

# Neuro-Bhavana:

---

## *The Mindful Cultivation Of Happiness, Love, and Wisdom*

**Barre Center for Buddhist Studies**

**April 18-20, 2014**

**Rick Hanson, Ph.D.**

**The Wellspring Institute for Neuroscience and Contemplative Wisdom**

**[WiseBrain.org](http://WiseBrain.org) [RickHanson.net](http://RickHanson.net)**

# Topics

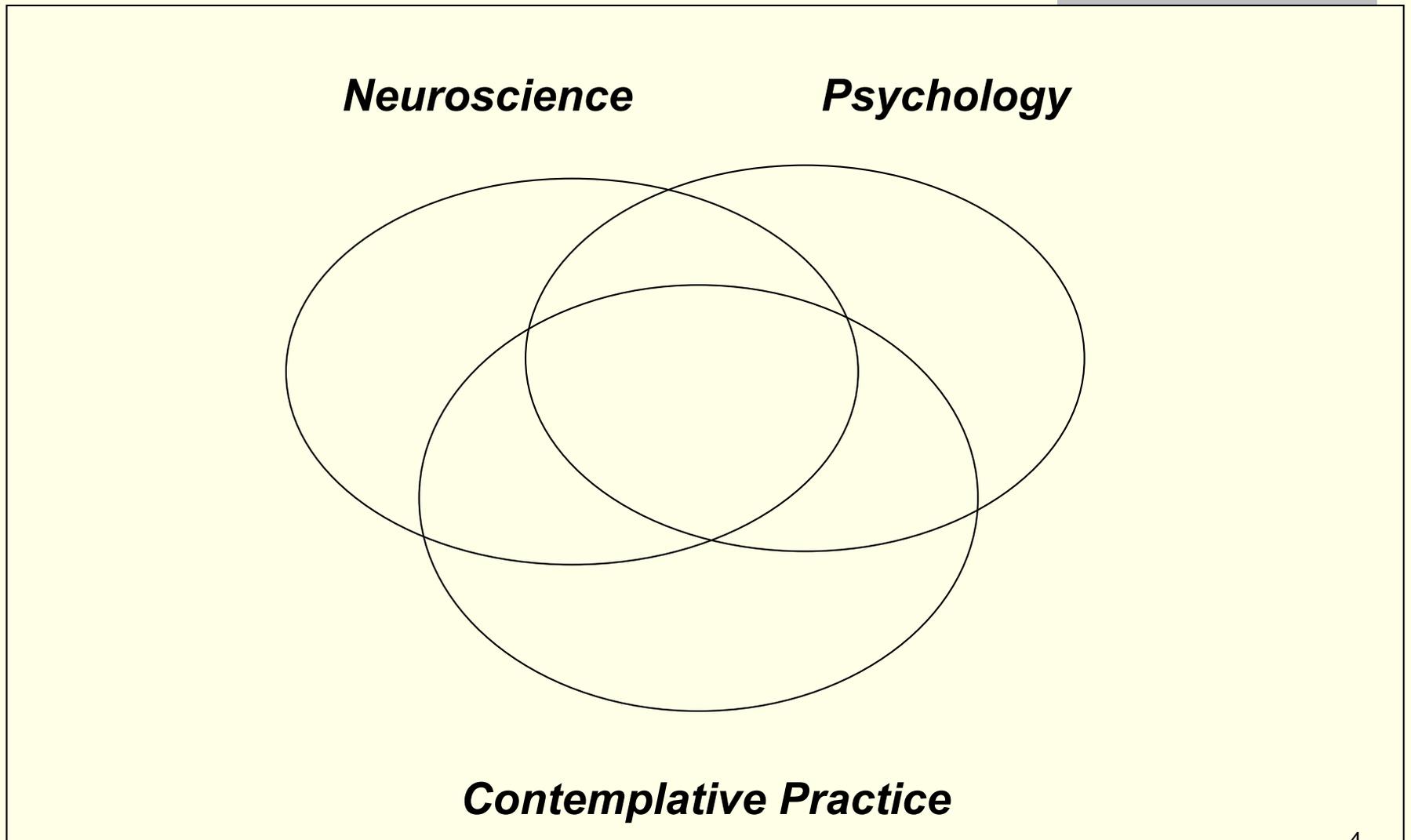
---

- **Neural factors of mindfulness**
- **Grounding the mind in life**
- **Self-directed neuroplasticity**
- **Being on your own side**
- **Growing inner strengths**
- **The negativity bias**
- **Taking in the good**
- **The 2<sup>nd</sup> and 3<sup>rd</sup> Noble Truths**
- **Key resource experiences**
- **Healing old pain**
- **The fruit as the path**



# **Neural Factors of Mindfulness**

# Common - and Fertile - Ground



# Basics of Meditation

---

- Relax; find a posture that is comfortable and alert
- Simple good will toward yourself
- Awareness of your body
- Focus on something to steady your attention
- Accepting whatever passes through awareness, not resisting it or chasing it
- Gently settling into peaceful well-being

# Steadying the Mind

---

- **Setting an intention**
- **Relaxing the body**
- **Feeling cared about**
- **Feeling safer**
- **Encouraging positive emotion**
- **Taking in the good**

# Some Neural Factors of Mindfulness

---

- **Setting an intention** - “top-down” frontal, “bottom-up” limbic
- **Relaxing the body** - parasympathetic nervous system
- **Feeling cared about** - social engagement system
- **Feeling safer** - inhibits amygdala/ hippocampus alarms
- **Encouraging positive emotion** - dopamine, norepinephrine
- **Taking in the good** - positive implicit memories

---

*The brain is wider than the sky,  
For, put them side by side,  
The one the other will include  
With ease, and you beside.*

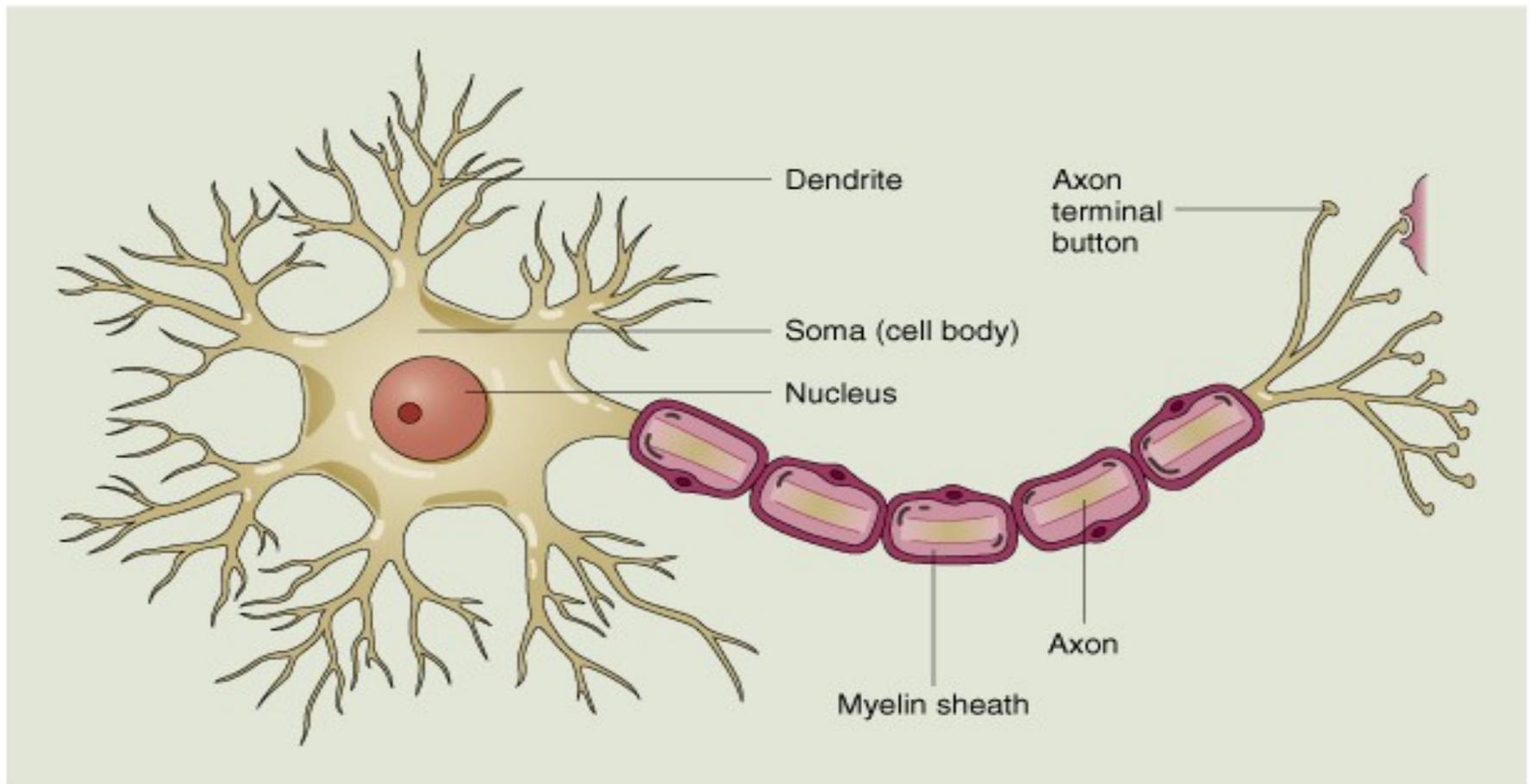
Emily Dickinson



# **Grounding the Mind in Life**



# A Neuron



© 2000 John Wiley & Sons, Inc.

---

*All cells have specialized functions. Brain cells have particular ways of processing information and communicating with each other. Nerve cells form complete circuits that carry and transform information.*

*Electrical signaling represents the language of mind, the means whereby nerve cells, the building blocks of the brain, communicate with one another over great distances. Nerve cells generate electricity as a means of producing messages.*

*All animals have some form of mental life that reflects the architecture of their nervous system.*

# The Natural Mind

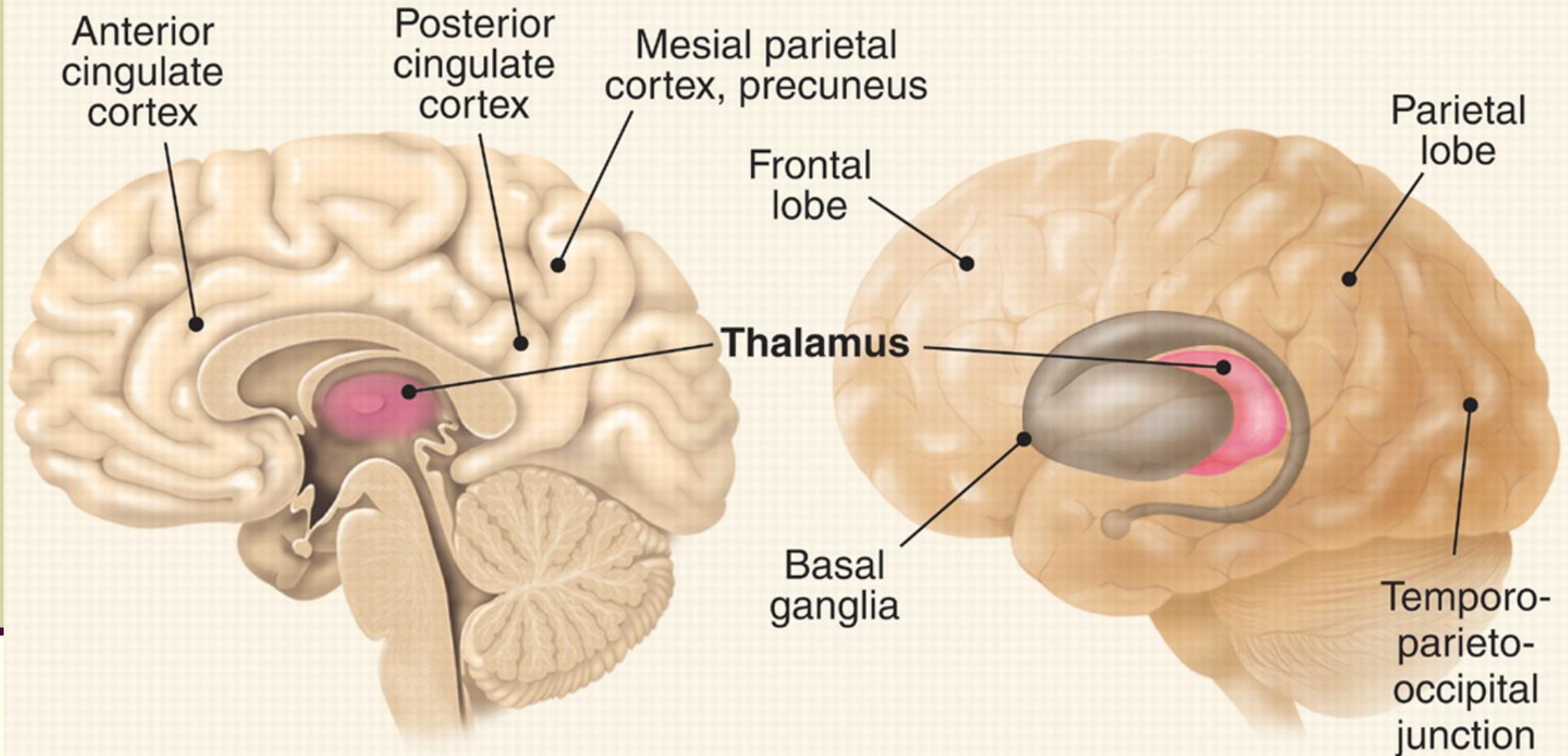
---

Apart from the hypothetical influence of a transcendental X factor . . .

Awareness and unconsciousness, mindfulness and delusion, and happiness and suffering must be natural processes.

Mind is grounded in life.

# Key Brain Areas for Consciousness



(adapted from) M. T. Alkire et al., *Science* 322, 876-880 (2008)

# Naturalizing the Dharma

---

To “naturalize” something is to place it in the frame of the natural world, to operationalize it in natural terms.

Buddhist practice engages the *mental* causes of suffering and its end. What could be the natural, *neurobiological* (NB) causes of those causes?

What could be a NB operationalization of dukkha, tanha, nirodha, sila, samadhi, panna, and bhavana?

It is ironic that a practice that is so much about coming into the body can be reluctant to engage the full implications of what embodiment in life means.

---

*We ask, "What is a thought?"*

*We don't know,*

*yet we are thinking continually.*

Venerable Tenzin Palmo

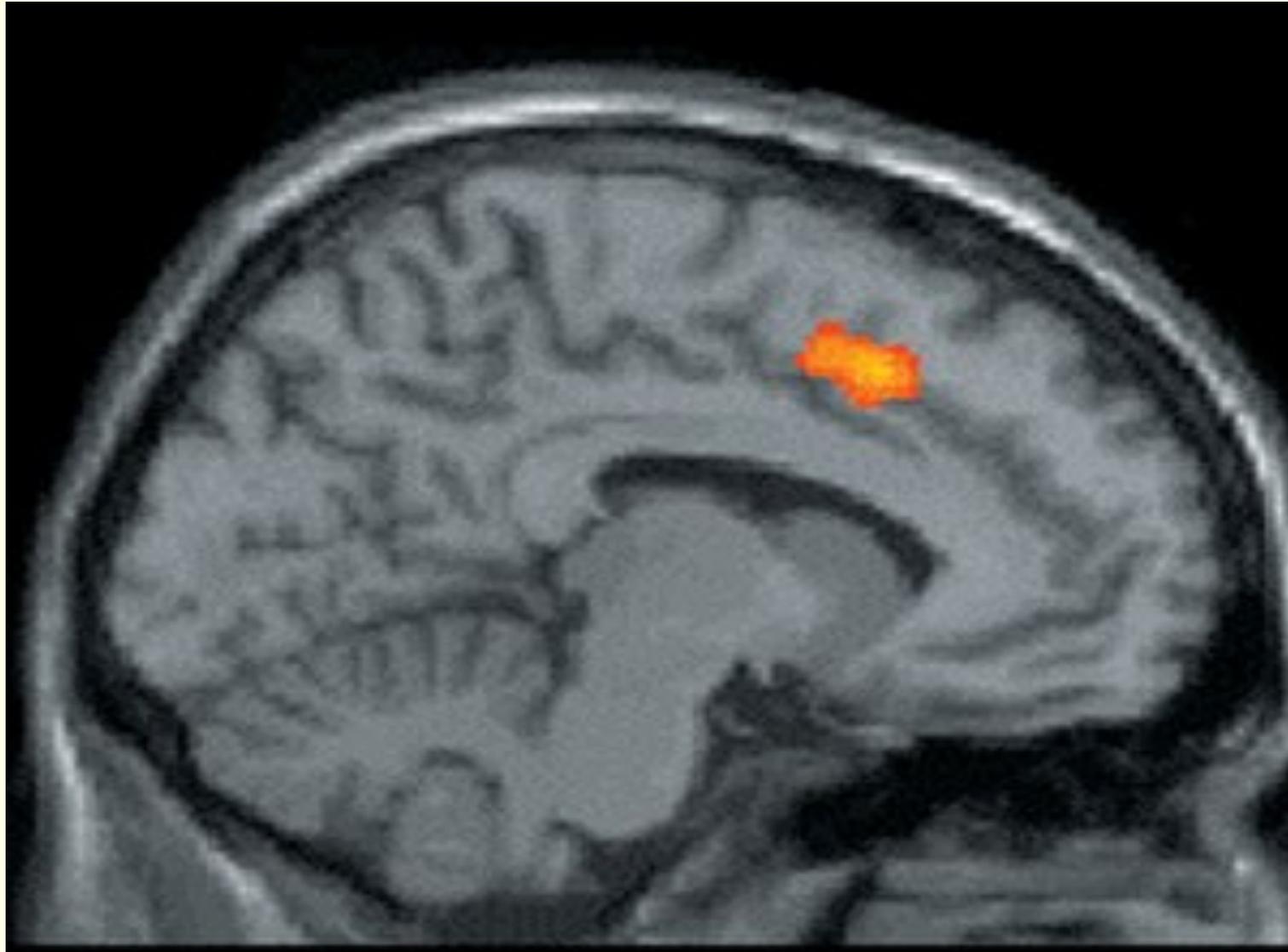


# **Self-Directed Neuroplasticity**

**Mental activity entails  
underlying neural activity.**

# Steadiness of Mind

---



---

**Repeated mental activity entails  
repeated neural activity.**

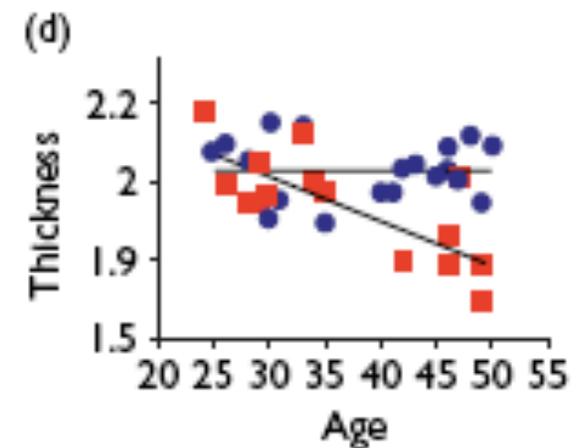
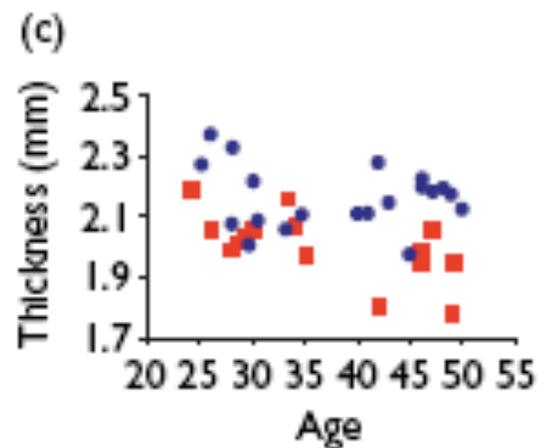
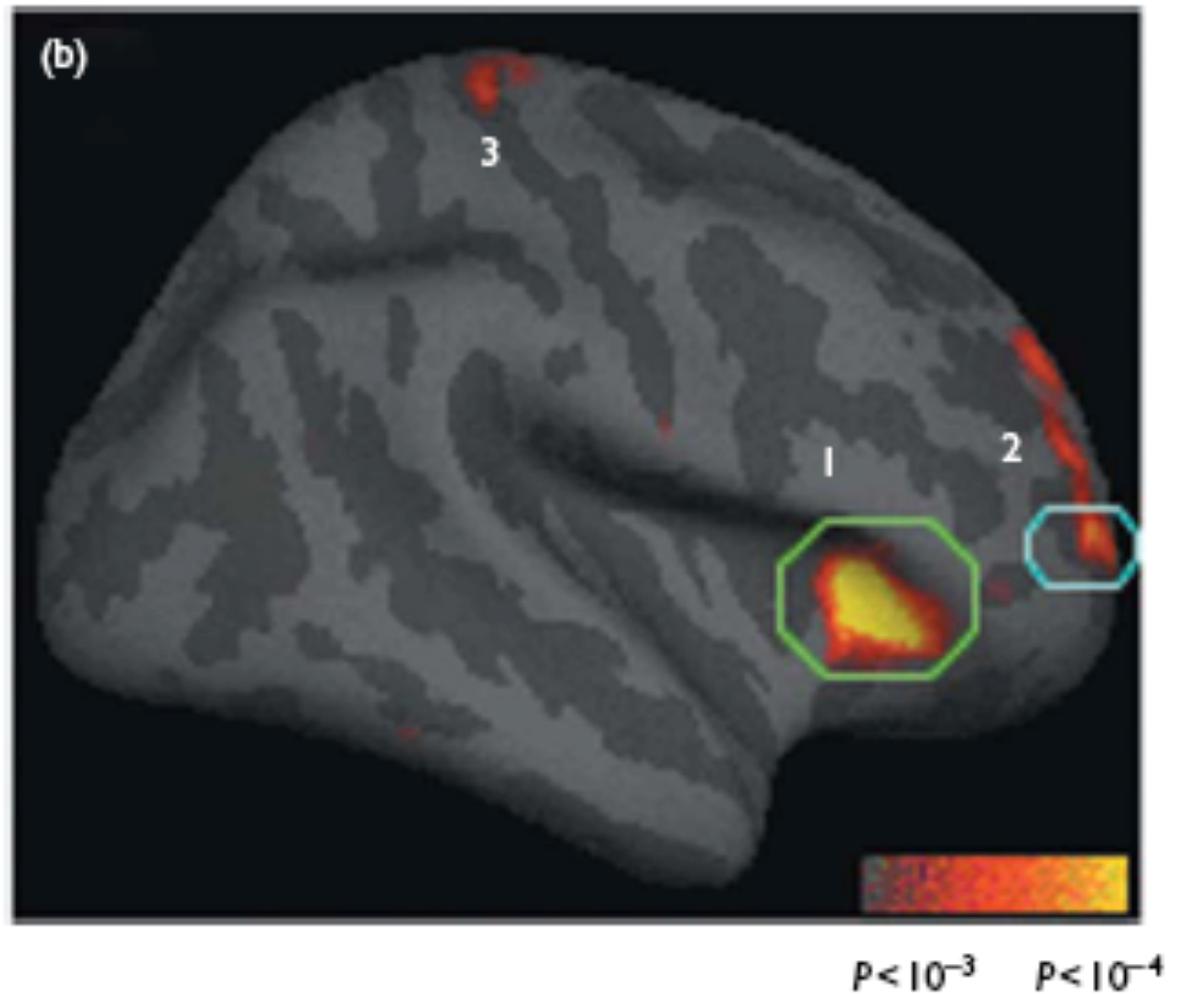
**Repeated neural activity  
builds neural structure.**

A network of glowing yellow neurons with a central neuron highlighted in green. The neurons are interconnected by a dense web of fibers, creating a complex, interconnected structure. The background is dark, making the glowing neurons stand out. The text "Neurons that fire together," is overlaid on the top left, and "wire together." is overlaid on the bottom right.

Neurons that fire together,

wire together.

Lazar, et al. 2005.  
Meditation  
experience is  
associated  
with increased  
cortical thickness.  
*Neuroreport*, 16,  
1893-1897.



# Meditation - Neural Benefits

---

- Increased gray matter in the:
  - Insula - interoception; self-awareness; empathy for emotions
  - Hippocampus - visual-spatial memory; establishing context; inhibiting amygdala and cortisol
  - Prefrontal cortex (PFC) - executive functions; attention control
- Reduced cortical thinning with aging in insula and PFC
- Increased activation of left frontal regions, which lifts mood
- Increased gamma-range brainwaves - may be associated with integration, “coming to singleness,” “unitary awareness”
- Preserved telomere length

# Self-Directed Neuroplasticity

---

**We can use the mind**

**To change the brain**

**To change the mind for the better**

**To benefit ourselves and other beings.**



# **Being on Your Own Side**

---

*If one going down into a river,  
swollen and swiftly flowing,  
is carried away by the current --  
how can one help others across?*

The Buddha

---

*The root of Buddhism is compassion,  
and the root of compassion is compassion for oneself.*

Pema Chodren

# Self-Compassion

---

- Compassion is the wish that a being not suffer, combined with sympathetic concern. Self-compassion simply applies that to oneself. It is not self-pity, complaining, or wallowing in pain.
- Studies show that self-compassion buffers stress and increases resilience and self-worth.
- But self-compassion is hard for many people, due to feelings of unworthiness, self-criticism, or “internalized oppression.” To encourage the neural substrates of self-compassion:
  - Get the sense of being cared about by someone else.
  - Bring to mind someone you naturally feel compassion for
  - Sink into the experience of compassion in your body
  - Then shift the compassion to yourself, perhaps with phrases like: “May I not suffer. May the pain of this moment pass.”

# “Anthem”

---

*Ring the bells that still can ring  
Forget your perfect offering  
There is a crack in everything  
That's how the light gets in  
That's how the light gets in*

Leonard Cohen



# **Growing Inner Strengths**

The image is a split-screen comparison of two wolves. The left side shows a domesticated wolf, likely a husky, with a soft, white and grey coat and a gentle expression. The right side shows a wild wolf with a more rugged, brown and grey coat and a more intense, focused expression. The text "Two wolves in the heart" is centered across both images in a white, serif font.

Two wolves in the heart

# Inner Strengths Include

---

- **Virtues** (e.g., patience, energy, generosity, restraint)
- **Executive functions** (e.g., meta-cognition)
- **Attitudes** (e.g., optimism, openness, confidence)
- **Capabilities** (e.g., mindfulness, emotional intelligence, resilience)
- **Positive emotions** (e.g., gratitude, self-compassion)
- **Approach orientation** (e.g., curiosity, exploration)

# Major Buddhist Inner Strengths

---

**Mindfulness**

**Compassion**

**View**

**Investigation**

**Kindness**

**Intention**

**Energy**

**Altruistic joy**

**Effort**

**Bliss**

**Tranquility**

**Virtue**

**Conviction**

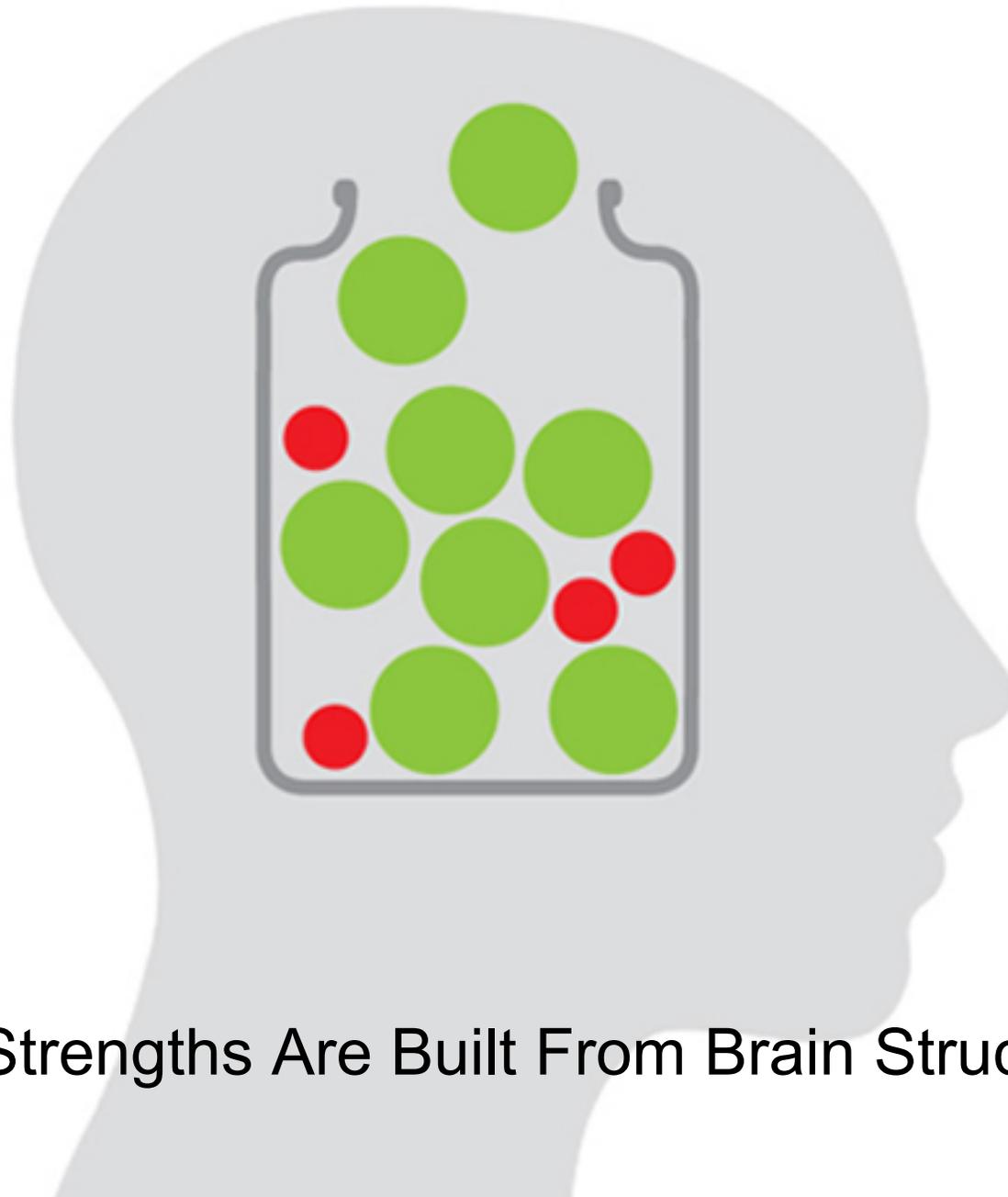
**Concentration**

**Wisdom**

**Generosity**

**Equanimity**

**Patience**



Inner Strengths Are Built From Brain Structure

# Let's Try It

---

- **Notice** the experience already present in awareness that you are alright right now
  - Have the experience
  - Enrich it
  - Absorb it
  
- **Create** the experience of compassion
  - Have the experience - bring to mind someone you care about . . . Feel caring . . . Wish that he or she not suffer . . . Open to compassion
  - Enrich it
  - Absorb it

# The Machinery of Memory

---

States are temporary, traits are enduring.

States foster traits, and traits foster states

Activated states --> Installed traits --> Reactivated states --> Reinforced traits

Negative states --> Negative traits --> Reactivated negative states --> Reinforced negative traits

Positive states --> Positive traits --> Reactivated positive states --> Reinforced positive traits

# Growing Inner Strengths

---

Inner strengths are grown from positive mental states that are turned into positive neural traits.

Change in neural structure and function (learning, memory) involves activation and installation.

We become more compassionate by repeatedly internalizing feelings of compassion; etc.

Without **installation**, there is no growth, no learning, no lasting benefit.



# **The Negativity Bias**

# Negative Experiences In Context

---

- Going negative about negative --> more negative
- Some inner strengths come only from negative experiences, e.g., knowing you'll do the hard thing.
- But negative experiences have inherent costs, in discomfort and stress.
- Many inner strengths could have been developed without the costs of negative experiences.
- Many negative experiences are pain with no gain.

# The Brain's Negativity Bias

---

- As our ancestors evolved, avoiding “sticks” was more important for survival than getting “carrots.”
- Negative stimuli:
  - More attention and processing
  - Greater motivational focus: loss aversion
- Preferential encoding in implicit memory:
  - We learn faster from pain than pleasure.
  - Negative interactions: more impactful than positive
  - Easy to create learned helplessness, hard to undo
  - Rapid sensitization to negative through cortisol

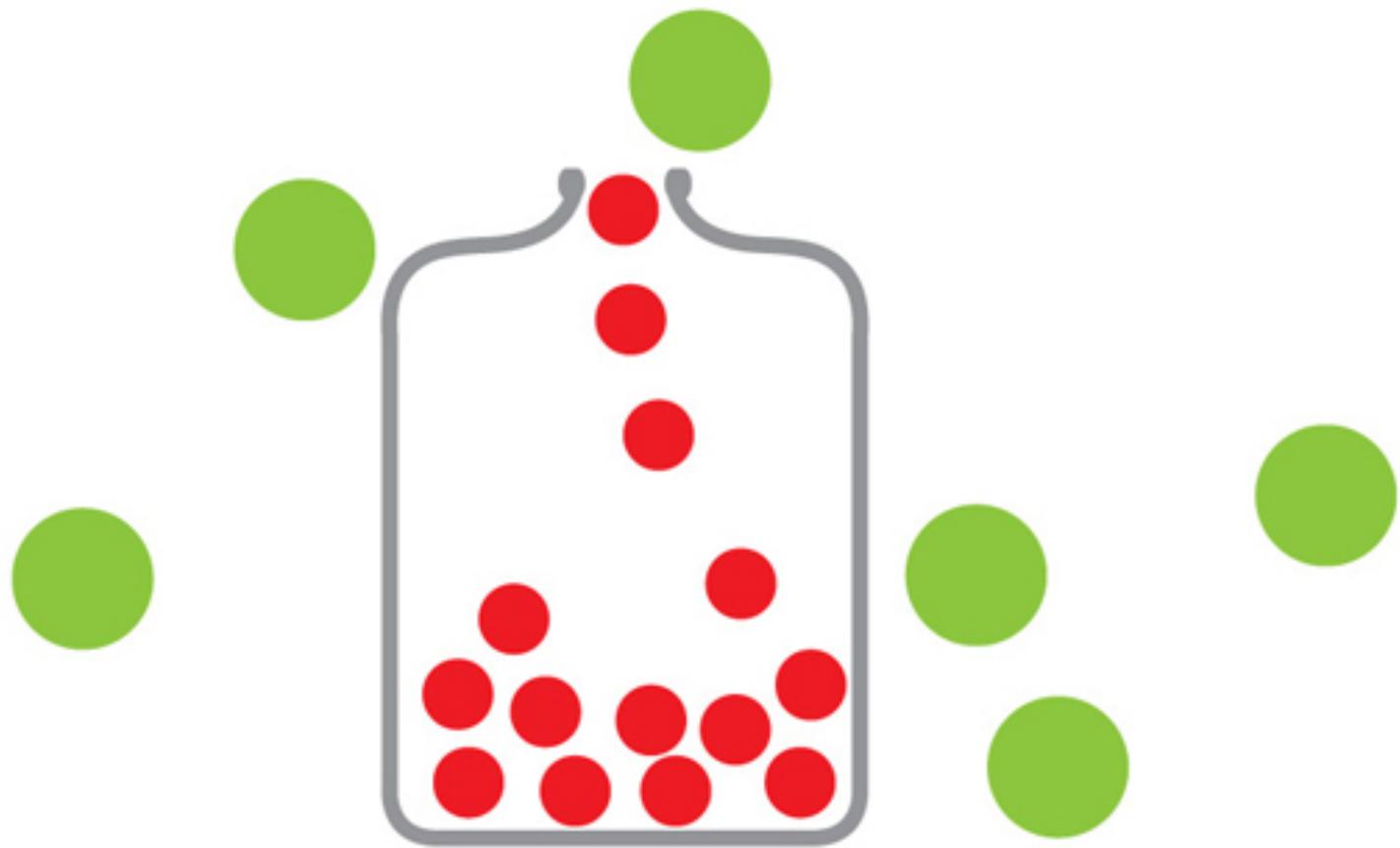
# Velcro for Bad, Teflon for Good

---

The negativity bias

bad experiences

good experiences



The Negativity Bias

A composite image showing Stone Age people in a modern city park. In the background, several tall, modern apartment buildings with many windows rise above a dense line of green trees. In the foreground, three Stone Age people, dressed in animal skins and with long hair, are crouching in a grassy field. One person in the center is looking directly at the camera, while the others are looking to the side. The overall scene is a juxtaposition of ancient and modern environments.

# Stone age brains in the 21st century

---

*We can deliberately use the mind  
to change the brain for the better.*



# **Taking in the Good**

---

**Just having positive experiences is not enough.**

**They pass through the brain like water through a sieve, while negative experiences are caught.**

**This is the fundamental weakness in most psychotherapy, human resources training, and spiritual practices.**

**We need to engage positive experiences actively to weave them into the brain.**

---

*The same research that proves therapy works  
shows no improvement in outcomes  
over the last 30 or so years.*

Scott Miller



*To see what is in front of one's nose  
takes a constant struggle.*

George Orwell

# The Humility of Receptivity

---

It's easy and tempting to be fascinated with the rapid flow of thought, and with a mind darting toward or away from anticipated pleasures or pains.

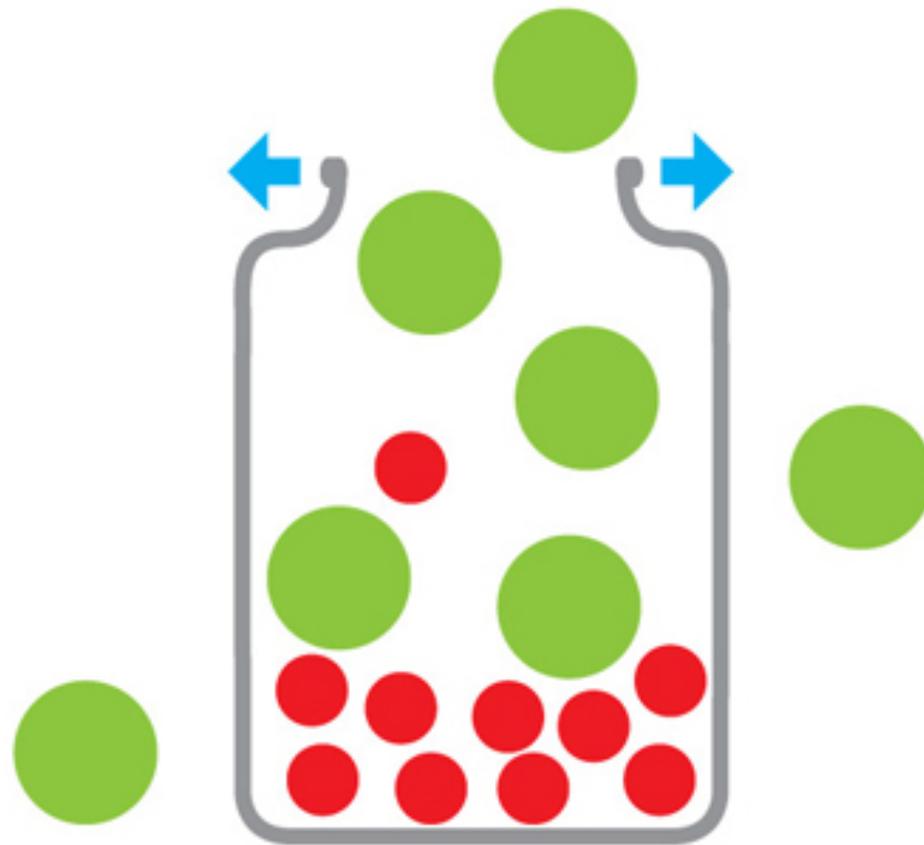
But the memory-making – neural structure and function changing – processes of the brain, especially for emotional, somatic, and motivational learning, are generally slower than cascading thought.

To consolidate useful experiences in the brain takes time . . . Accepting the rhythms of the flesh.

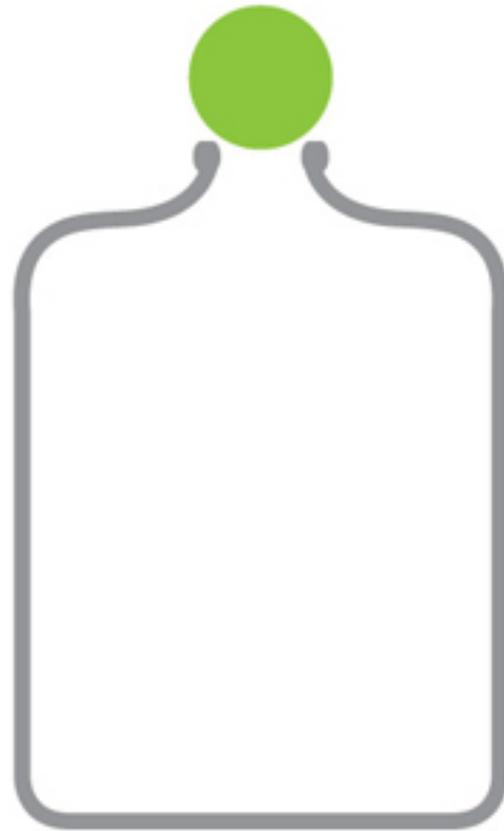
---

*The education of attention  
would be the education par excellence.*

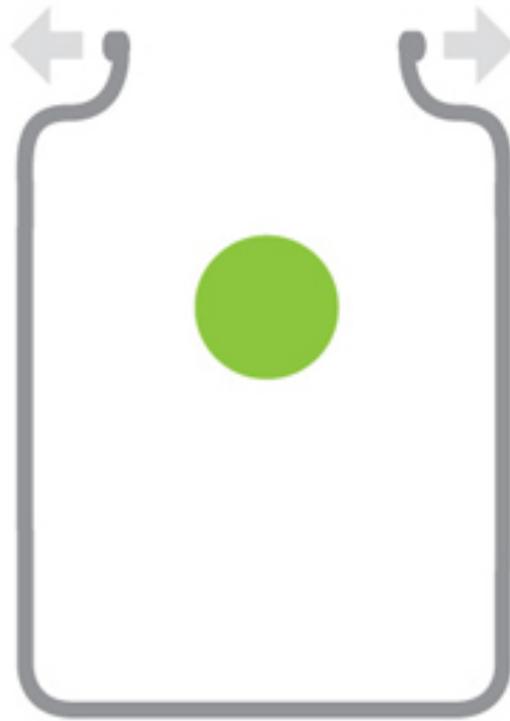
William James



Learning to Take in the Good



Have a Good Experience



Enrich It

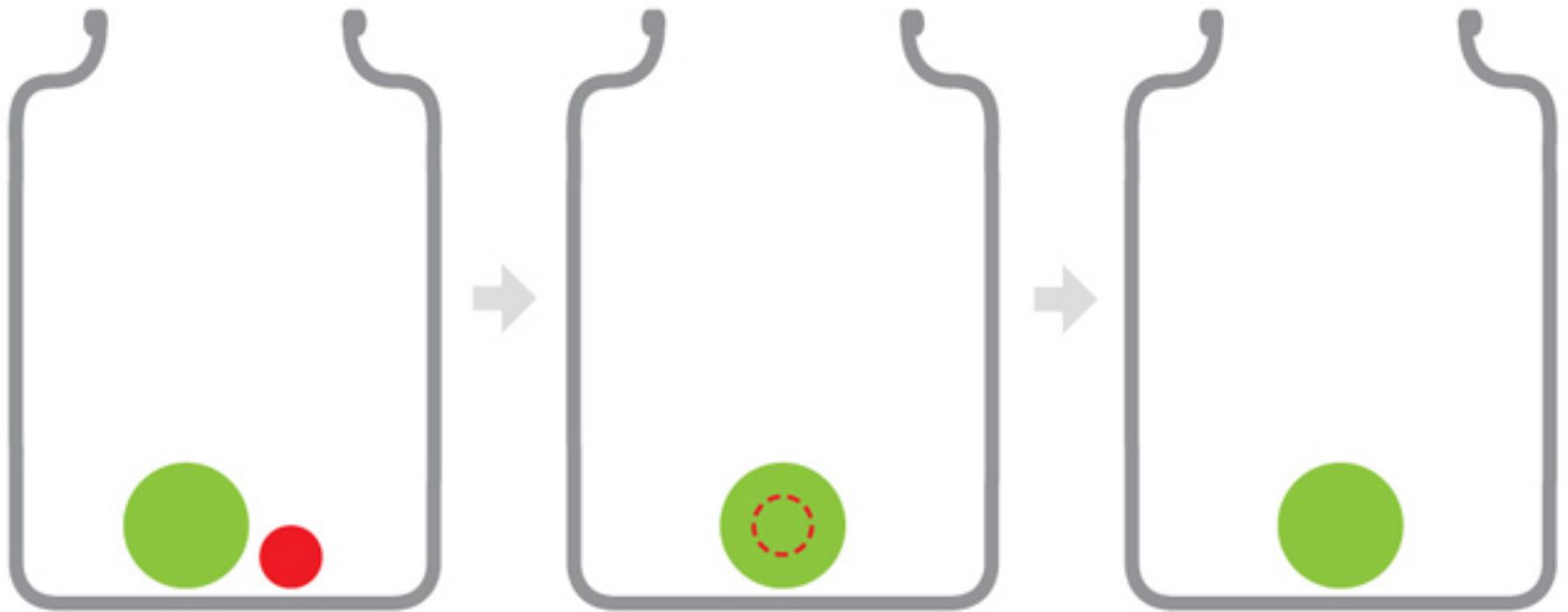
# “Enriching” Factors

---

- Duration
- Intensity
- Multimodality – thought, perception, emotion, desire, action
- Novelty
- Personal relevance



Absorb It

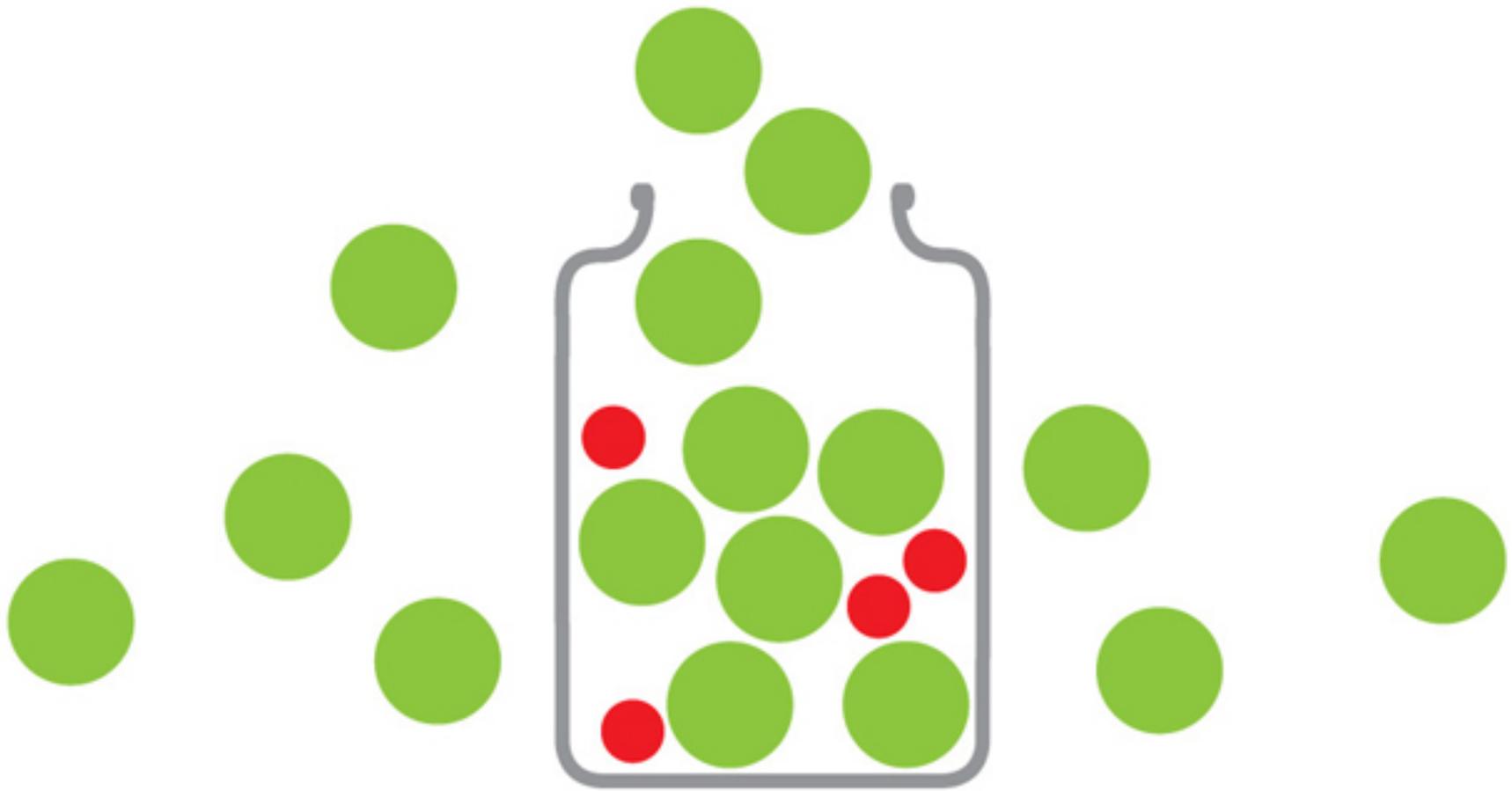


**L**ink Positive and Negative Material

# HEAL by Taking in the Good

---

1. Have a positive experience. Notice it or create it.
2. Enrich the experience through duration, intensity, multimodality, novelty, personal relevance
3. Absorb the experience by intending and sensing that it is sinking into you as you sink into it.
4. Link positive and negative material. [optional]



Have It, Enjoy It

# Let's Try It

---

- **Create** the experience of compassion
  - **Have** the experience – Bring to mind someone you care about . . . Be aware of the difficulties, stress, or suffering of this being . . . Open to the wish that this being not suffer . . . Open to warmth and tenderness
  - **Enrich** it – Stay with it . . . Feel compassion in your body . . . Let it grow more intense, pervading your mind
  - **Absorb** it – Intend and sense that compassion sink into you . . . Give yourself over to it . . .

# It's Good to Take in the Good

---

- Development of specific inner strengths
  - General - resilience, positive mood, feeling loved
  - “Antidote experiences” - Healing old wounds, filling the hole in the heart
- Implicit benefits:
  - Shows that there is still good in the world
  - Being active rather than passive
  - Treating yourself kindly, like you matter
  - Rights an unfair imbalance, given the negativity bias
  - Training of attention and executive functions
- Sensitizes brain to positive: like Velcro for good

---

*Keep a green bough in your heart,  
and a singing bird will come.*

Lao Tsu

# The Role of Cultivation

---

- Three fundamental ways to engage the mind:
  - Be with it. Decrease negative. Increase positive.
  - The garden: Observe. Pull weeds. Plant flowers.
  - Let be. Let go. Let in.
  - Mindfulness present in all three ways to engage mind
- While “being with” is profound, it can be isolated and over-valued in some therapies or spiritual practices.
- Skillful means for decreasing the negative and increasing the positive have developed over thousands of years. Why not use them?



# SPIRIT ROCK MEDITATION CENTER



Join us for

## Cultivating Inner Strength - Monastic Daylong [Dana - No Fee Day]

with Ayya Anandabodhi  
and Ayya Santacitta

on

**Sunday, July 8**

from 9:30 am - 5 pm.

(Photo by Ed Ritger)



*Know the mind.*

*Shape the mind.*

*Free the mind.*

# Synergies of TG and Mindfulness

---

- Improved mindfulness enhances TG.
- TG increases factors of mindfulness (e.g., self-acceptance, self-compassion, distress tolerance).
- TG heightens learning from mindfulness:
  - The sense of stable presence itself
  - Confidence that awareness itself is never disturbed
  - Peace of realizing that experiences come and go

# Teaching the HEAL Process

---

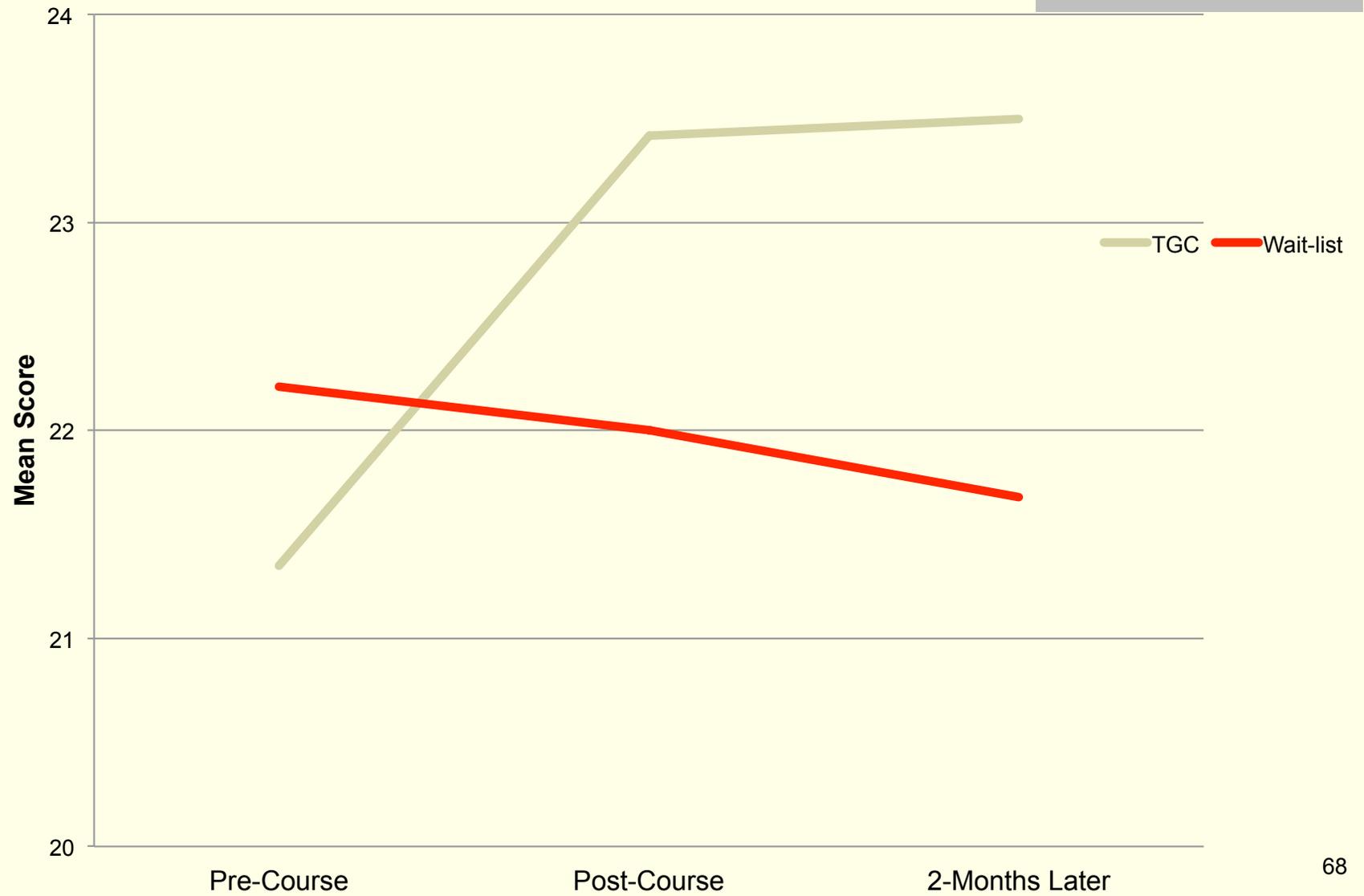
- 18 hour course, currently formatted in 3-hour classes spread over six or seven weeks
- First two classes lay a foundation and teach the first three steps of HEAL; third class teaches the fourth step (Link); remaining classes focus on internalizing experiences and growing inner strengths related to the Avoiding harms, Approaching rewards, and Attaching to others systems
- Information about taking the course, training in applying it in professional settings, and training to teach it is available at [www.RickHanson.net](http://www.RickHanson.net).

# Research on the HEAL Process

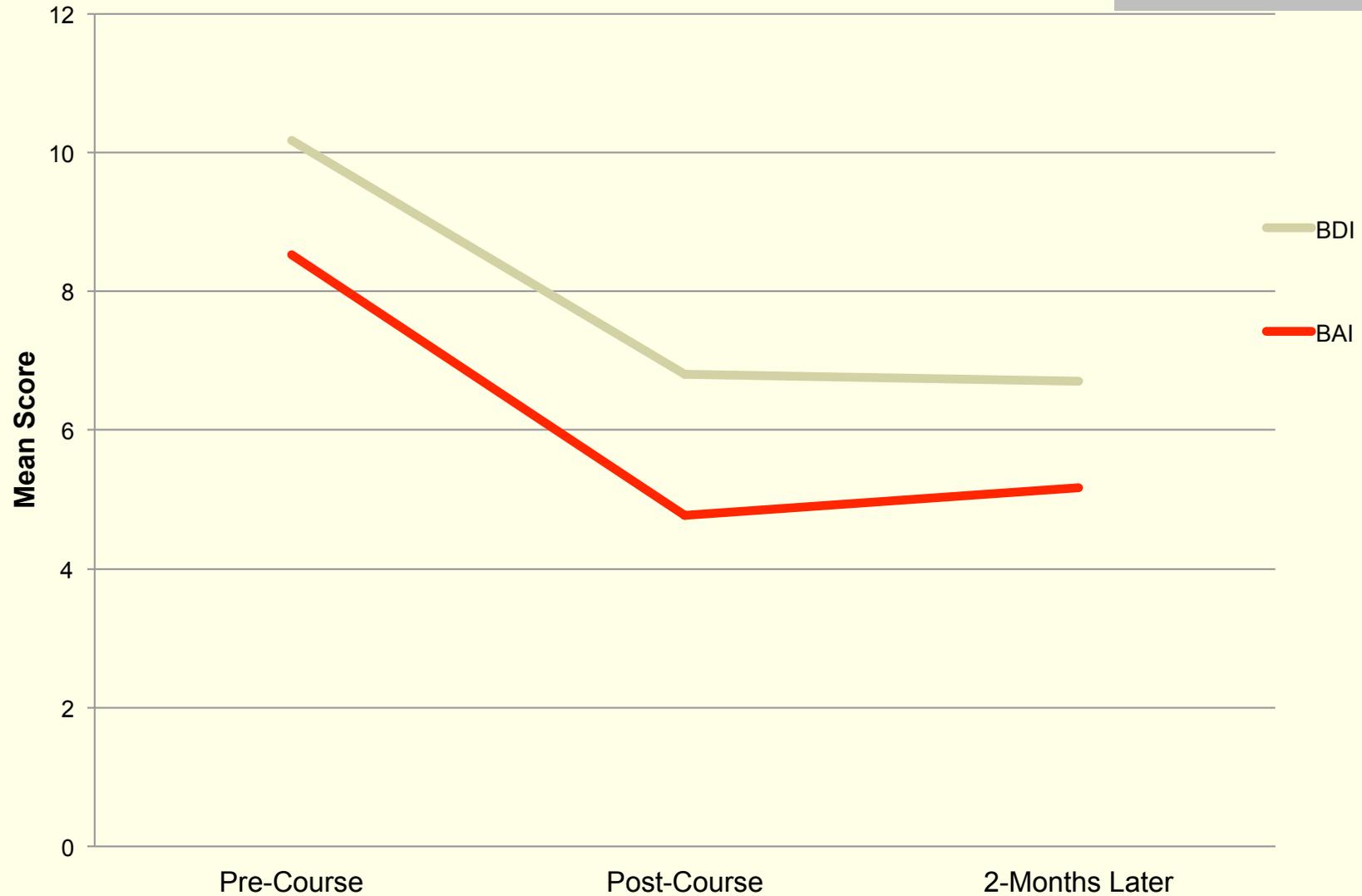
---

- With collaborators from the University of California, a 2013 study on the HEAL course, using a randomized waitlist control group design (46 subjects).
- Course participants, compared to the control group, reported more Contentment, Self-Esteem, Satisfaction with Life, Savoring, and Gratitude.
- After the course and at two month follow-up, pooled participants also reported more Love, Compassion, Self-Compassion, Mindfulness, Self-Control, Positive Rumination, Joy, Amusement, Awe, and Happiness, and less Anxiety and Depression.

# Self-Esteem



# Combined Sample: Depression (BDI) & Anxiety (BAI)





# **The 2<sup>nd</sup> and 3<sup>rd</sup> Noble Truths**

# **A Telling of the Four Noble Truths**

---

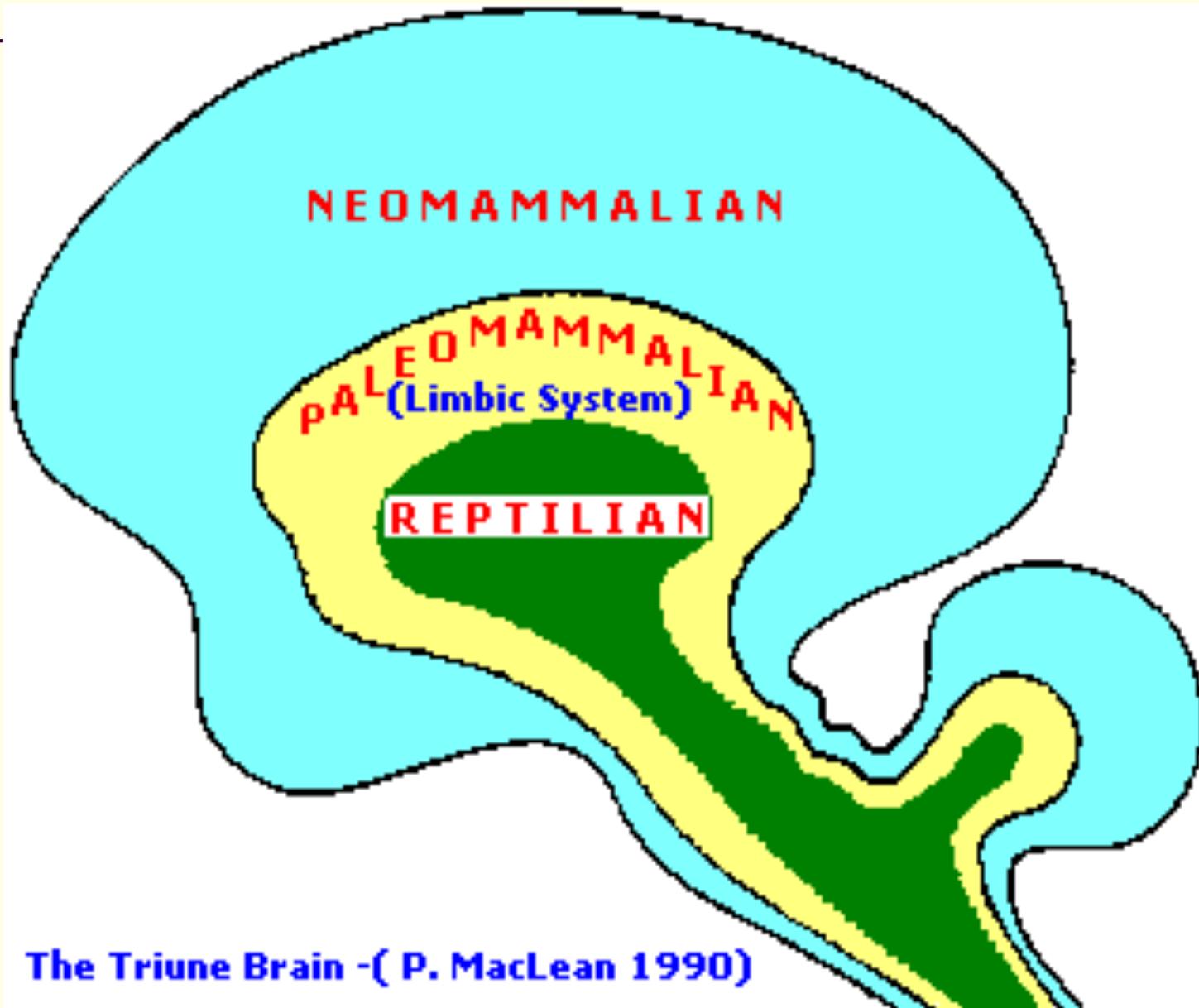
**There is suffering.**

**When craving arises, so does suffering.**

**When craving passes away, so does suffering.**

**There is an eight-part path that both embodies and leads to the passing away of this craving.**

# Evolution of the Brain



# Three Motivational and Self-Regulatory Systems

---

- **Avoid Harms:**

- Predators, natural hazards, aggression, pain
- Primary need, tends to trump all others

- **Approach Rewards:**

- Food, shelter, mating, pleasure
- Mammals: rich emotions and sustained pursuit

- **Attach to Others:**

- Bonding, language, empathy, cooperation, love
- Taps older Avoiding and Approaching networks

Each system can draw on the other two for its ends.<sup>73</sup>

# Craving Arising . . .

---

*When invaded by threat, loss, or rejection [felt deficit or disturbance of safety, satisfaction, or connection]:*

The body fires up into the stress response; outputs exceed inputs; long-term building is deferred.

The mind fires up into:

- **Fear** (the Avoiding system)
- **Frustration** (the Approaching system)
- **Heartache** (the Attaching system)

This is the brain in its allostatic, **Reactive**, *craving* mode.<sup>74</sup>

# Craving Passing Away . . .

---

*When not invaded by threat, loss, or rejection [no felt deficit or disturbance of safety, satisfaction, and connection]*

The body defaults to a sustainable equilibrium of refueling, repairing, and pleasant abiding.

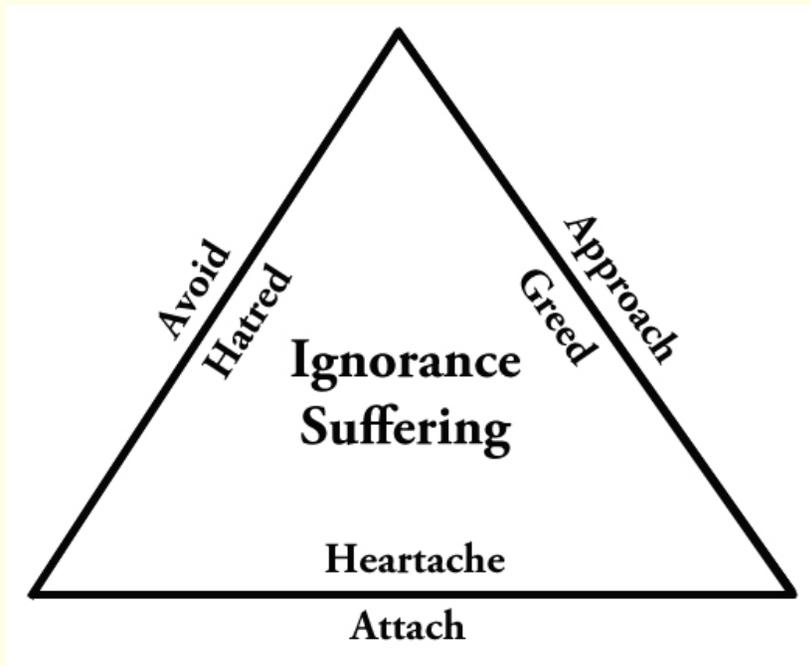
The mind defaults to a sustainable equilibrium of:

- **Peace** (the Avoiding system)
- **Contentment** (the Approaching system)
- **Love** (the Attaching system)

This is the brain in its homeostatic **Responsive**,  
*minimal craving* mode.

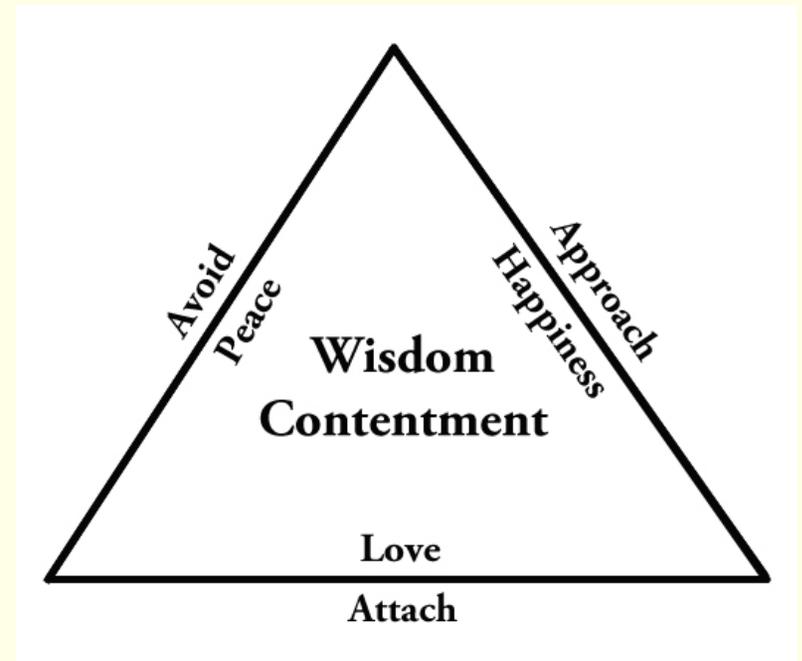
# Choices . . .

---



**Reactive Mode**

Or?



**Responsive Mode<sub>6</sub>**

# Coming Home, Staying Home

---

**Positive experiences of core needs met - the felt sense of safety, satisfaction, and connection - activate Responsive mode.**

**Activated Responsive states can become installed Responsive traits. Responsive traits foster Responsive states.**

**Responsive states and traits enable us to stay Responsive with challenges.**



# **Key Resource Experiences**

# Pet the Lizard



# Feed the Mouse

---



# Hug the Monkey





**Peace**

**Contentment**

**Love**

# Some Types of Resource Experiences

---

## Avoiding Harms

- Feeling basically alright right now
- Feeling protected, strong, safe, at peace
- The sense that awareness itself is untroubled

## Approaching Rewards

- Feeling basically full, the enoughness in this moment as it is
- Feeling pleased, glad, grateful, satisfied
- Therapeutic, spiritual, or existential realizations

## Attaching to Others

- Feeling basically connected
- Feeling included, seen, liked, appreciated, loved
- Feeling compassionate, kind, generous, loving



# Healing Old Pain

# Using Memory Mechanisms To Help Heal Painful Experiences

---

- The machinery of memory:
  - When explicit or implicit memory is re-activated, it is re-built from schematic elements, not retrieved *in toto*.
  - When attention moves on, elements of the memory get re-consolidated.
- The open processes of memory activation and consolidation create a window of opportunity for shaping your internal world.
- Activated memory tends to associate with other things in awareness (e.g., thoughts, sensations), esp. if they are prominent and lasting.
- When memory goes back into storage, it takes associations with it.
- You can imbue implicit and explicit memory with positive associations.

# The Fourth Step of TG

---

- When you are having a positive experience:
  - Sense the experience sinking down into old pain and deficits, and soothing and replacing them.
- When you are having a negative experience:
  - Bring to mind a positive experience that is its antidote.
- Have the positive experience be prominent while the negative experience is small and in the background.
- You're not resisting negative experiences or getting attached to positive ones. You're being kind to yourself and cultivating resources in your mind.

# Psychological Antidotes

---

## Avoiding Harms

- Strength, efficacy --> Weakness, helplessness, pessimism
- Safety, security --> Alarm, anxiety
- Compassion for oneself and others --> Resentment, anger

## Approaching Rewards

- Satisfaction, fulfillment --> Frustration, disappointment
- Gladness, gratitude --> Sadness, discontentment, “blues”

## Attaching to Others

- Attunement, inclusion --> Not seen, rejected, left out
- Recognition, acknowledgement --> Inadequacy, shame
- Friendship, love --> Abandonment, feeling unloved or unlovable



# **The Fruit as the Path**

# Cultivation Undoes Craving

---

- Taking in the good is an openness to positive experience while letting go – allowing the experience in and through you.
- Much suffering and harm comes from “craving” – resisting the unpleasant, grasping after the pleasant, and clinging to the heartfelt – a drive state based on deficit or disturbance of core needs – safety, satisfaction, connection – being met.
- By repeatedly internalizing the felt sense of core needs being met, we gradually reduce the sense of deficit or disturbance, and rest increasingly in a peace, happiness, and love that is independent of external conditions.
- With time, even the practice of cultivation falls away - like a raft that is no longer needed once we reach the farther shore.

# Coming Home

---

**Peace**

**Contentment**

**Love**

# A Fifth Yana?

---

The “Buddhastream” has developed through four major vehicles (*yanas*): Theravadan, Tibetan, Chan/Zen, and Pure Land.

Could we be helping develop an emergent Fifth Yana, with:

- Many householders engaging deep contemplative practice
- Multiculturalism as both a reality and a value
- Access to and eclectic use of the full array of Buddhist teachings
- Flattening hierarchies
- Naturalizing dharma practice; using science and psychology
- Skillful use of positive experiences; “Western tantra”
- Deconstructing and applying Buddhist practices in non-Buddhist settings (e.g., pain-control clinics, schools, psychotherapy)

---

*Think not lightly of good, saying,  
"It will not come to me."*

*Drop by drop is the water pot filled.*

*Likewise, the wise one,  
gathering it little by little,  
fills oneself with good.*

# Suggested Books

---

See [www.RickHanson.net](http://www.RickHanson.net) for other suggestions.

- Austin, J. 2009. *Selfless Insight*. MIT Press.
- Begley, S. 2007. *Train Your Mind, Change Your Brain*. Ballantine.
- Carter, C. 2010. *Raising Happiness*. Ballantine.
- Hanson, R. (with R. Mendius). 2009. *Buddha's Brain: The Practical Neuroscience of Happiness, Love, and Wisdom*. New Harbinger.
- Johnson, S. 2005. *Mind Wide Open*. Scribner.
- Keltner, D. 2009. *Born to Be Good*. Norton.
- Kornfield, J. 2009. *The Wise Heart*. Bantam.
- LeDoux, J. 2003. *Synaptic Self*. Penguin.
- Linden, D. 2008. *The Accidental Mind*. Belknap.
- Sapolsky, R. 2004. *Why Zebras Don't Get Ulcers*. Holt.
- Siegel, D. 2007. *The Mindful Brain*. Norton.
- Thompson, E. 2007. *Mind in Life*. Belknap.

# Key Papers - 1

---

See [www.RickHanson.net](http://www.RickHanson.net) for other scientific papers.

- Atmanspacher, H. & Graben, P. 2007. Contextual emergence of mental states from neurodynamics. *Chaos & Complexity Letters*, 2:151-168.
- Baumeister, R., Bratlavsky, E., Finkenauer, C. & Vohs, K. 2001. Bad is stronger than good. *Review of General Psychology*, 5:323-370.
- Braver, T. & Cohen, J. 2000. On the control of control: The role of dopamine in regulating prefrontal function and working memory; in *Control of Cognitive Processes: Attention and Performance XVIII*. Monsel, S. & Driver, J. (eds.). MIT Press.
- Carter, O.L., Callistemon, C., Ungerer, Y., Liu, G.B., & Pettigrew, J.D. 2005. Meditation skills of Buddhist monks yield clues to brain's regulation of attention. *Current Biology*. 15:412-413.

# Key Papers - 2

---

- Davidson, R.J. 2004. Well-being and affective style: neural substrates and biobehavioural correlates. *Philosophical Transactions of the Royal Society*. 359:1395-1411.
- Farb, N.A.S., Segal, Z.V., Mayberg, H., Bean, J., McKeon, D., Fatima, Z., and Anderson, A.K. 2007. Attending to the present: Mindfulness meditation reveals distinct neural modes of self-reflection. *SCAN*, 2, 313-322.
- Gillihan, S.J. & Farah, M.J. 2005. Is self special? A critical review of evidence from experimental psychology and cognitive neuroscience. *Psychological Bulletin*, 131:76-97.
- Hagmann, P., Cammoun, L., Gigandet, X., Meuli, R., Honey, C.J., Wedeen, V.J., & Sporns, O. 2008. Mapping the structural core of human cerebral cortex. *PLoS Biology*. 6:1479-1493.
- Hanson, R. 2008. Seven facts about the brain that incline the mind to joy. In *Measuring the immeasurable: The scientific case for spirituality*. Sounds True.

# Key Papers - 3

---

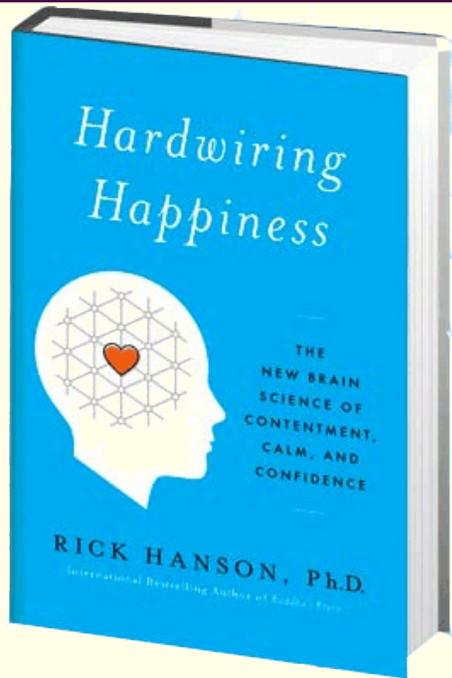
- Lazar, S., Kerr, C., Wasserman, R., Gray, J., Greve, D., Treadway, M., McGarvey, M., Quinn, B., Dusek, J., Benson, H., Rauch, S., Moore, C., & Fischl, B. 2005. Meditation experience is associated with increased cortical thickness. *Neuroreport*. 16:1893-1897.
- Lewis, M.D. & Todd, R.M. 2007. The self-regulating brain: Cortical-subcortical feedback and the development of intelligent action. *Cognitive Development*, 22:406-430.
- Lieberman, M.D. & Eisenberger, N.I. 2009. Pains and pleasures of social life. *Science*. 323:890-891.
- Lutz, A., Greischar, L., Rawlings, N., Ricard, M. and Davidson, R. 2004. Long-term meditators self-induce high-amplitude gamma synchrony during mental practice. *PNAS*. 101:16369-16373.
- Lutz, A., Slager, H.A., Dunne, J.D., & Davidson, R. J. 2008. Attention regulation and monitoring in meditation. *Trends in Cognitive Sciences*. 12:163-169.

# Key Papers - 4

---

- Rozin, P. & Royzman, E.B. 2001. Negativity bias, negativity dominance, and contagion. *Personality and Social Psychology Review*, 5:296-320.
- Takahashi, H., Kato, M., Matsuura, M., Mobbs, D., Suhara, T., & Okubo, Y. 2009. When your gain is my pain and your pain is my gain: Neural correlates of envy and schadenfreude. *Science*, 323:937-939.
- Tang, Y.-Y., Ma, Y., Wang, J., Fan, Y., Feng, S., Lu, Q., Yu, Q., Sui, D., Rothbart, M.K., Fan, M., & Posner, M. 2007. Short-term meditation training improves attention and self-regulation. *PNAS*, 104:17152-17156.
- Thompson, E. & Varela F.J. 2001. Radical embodiment: Neural dynamics and consciousness. *Trends in Cognitive Sciences*, 5:418-425.
- Walsh, R. & Shapiro, S. L. 2006. The meeting of meditative disciplines and Western psychology: A mutually enriching dialogue. *American Psychologist*, 61:227-239.

# Where to Find Rick Hanson Online



***Hardwiring Happiness: The New Brain Science of Contentment, Calm, and Confidence***

[www.rickhanson.net/hardwiringhappiness](http://www.rickhanson.net/hardwiringhappiness)

Personal website: [www.rickhanson.net](http://www.rickhanson.net)

Wellspring Institute: [www.wisebrain.org](http://www.wisebrain.org)



[youtube.com/drrhanson](https://youtube.com/drrhanson)



[facebook.com/rickhansonphd](https://facebook.com/rickhansonphd)