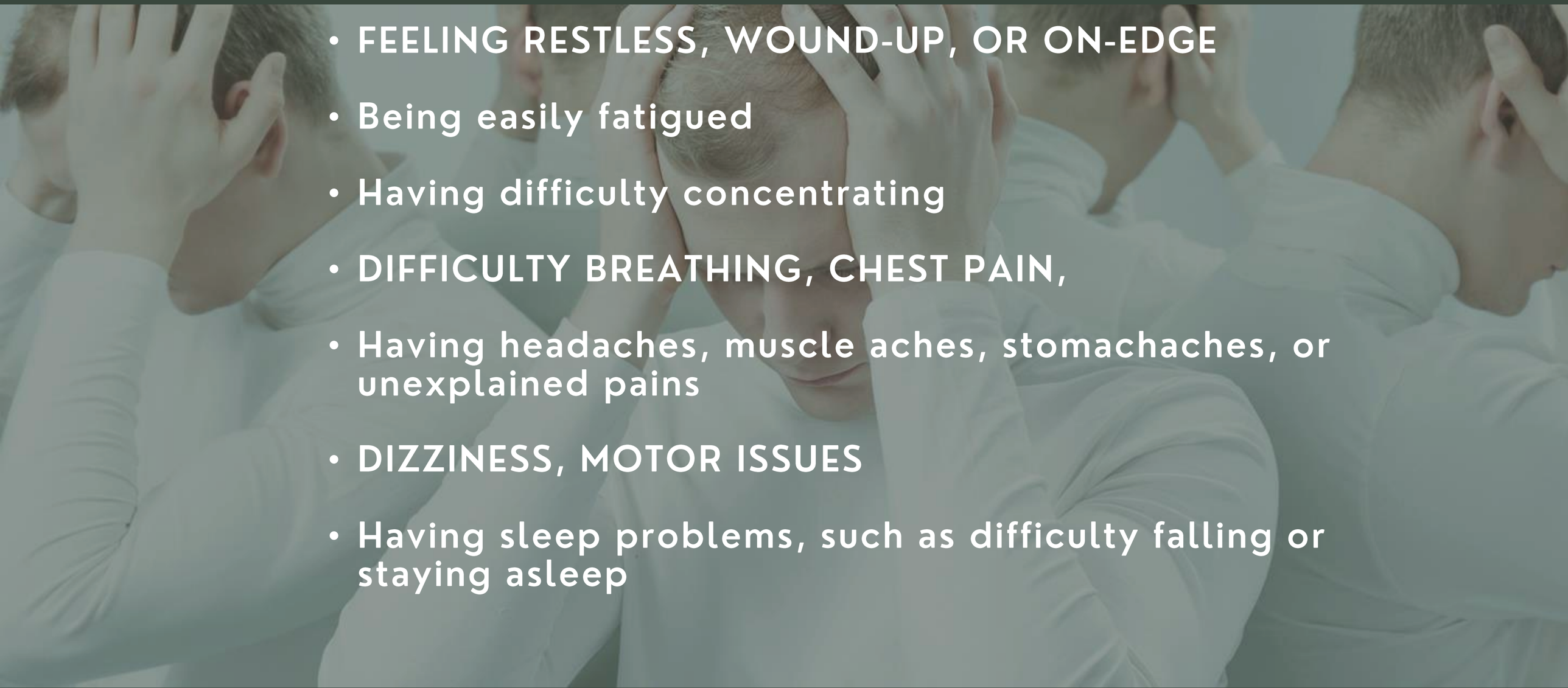
"ANXIETY IS MARKED BY EXCESSIVE FEAR (AND AVOIDANCE)

OFTEN IN RESPONSE TO SPECIFIC OBJECTS OR SITUATIONS AND IN THE ABSENCE OF TRUE DANGER"

(SHIN,L. ET AL, 2010)

# SOMATIC SYMPTOMS OF ANXIETY

(GELENBURG ET AL., 2000)



- FEELING RESTLESS, WOUND-UP, OR ON-EDGE
- Being easily fatigued
- Having difficulty concentrating
- DIFFICULTY BREATHING, CHEST PAIN,
- Having headaches, muscle aches, stomachaches, or unexplained pains
- DIZZINESS, MOTOR ISSUES
- Having sleep problems, such as difficulty falling or staying asleep

# WHAT DO THEY WISH FOR?


Me
Ability to make them happen
Hopes and Dreams

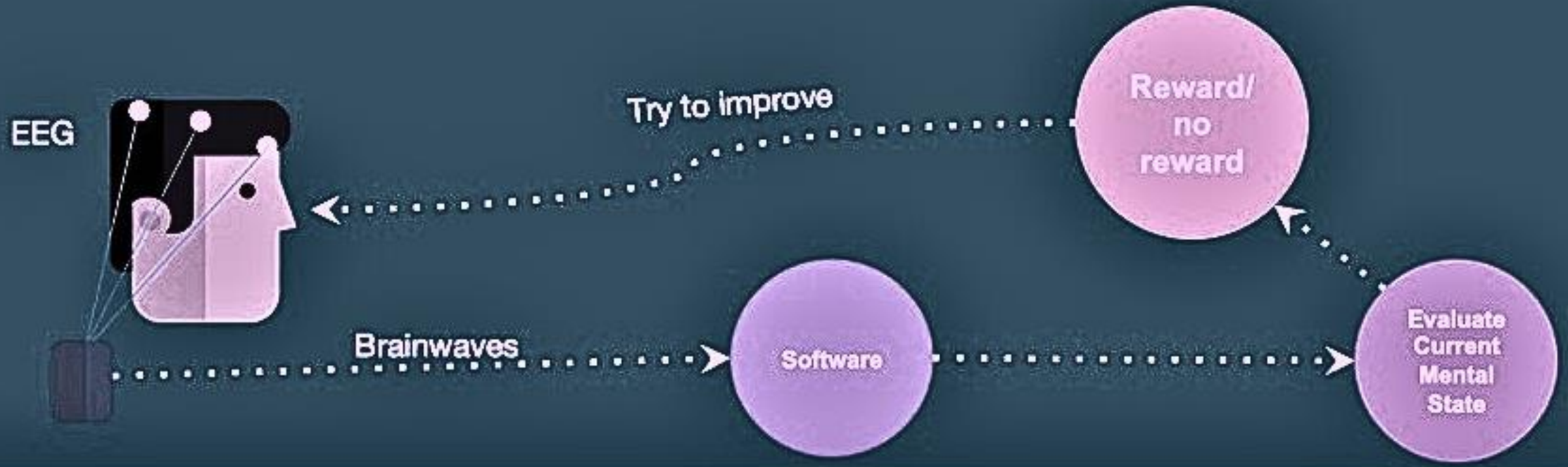
Sometimes the brain corrects itself.

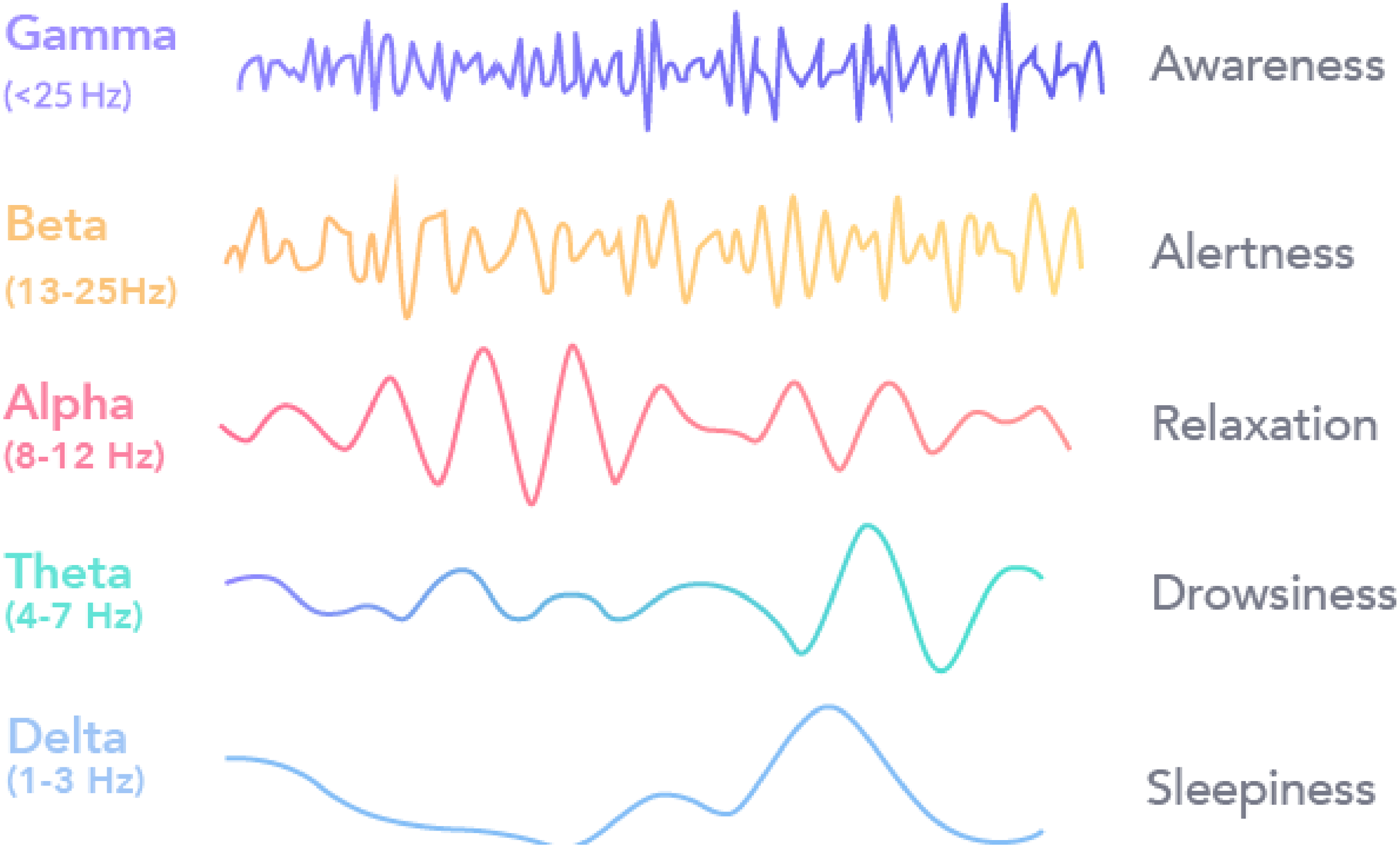
When it doesn't, dysregulation becomes the

**“new normal”.**

# Brainwaves are Translated to **Feedback in Real Time**

Users get feedback based on their current mental state and try to improve upon it instantly.




Gamma
(<25 Hz)
Awareness
Beta
(13-25Hz)
Alertness
Alpha
(8-12 Hz)
Relaxation
Theta
(4-7 Hz)
Drowsiness
Delta
(1-3 Hz)
Sleepiness

# Self-Regulation

Slowly, the brain learns to engage in a new way as feedback teaches it to **self-regulate** and correct a specific activity.

# Risks?

There are none! It just **monitors** the electrical activity in the brain. Doesn't send anything.


DID YOU KNOW?
IF YOU RUB A BIT OF OLIVE OIL AND EPSOM SALT ON THE PAINFUL SPOTS ON YOUR BODY, IT WILL IMMEDIATELY FEEL GREASIER AND SALTIER.

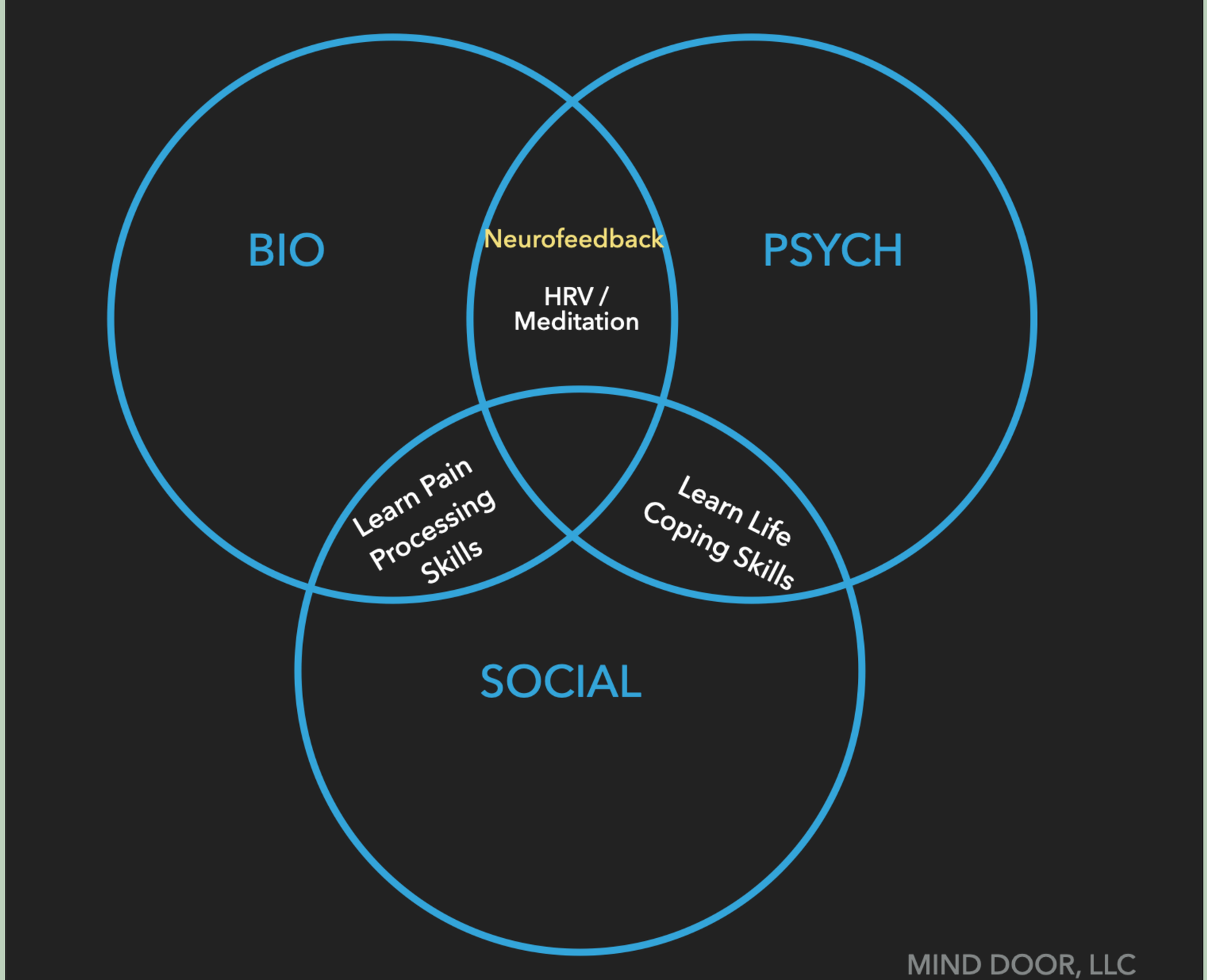
#1 NEW YORK TIMES BESTSELLER

# THE BODY KEEPS THE SCORE

## BRAIN, MIND, AND BODY IN THE HEALING OF TRAUMA

BESSEL VAN DER KOLK, M.D.

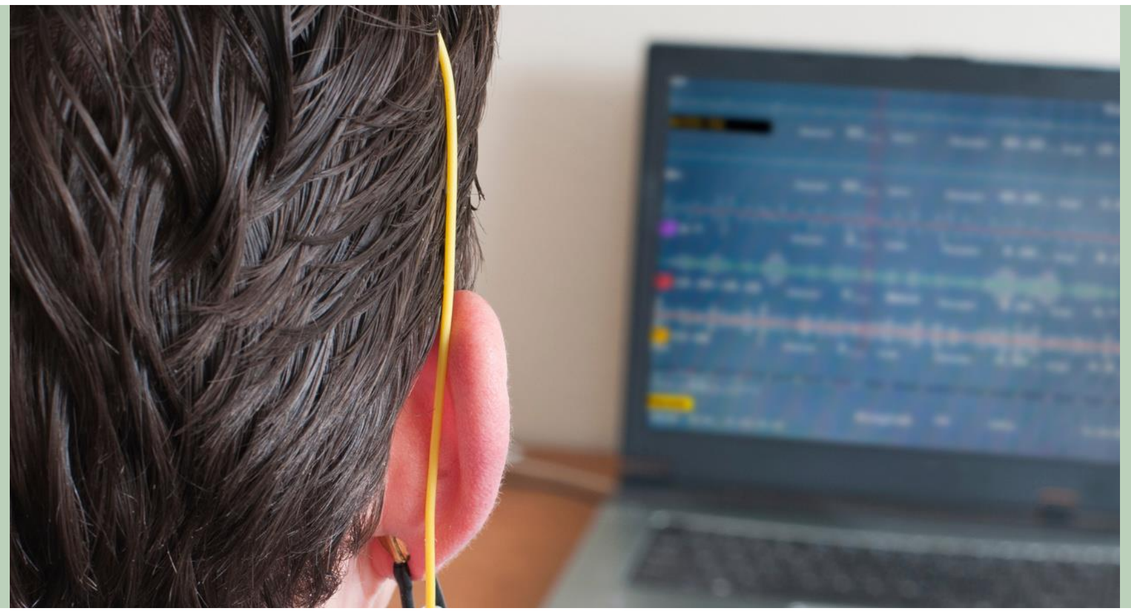
"A MASTERPIECE THAT COMBINES THE BOUNDLESS CURIOSITY OF THE SCIENTIST, THE ERUDITION OF THE SCHOLAR, AND THE PASSION OF THE TRUTH TELLER." —JUDITH HERMAN, M.D.


BIO
PSYCH
SOCIAL
Neurofeedback
HRV /
Meditation
Learn Pain
Processing
Skills
Learn Life
Coping Skills
MIND DOOR, LLC

# A Randomized Controlled Study of Neurofeedback for Chronic PTSD

Bessel A. van der Kolk, Hilary Hodgdon, Mark Gapen, Regina Musicaro, Michael K. Suvak, Ed Hamlin, Joseph Spinazzola

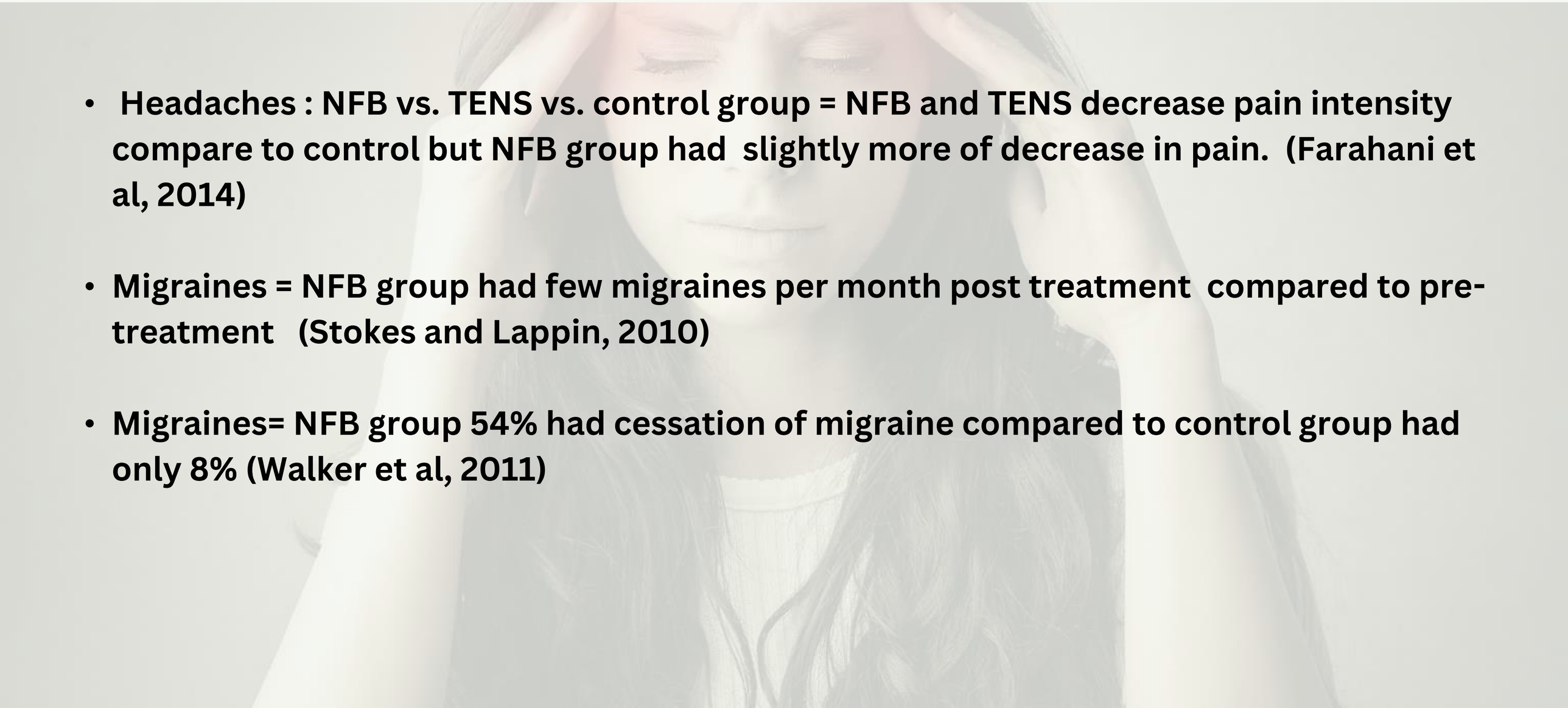
Published: December 16, 2016 • https://doi.org/10.1371/journal.pone.0166752



Twenty-four sessions of NF produced significant improvements in PTSD symptomatology in multiply traumatized individuals with PTSD who had not responded to at least six months of trauma-focused psychotherapy, compared to a waitlist control group that continued to receive treatment as usual. The effect sizes of NF in this study (*d* = -2.33 within, d = - 1.71 between


RECORDING THE RADIO
COBY
WITH CASSETTE TAPES

# HEADACHE RESEARCH



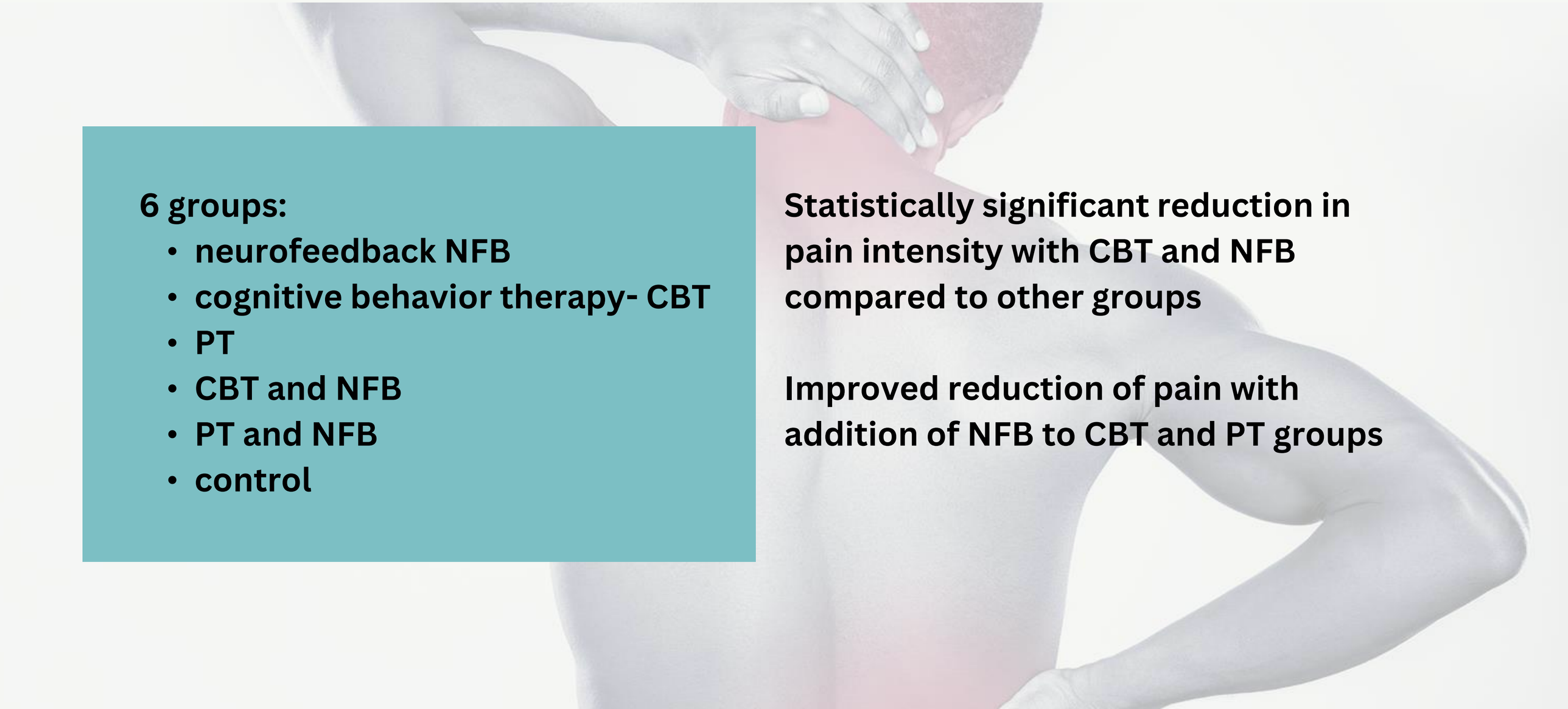
- **Headaches : NFB vs. TENS vs. control group = NFB and TENS decrease pain intensity compare to control but NFB group had slightly more of decrease in pain. (Farahani et al, 2014)**
- **Migraines = NFB group had few migraines per month post treatment compared to pre-treatment (Stokes and Lappin, 2010)**
- **Migraines= NFB group 54% had cessation of migraine compared to control group had only 8% (Walker et al, 2011)**

# NEUROPATHIC PAIN RESEARCH

- **Cancer survivor w/neuropathy: NFB vs. control group = NFB decrease pain intensity compared to control even at 1 and 4 month follow up (Prinsloo et al, 2018)**
- **CRPS : decrease in pain intensity by at least 30% post session compared to pre-session (Jensen, 2007)**
- **Neuropathic pain in SCI : increase alpha brain waves, decrease in pain intensity ((Vučković et al., 2019)**

# CHRONIC BACK PAIN RESEARCH

## Shimizu et al, 2022



**6 groups:**

- **neurofeedback NFB**
- **cognitive behavior therapy- CBT**
- **PT**
- **CBT and NFB**
- **PT and NFB**
- **control**

**Statistically significant reduction in pain intensity with CBT and NFB compared to other groups**

**Improved reduction of pain with addition of NFB to CBT and PT groups**

# FIBROMYALGIA RESEARCH

- **NFB vs pain med for fibromyalgia = Both reduce pain but NFB at 4 weeks, meds at 8 weeks (Kayiran et al, 2010)**
- **NFB vs traditional medical intervention: 39% reduction pain intensity and 40% less fatigue after NFB compared to control (Caro et al, 2011)**

# Effects of Neurofeedback on Fibromyalgia: A Randomized Controlled Trial

**Article** *in* Pain management nursing: official journal of the American Society of Pain Management Nurses · February 2021

DOI: 10.1016/j.pmn.2021.01.004

## Wu et al, 2021

- **80 total diagnosed fibromyalgia (60 neurofeedback, 20 control)**
- **8 weeks**
- **Neurofeedback:  20 session (600 min total)**
- **Control: Education materials and weekly telephone calls 10 min.**

# Wu et al, 2021

## MEASUREMENTS:

- **Brief Pain Inventory (BPI):** 0-10 scale or worst, average and current pain
- **Fibromyalgia Inventory Questionnaire Revised (FIQR):** fibromyalgia symptoms (pain, fatigue, unrefreshing sleep, stiffness, anxiety, depression, tenderness to touch, memory, balance, and environmental sensitivity AND physical function
- **Pittsburgh Sleep Quality Index**
- **Psychomotor Vigilance Test:** Attention -- reponse time to visual stimuli
- **Digit Span Test:** Memory-- remember digits fowards and back

# Wu et al, 2021

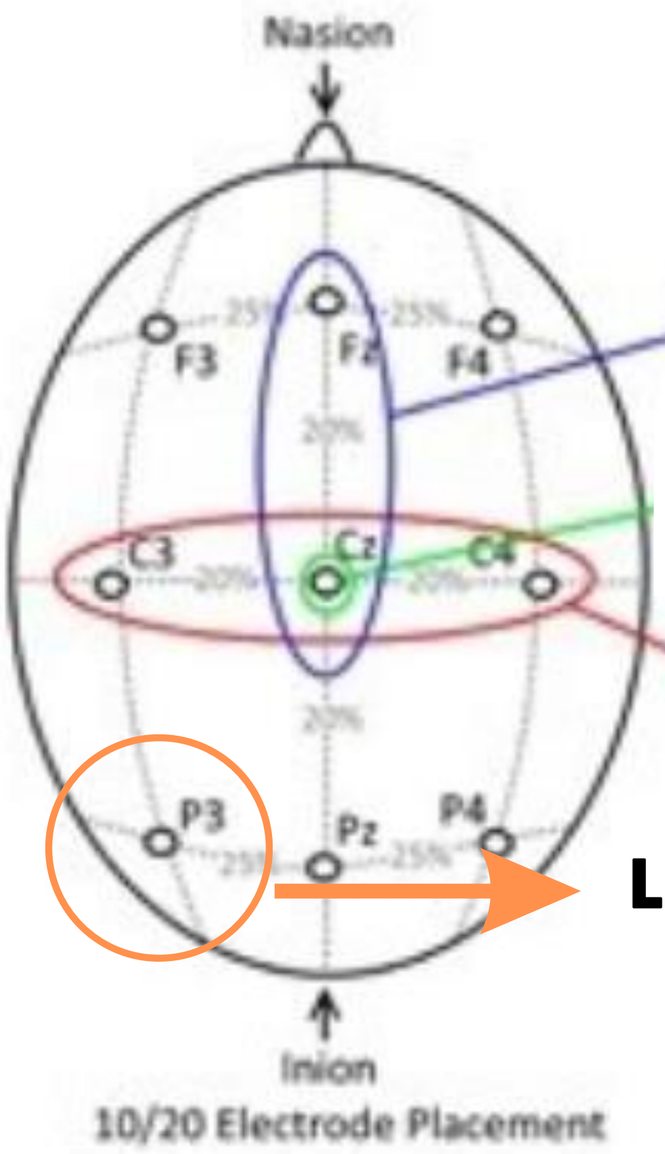
## RESULTS BETWEEN GROUPS

- Brief Pain Inventory (BPI): statistically significant **decrease in pain severity** (p=.002) AND **decrease in pain interference** (p<.001) in neurofeedback group compared to control

- Fibromyalgia Inventory Questionnaire Revised (FIQR): Statistically significant **decrease in total score (p<.001) AND increase in function score (p=.038) AND decrease in fibromyalgia symptoms (p=.001**) in neurofeedback compared to control.
- Sleep is is not significanly different between groups

- Cognitive function: Statistically **significant decrease in errors** (p=.028) in neurofeedback group compared to control but not in other cognitive number tasks.

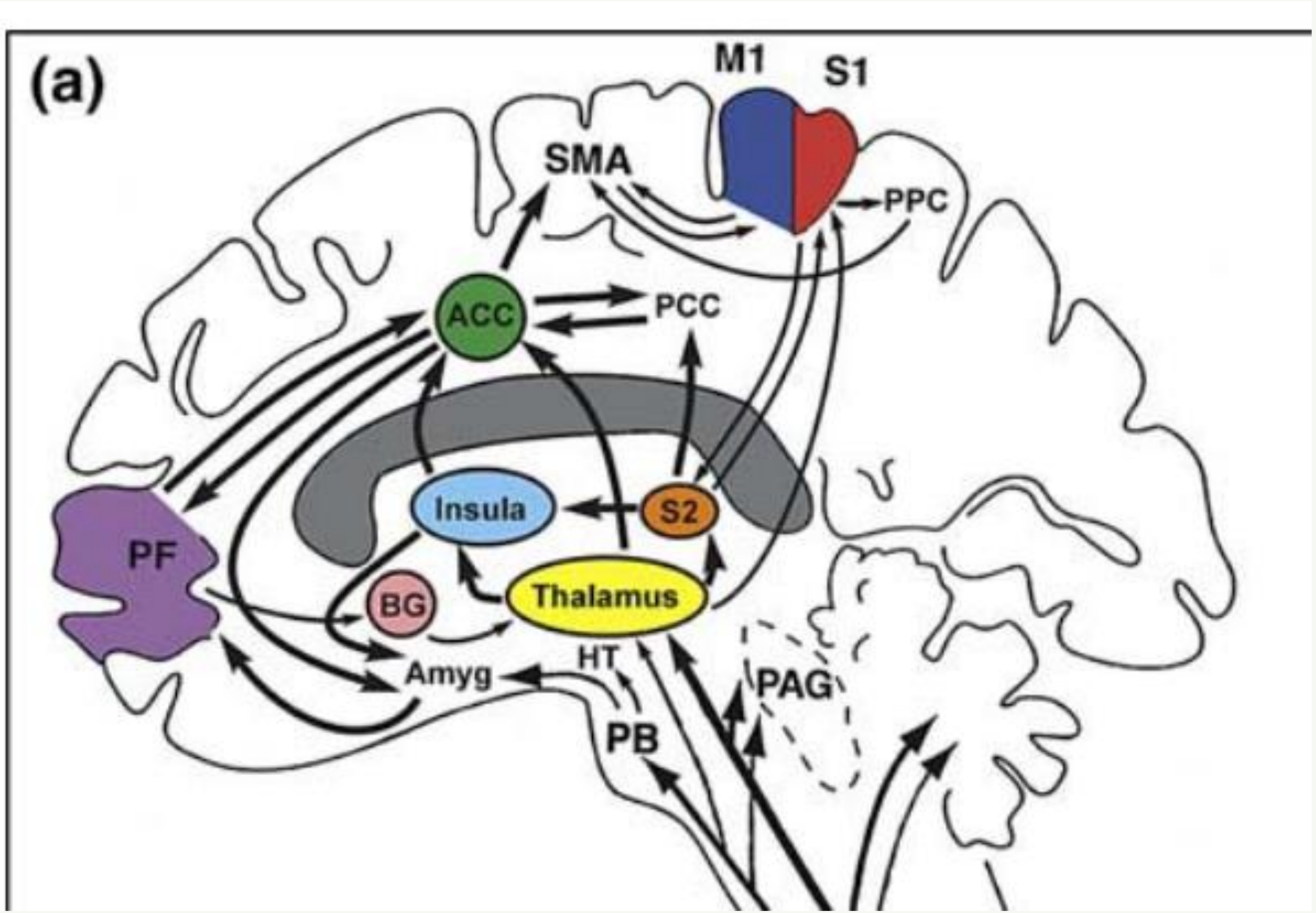

KIDS THESE DAYS WILL NEVER
VIA 9GAG.COM
KNOW THE STRUGGLE

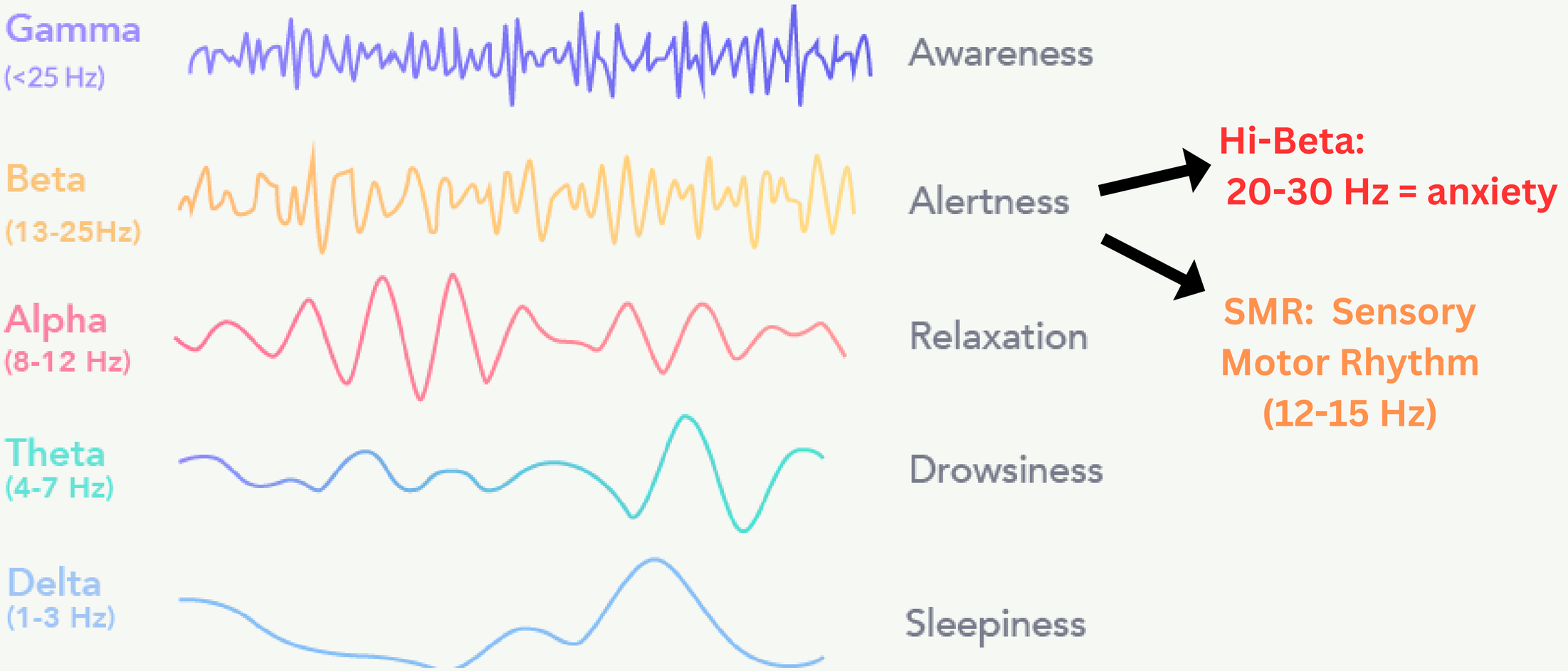



**Theta/Beta neurofeedback (Cognition )**

**Sensori-Motor-Rhythm (SMR) neurofeedback**

**Limbic System, Primitive Response, Trauma**


(a)
M1
S1
SMA
PPC
ACC
PCC
Insula
S2
PF
BG
Thalamus
HT
Amyg
PAG
PB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SMR: Sensory
Motor Rhythm
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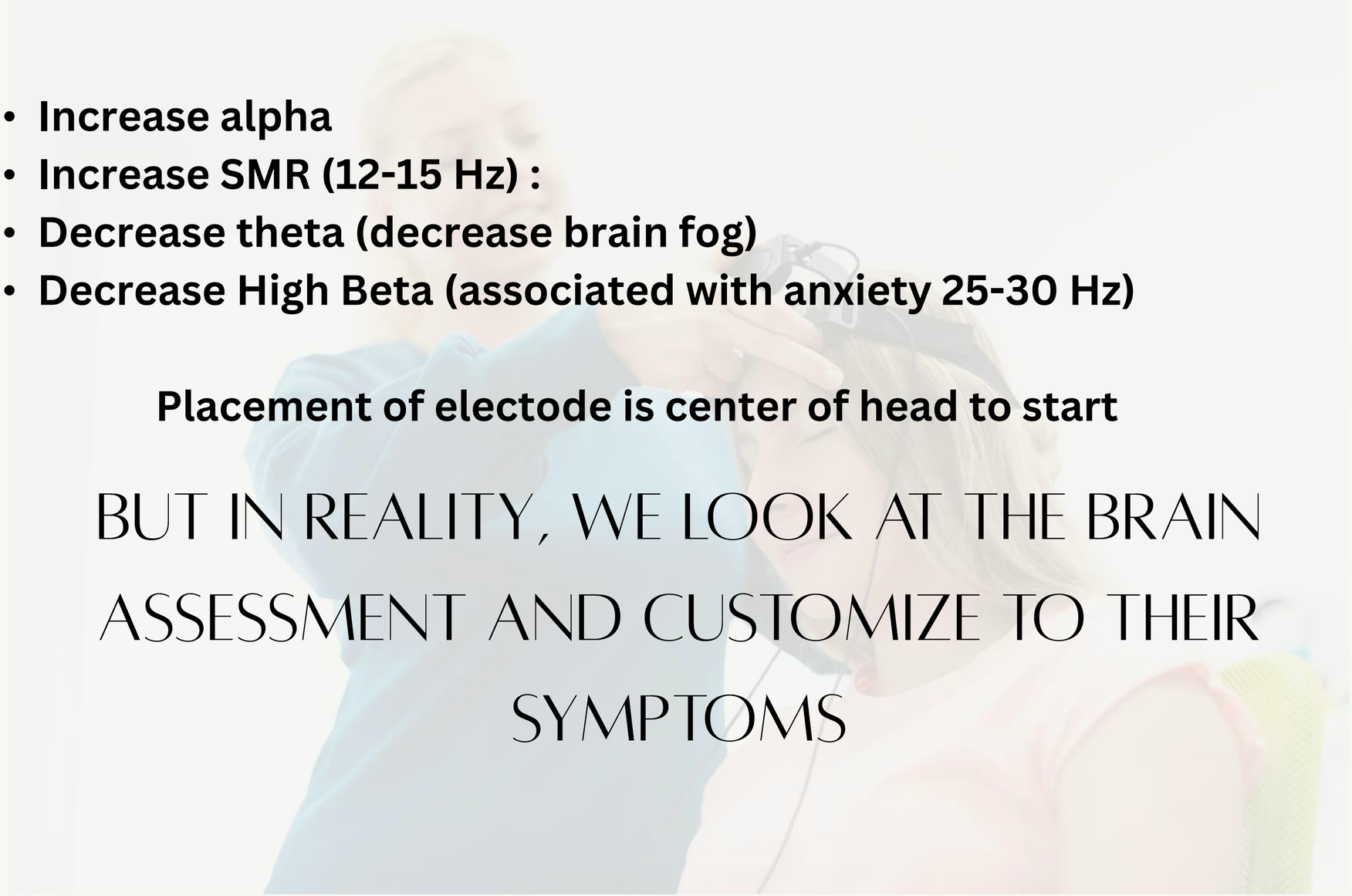
Theta
(4-7 Hz)
Drowsiness
Delta
(1-3 Hz)
Sleepiness

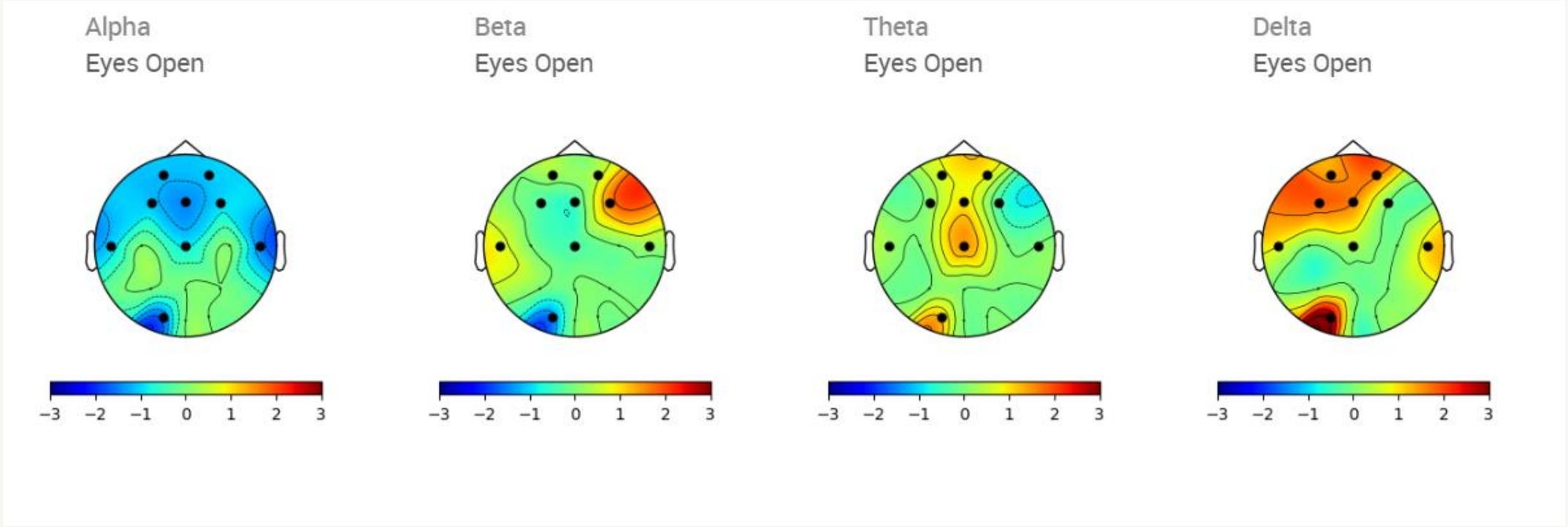
# TYPICAL NEUROFEEDBACK PROTOCOLS



- **Increase alpha**
- **Increase SMR (12-15 Hz) :**
- **Decrease theta (decrease brain fog)**
- **Decrease High Beta (associated with anxiety 25-30 Hz)**

**Placement of electode is center of head to start**

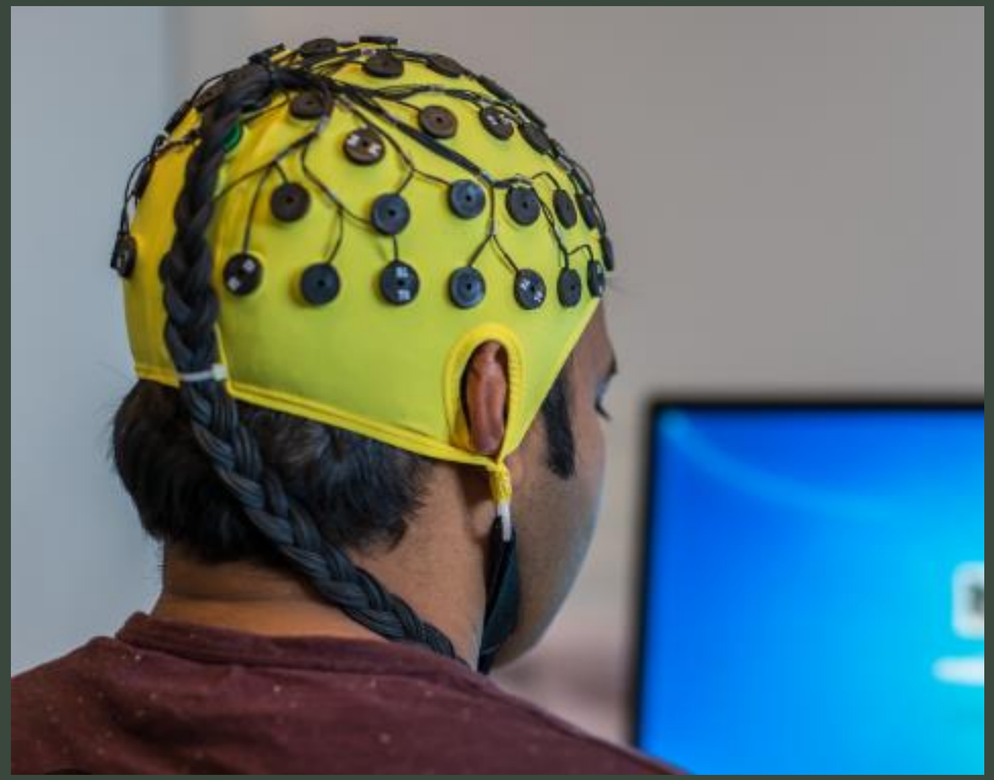
BUT IN REALITY, WE LOOK AT THE BRAIN ASSESSMENT AND CUSTOMIZE TO THEIR SYMPTOMS

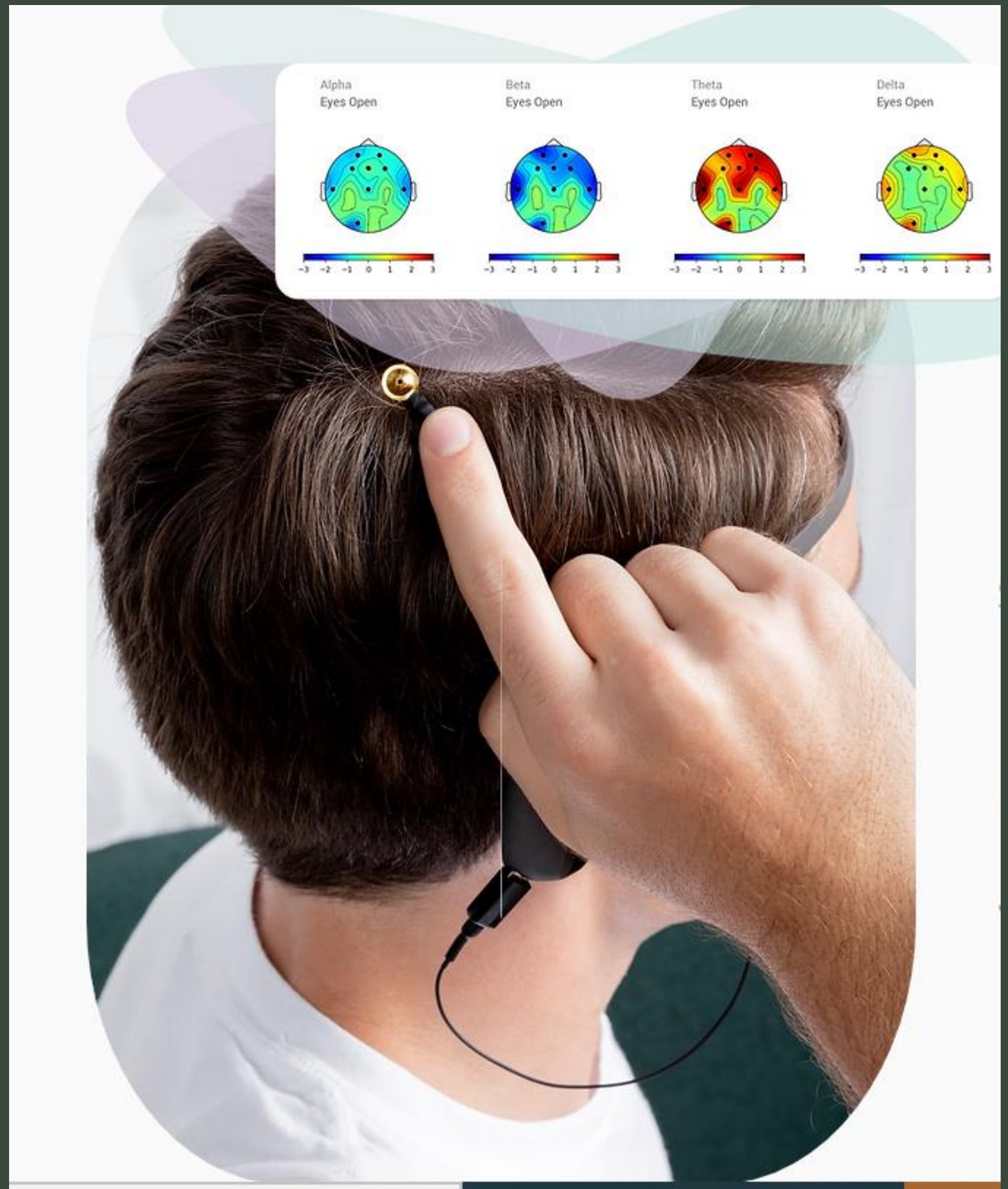



**25 y.o female**
**Diagnosis: Fibromyalgia and POTS**
**Meds:  Low dose Naltrexone, Hydroyzine and Midrodrine (for POTS)**

**Program:  Center of head to increase alpha , decrease theta**
**Back of the head to decrease delta and theta**

# Traditional EEG






Myndlift
Electrode
Myndlift


THIS ROUND
THIS SESSION
1
54
Deep Zone
Zone
Worked
Zone performance:
Zone streak:

# AT HOME NEUROFEEDBACK

- **5 sensors in headband +1 active electrode.**
- **75 min. in-office brain assessment**
- **15-20 min customized programs daily or every other day**
- **3 months= total of 675-1350 minutes of training**

# WHO IS THE BEST CANDIDATE FOR NEUROFEEDBACK?

- Stalled out in talk therapy
- Meds not as effective
- Physical symptoms affecting mental health
- Willing to be consistent with a daily routine (or has help to remember)
- Financially afford 3 month commitment (no insurance coverage)
- Able to manage the technology

KIDS TODAY WILL NEVER KNOW WHAT IT WAS LIKE TO TAKE A TON OF PICTURES


AND HAVE TO WAIT A WEEK TO FIND OUT THEY WERE USELESS

# THANK YOU!

**Email: Irene@mind-door.com**

**Consult phone:  509-557-0373**

**Mind Door, LLC**
**1177 Jadwin Ave**
**Richland, 99352**

# References page 1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