UNIVERSITÄT DUISBURG ESSEN

Mindfulness, MBSR & Health

Research update

download: http://www.achtsamkeit.com/forschung.htm

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mindfulness ?

English: Mindfulness

Pali: sati, Sanskrit: smṛti / स्मृति - Presence

Chin./jap: sati 今 Now, today, current

人 mouth, from above speaking

念

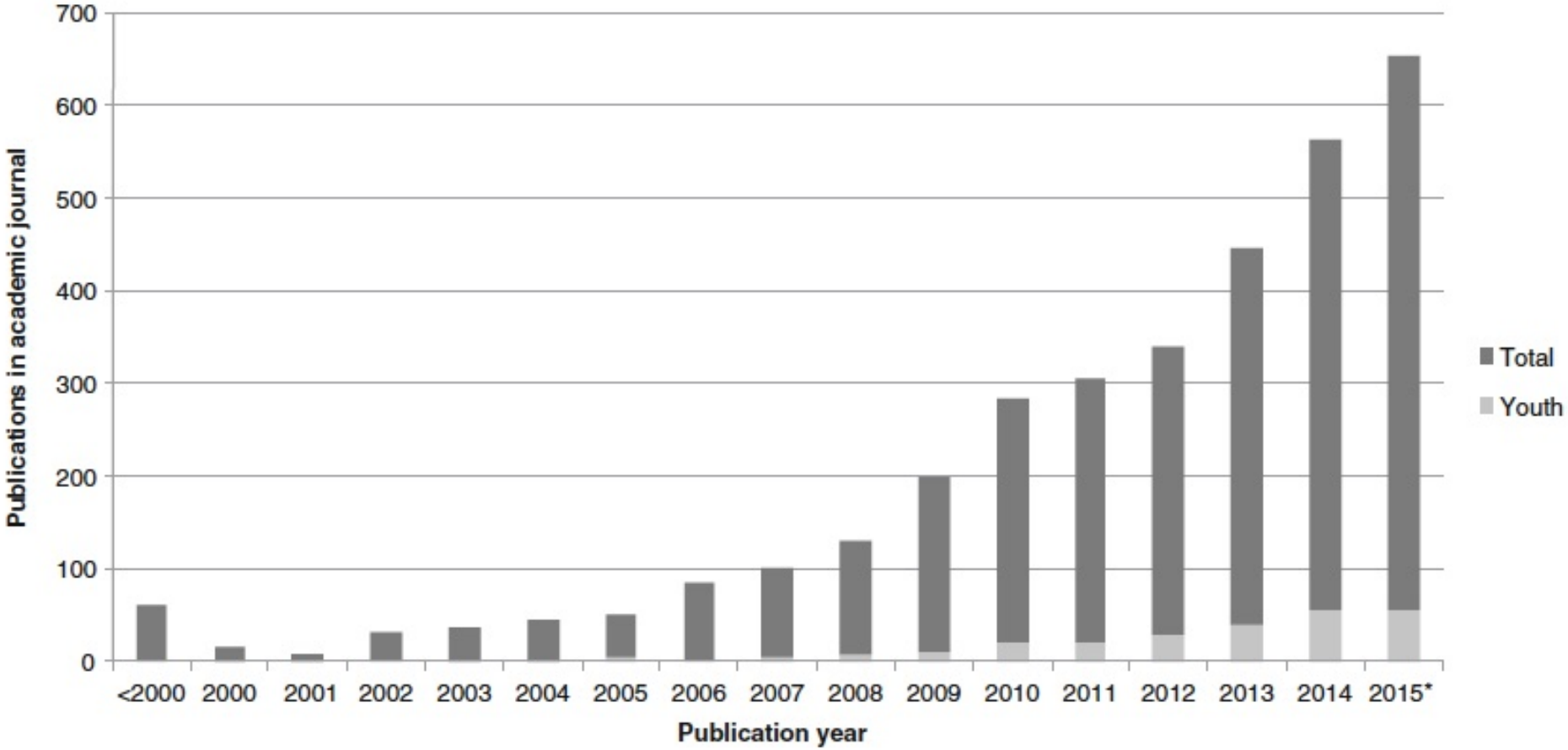
心 Heart

Mindfulness ?

Moment to moment
non-judgemental awareness

Jon Kabat-Zinn

Publications in academic journals with keyword „mindfulness“



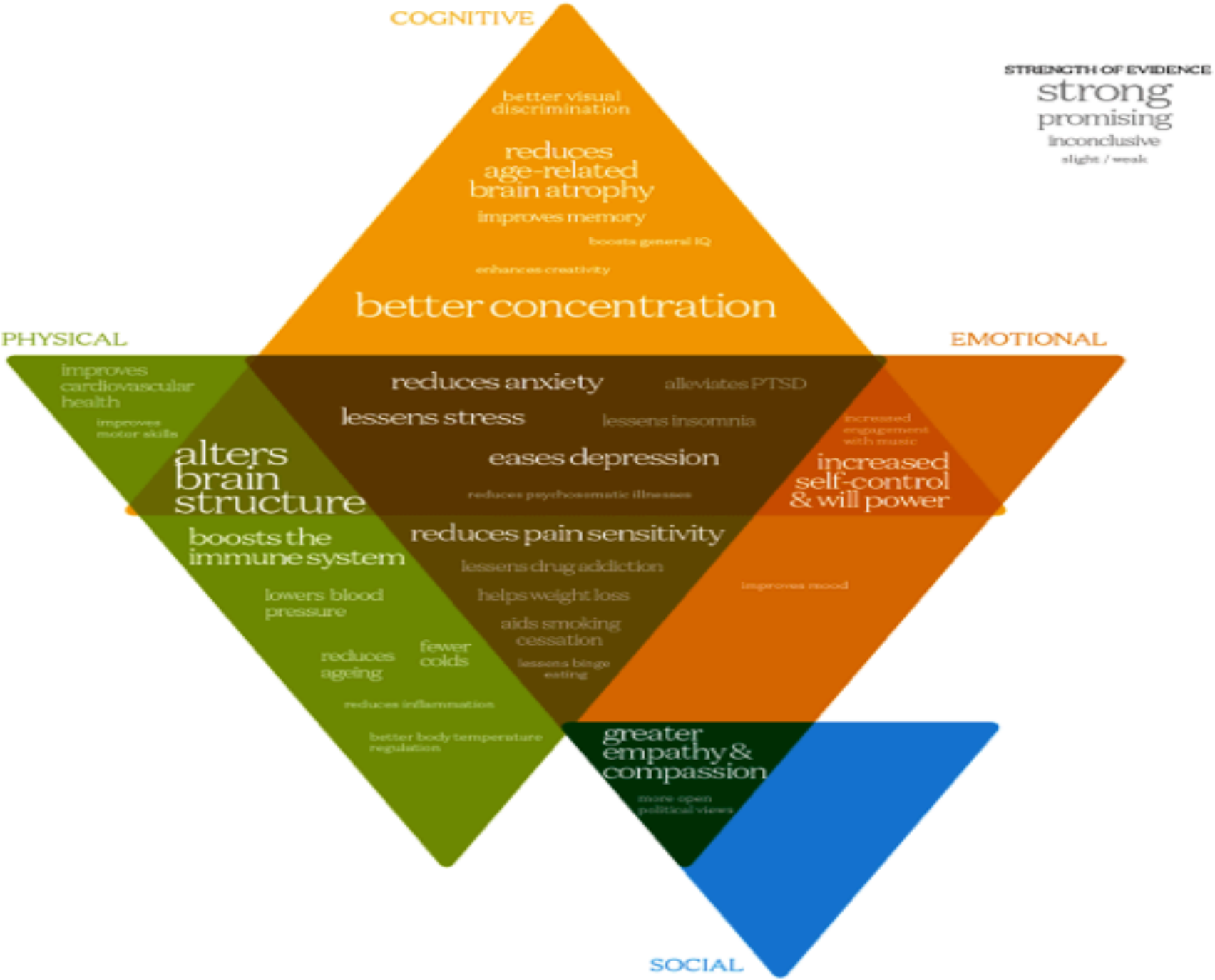
Gotink RA, Chu P, Busschbach JJ, Benson H, Fricchione GL, Hunink MG: Standardised Mindfulness-Based Interventions in Healthcare: An Overview of Systematic Reviews and Meta-Analyses of RCTs. PLoS One. 2015 Apr 16;10(4)

Of 187 reviews 23 were included, covering 115 unique RCTs and **8,683 individuals** with various conditions.

Compared to wait list control and compared to treatment as usual, MBSR and MBCT significantly improved

- depressive symptoms (d=0.37, based on 5 reviews, N=2814),
- anxiety (d=0.49, based on 4 reviews, N=2525),
- stress (d=0.51, based on 2 reviews, N=1570),
- quality of life (d=0.39, based on 2 reviews, N=511)
- and physical functioning (d=0.27, based on 3 reviews, N=1015).

CONCLUSION: The evidence supports the use of MBSR and MBCT to alleviate symptoms, both mental and physical, in the adjunct treatment of cancer, cardiovascular disease, chronic pain, depression, anxiety disorders and in prevention in healthy adults and children.


COGNITIVE
better visual discrimination
reduces age-related brain atrophy
improves memory
boosts general IQ
enhances creativity
better concentration
STRENGTH OF EVIDENCE
strong
promising
inconclusive
slight / weak
PHYSICAL
improves cardiovascular health
improves motor skills
alters brain structure
boosts the immune system
lowers blood pressure
reduces ageing
fewer colds
reduces inflammation
better body temperature regulation
reduces anxiety
alleviates PTSD
lessens stress
lessens insomnia
eases depression
reduces psychosomatic illnesses
reduces pain sensitivity
lessens drug addiction
helps weight loss
aids smoking cessation
lessens binge eating
EMOTIONAL
increased engagement with music
increased self-control & will power
improves mood
greater empathy & compassion
more open political views
SOCIAL

Effects of Mindfulness Practice

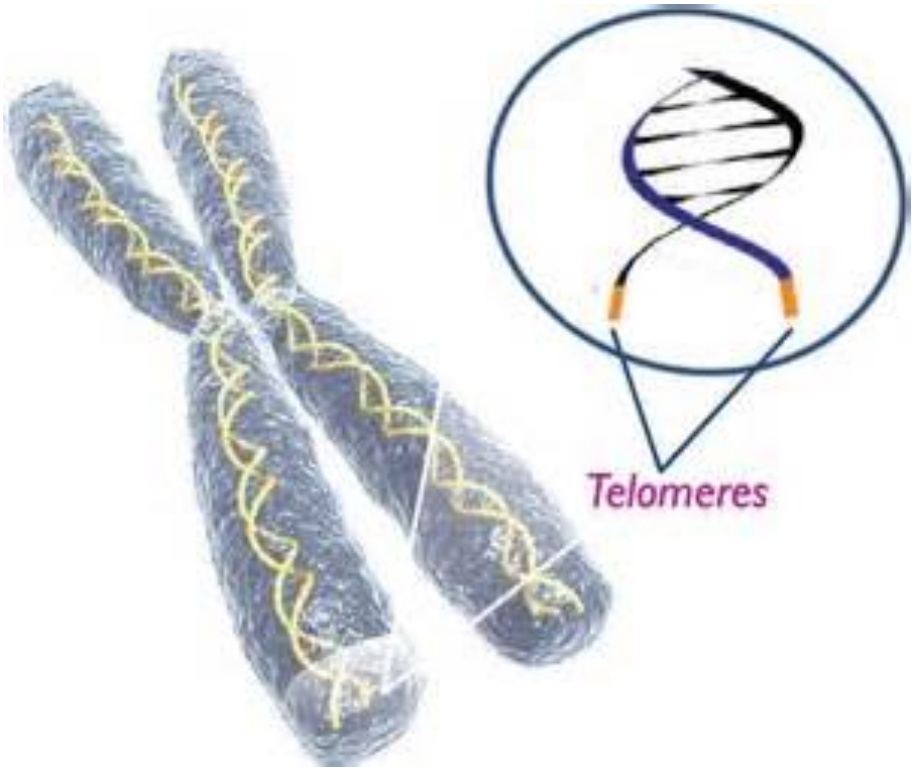
- Reduces symptoms like pain, stress, fatique and suffering
- improves QoL

- optimizes immune system
- increases telomerase activity in immune cells
- promotes anti-inflammatory epigenetic structures
- modulates brain functions, influences structural changes in the brain

- improves mood
- enhances cognitive function (e.g. concentration, perception, emotional regulation, rationale decision making, communication)

- Improves stress coping and –reduction, pro-active and (self-)caring behavior
- increases sense of coherence, empathie, flourishing and spirituality

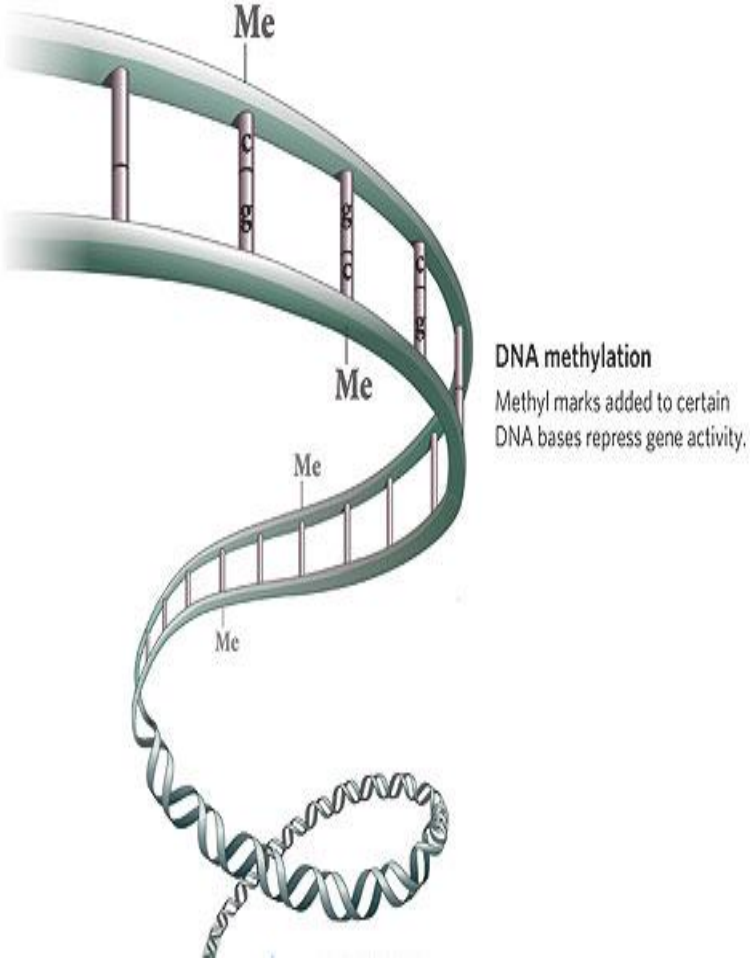
The Nobel Prize in Medicine 2009 jointly to
Elizabeth H. Blackburn, Carol W. Greider and Jack W. Szostak
for the discovery of **"How chromosomes are protected by telomeres and the enzyme telomerase"**



Schutte NS, Malouff JM. A meta-analytic review of the effects of mindfulness meditation on telomerase activity. Psychoneuroendocrinology. 2014 Apr;42:45-8

The enzyme telomerase, through its influence on telomere length, is associated with health and mortality. Four pioneering randomized control trials, including a total of 190 participants, provided information on the effect of mindfulness meditation on telomerase. A meta-analytic effect size of d=0.46 indicated that **mindfulness meditation leads to increased telomerase activity** in peripheral blood mononuclear cells. These results suggest the need for further large-scale trials investigating optimal implementation of mindfulness meditation to facilitate telomerase functioning.

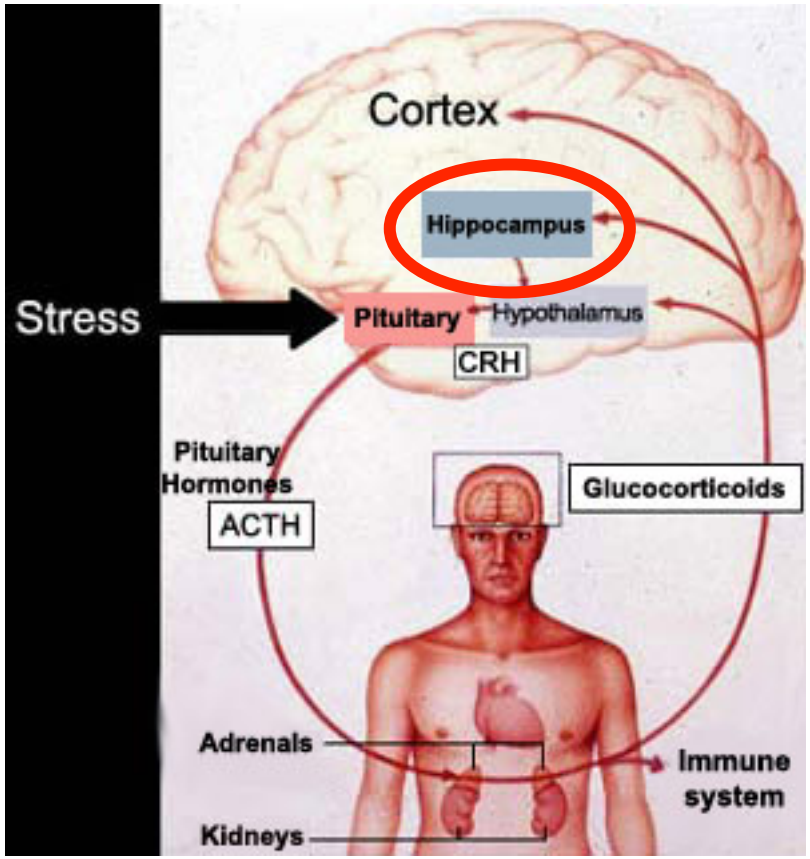
Epigenetic Structures influence Stress Reaction



Methyl molecules attached to DNA determine how much a in the sequence following gene is „read“, e.g. one of the anti-Stress-Genes, the Glucocorticoid-Receptor-Gene. It down-regulates the Corticotropin-Releasing-Hormon (CRH) in the Hypocampus which dampens cortisol release after a stress reaction.

Weaver et al., 2004

STRESS-KREISLAUF



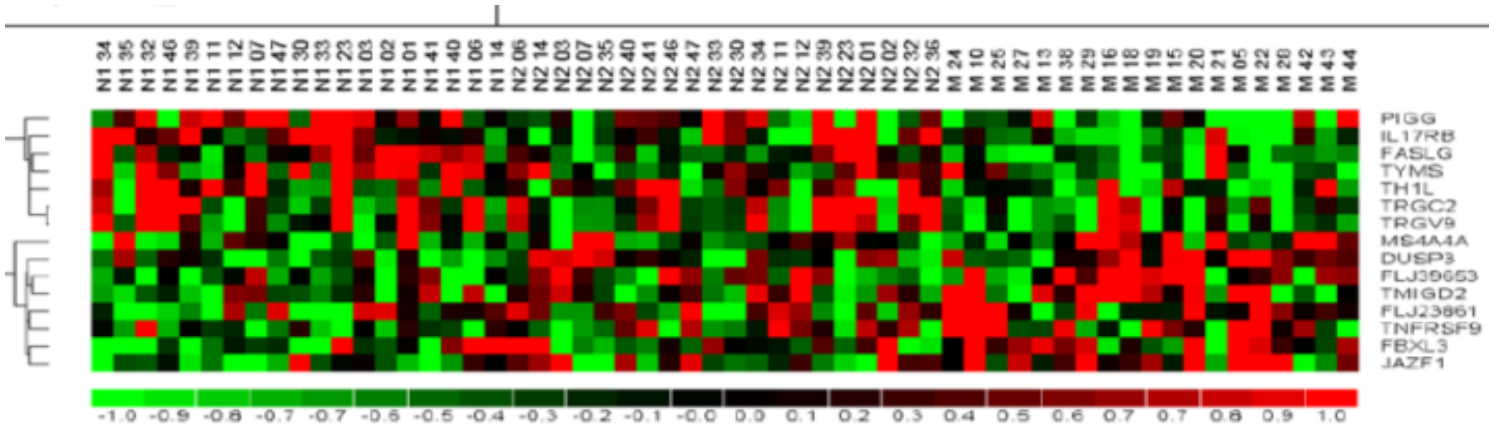
In Stresssituationen wird vom Hirnstamm Noradrenalin freigesetzt. Erreicht dieses den Hypothalamus, erzeugt dieser das Corticotropin-releasing Hormon (CRH), das in der Hirnanhangdrüse (Pituitary) zur Freisetzung des Adrenocorticotropinen Hormons (ACTH) führt. Dieses veranlasst in der Nebennierenrinde die Ausschüttung des Glucocorticoids Cortisol, das u.a. auf das Immunsystem wirkt.

Cortisol wirkt auch auf die Herab-Regulierung der Stresskaskade. Dabei registriert ein **spezieller Glucocorticoid Rezeptor im Hippocampus** eine erhöhte Cortisolkonzentration im Blut und unterdrückt daraufhin die Produktion von CRH im Hypothalamus.

Der Promoter des **Glucocorticoid Rezeptor-Gens** wird nachhaltig vom ersten Fürsorgeverhalten der Mutter beeinflusst. Es reagiert verstärkt bei fürsorglicher Behandlung.

Dusek JA et al. (2008) Genomic Counter-Stress Changes Induced by the Relaxation Response. PLoS ONE 3(7): e2576. doi:10.1371/journal.pone.0002576

Kaliman P, Alvarez-López MJ, Cosín-Tomás M, Rosenkranz MA, Lutz A, Davidson RJ. Rapid changes in histone deacetylases and inflammatory gene expression in expert meditators. Psychoneuroendocrinology. 2014 Feb;40:96-107. Free PMC Article



Anti-inflammatory epigenetic changes

After a day of mindfulness experienced meditators showed epigenetic changes at genes, that down-regulate inflammation (RIPK2, COX2). Non-meditators after a relaxed day did not. After a following stress test meditators showed faster than non-meditators „stress free“ cortisol concentrations.

Kaliman P, Alvarez-Lopez M, Cosin-Tomas M, Rosenkranz M, Lutz A, Davidson R (2014) Rapid changes in histone deacetylases and inflammatory gene expression in expert meditators. Psychoneuroendocrinology 40, 96-107.

Achtsamkeit in den Leitlinien

- Interdisziplinäre S3-Leitlinie für die Diagnostik, Therapie und Nachsorge des Mammakarzinoms (2012). Langversion 3.0, AWMF-Register-Nummer: 032 – 045OL, S. 283.

- Behandlungsleitlinie von depressiven Störungen bei Kindern und Jugendlichen (2013). Evidenz- und konsensbasierte Leitlinie (S3). AWMF-Registriernummer 028-043, S. 23

- Nationale Versorgungsleitlinie Unipolare Depression. S3-Leitlinie/Langfassung. Version Dezember 2009, S. 134 (zur Rückfallprophylaxe)

- Zentrale Prüfstelle Prävention (Umsetzung von § 20, SGB V)
  MBSR anteilig erstattungsfähig

de Vibe M, Bjørndal A, Tipton E, Hammerstrøm KT, Kowalski K. (2012): Mindfulness based stress reduction (MBSR) for improving health, quality of life and social functioning in adults. Campbell Systematic Reviews 2012:3, DOI: 10.4073/csr.2012.3

26 RCTs with total of 1.456 participants

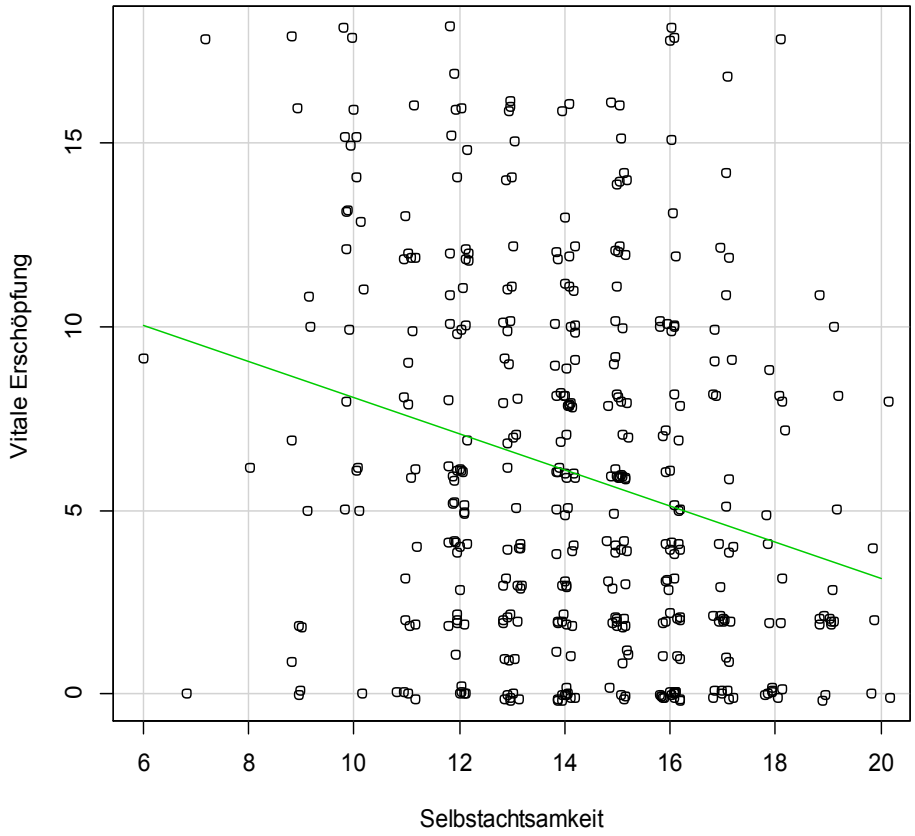
Positive effects on anxiety, depression, stress
Post Intervention Effect sizes for the combined mental health outcomes:
0.62 for non-clinical populations, in clinical populations: 0.51

Similar effects on symptoms of musculoskeletal disease, cancer, other chronic illness, HIV, cardiovascular disease and substance abuse

MBSR also **appears to improve** measures of personal development such as **empathy and coping**, and enhance both **mindfulness and quality of life**.

Only nine studies included follow-up data; the effects diminished over time except in one study in which refresher classes were held. Very little data were found on social functioning, and no information at all on side effects and costs.

Vital Exhaustion and Self-Mindfulness in Researches

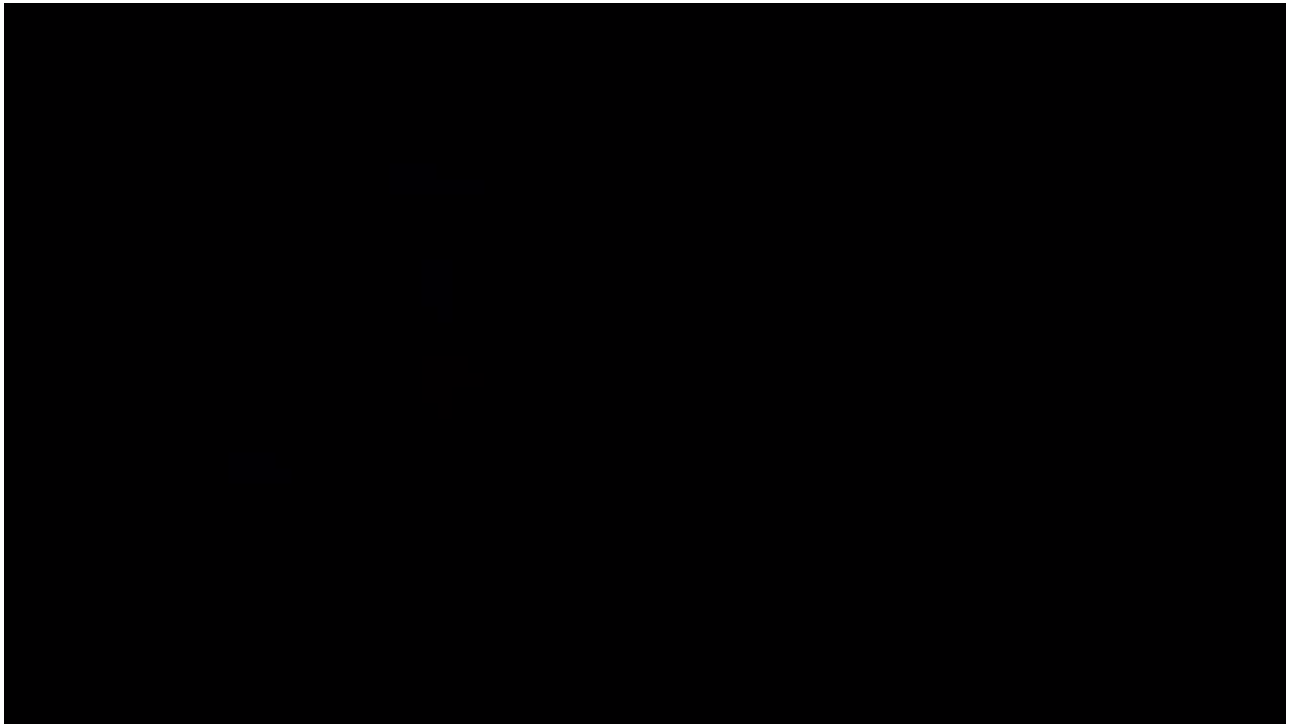


N=398

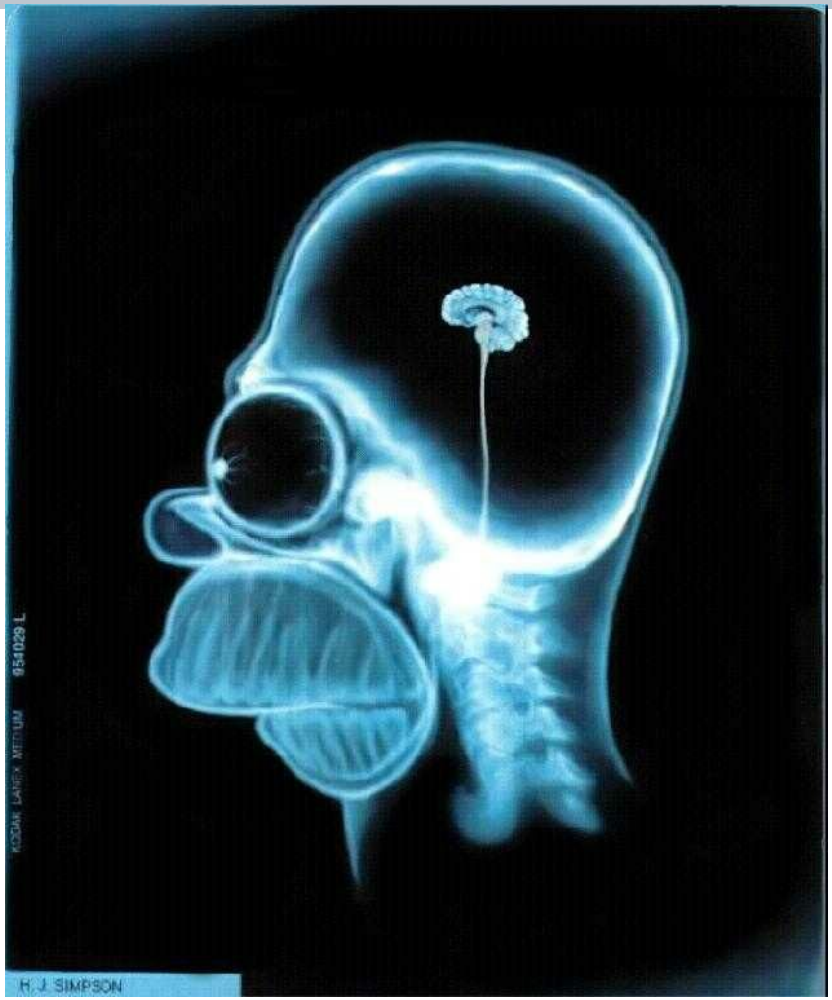
Meditation

Mindfulness with Children

How stress & meditation affect the brain



Meditation and the brain



Meditation and the brain

Mindfulness Meditation compares to a „cognitive emotional fasting“.

Compared to default-modus some brain regions are less active during meditation:

- Amygdala „fear center“,
- Hypothalamus „Stress center“,
- dorsolateral prefrontal cortex “think center”

Meditation and the brain

Over time of repeated meditation practice morphological changes occur in regions like:

Somatosensoric cortex & insula - interoception

Brodman areas 9 & 10 – concentration

Hypocampus – emotional regulation, learning, memory

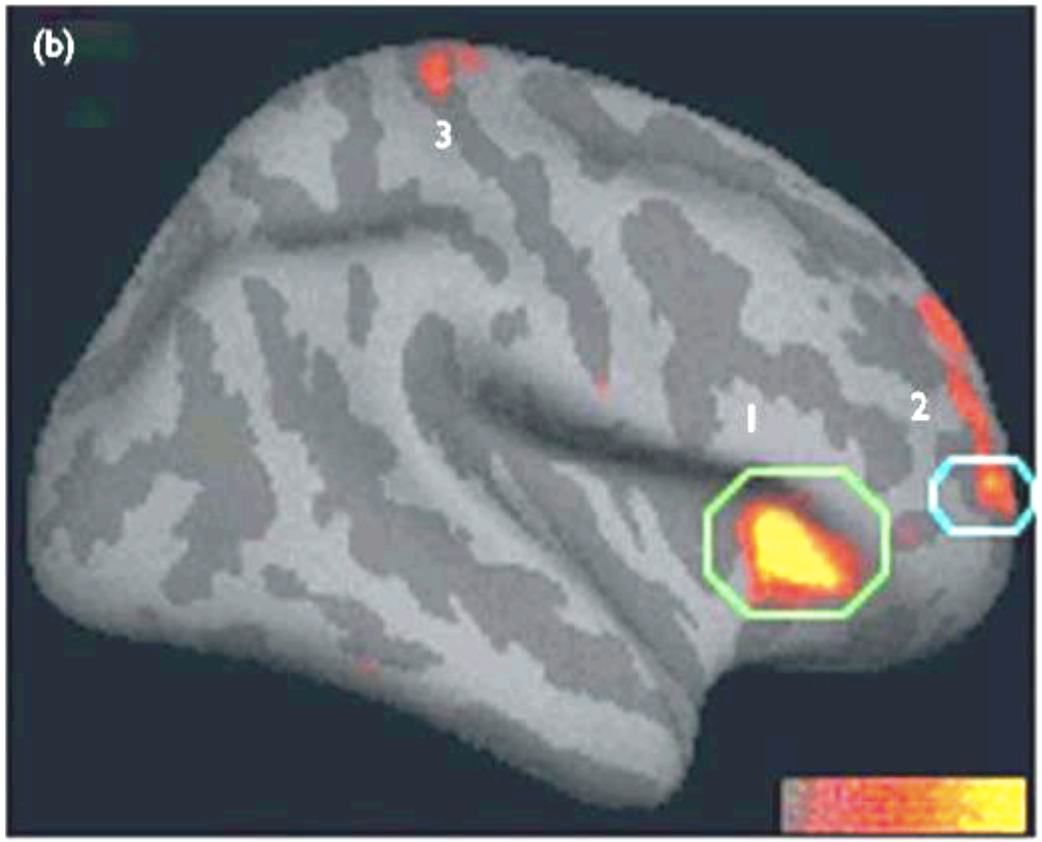
posterior cingulate cortex – pain memory, episodic memory

temporo-parietale junction – change of perspective, Theorie of Mind

Cerebellum – fine motor control

Lazar et al., 2005; Hölzel et al., 2011

Mindfulness Meditation changes Cortex

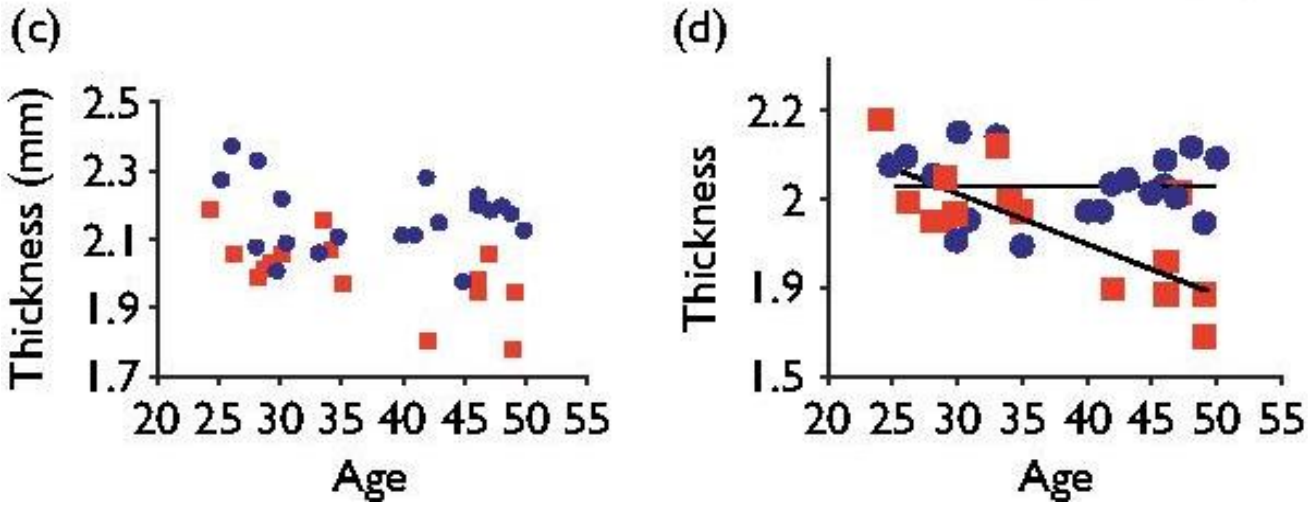


$P < 10^{-3}$ $P < 10^{-4}$

Magnetic resonance imaging was used to assess cortical thickness in 20 participants with extensive Insight meditation experience. Brain regions (1) insula, (2) Brodmann area 9 and 10, (3) somato-sensory cortex, associated with interoception, attention and sensory processing were thicker in meditation participants than in matched controls.

Lazar, S. W., C. E. Kerr, et al. (2005). "Meditation experience is associated with increased cortical thickness." Neuroreport 16(17): 1893-7.

meditation shapes & sustains cortex



Scatter plot of mean cortical thickness of each participant within region of (c) insula and (d) BA 9/10, plotted versus age.
Meditation participants: blue circles; **control participants: red squares**.
Between-group differences in prefrontal cortical thickness were most pronounced in older participants, suggesting that meditation might offset age-related cortical thinning.

Lazar et al., 2005

Brain Structure & Stress

Britta K. Hözel et al., Stress reduction correlates with structural changes in the amygdala. *Social Cognitive and Affective Neuroscience*, 2009

Stressed but otherwise healthy individuals (N = 26) participated in an 8-week MBSR program. Perceived stress was rated on the perceived stress scale (PSS) and anatomical MR images were acquired pre- and post-intervention.

Following the intervention, participants reported significantly reduced perceived stress. **Reductions in perceived stress correlated positively with decreases in right basolateral amygdala gray matter density.**

Die Amygdala (Mandelkern) ist wesentlich an der Entstehung von Angst beteiligt und spielt allgemein eine wichtige Rolle bei der emotionalen Bewertung und Wiedererkennung von Situationen sowie der Analyse möglicher Gefahren: sie verarbeitet externe Impulse und leitet die vegetativen Reaktionen dazu ein.

Brain Structure & Stress

Hölzel BK, Carmody J, Vangel M, Congleton C, Yerramsetti SM, Gard T, Lazar SW. Mindfulness practice leads to increases in regional brain gray matter density. Psychiatry Res. 2011 Jan 30;191(1):36-43. Epub 2010 Nov 10.

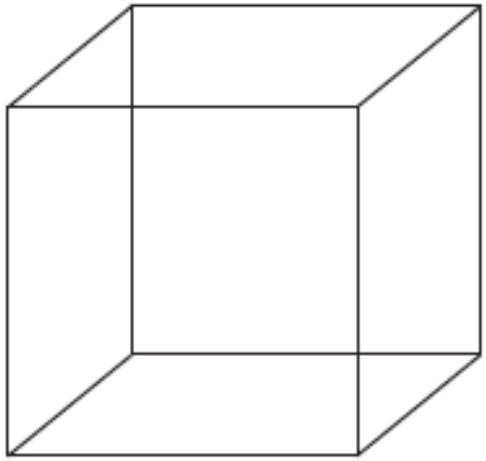
Anatomical magnetic resonance (MR) images from 16 healthy, meditation-naïve participants were obtained before and after they underwent the 8-week MBSR program. Changes in gray matter concentration were investigated using voxel-based morphometry, and compared with a waiting list control group of 17 individuals.

Analyses in a priori regions of interest confirmed **increases in gray matter concentration within the left hippocampus**. Whole brain analyses identified increases in the posterior cingulate cortex, the temporo-parietal junction, and the cerebellum in the MBSR group compared with the controls. The results suggest that participation in MBSR is associated with **changes in gray matter concentration in brain regions involved in learning and memory processes, emotion regulation (hippocampus), self-referential processing, i.e. pain & episodic memory (PCC), perspective taking, theory of mind (TPJ), and fine motor control (cerebellum).**


Ich lebe im Jetzt!
Und wie lange willst du da bleiben?
ZIGARREN
T. GAY

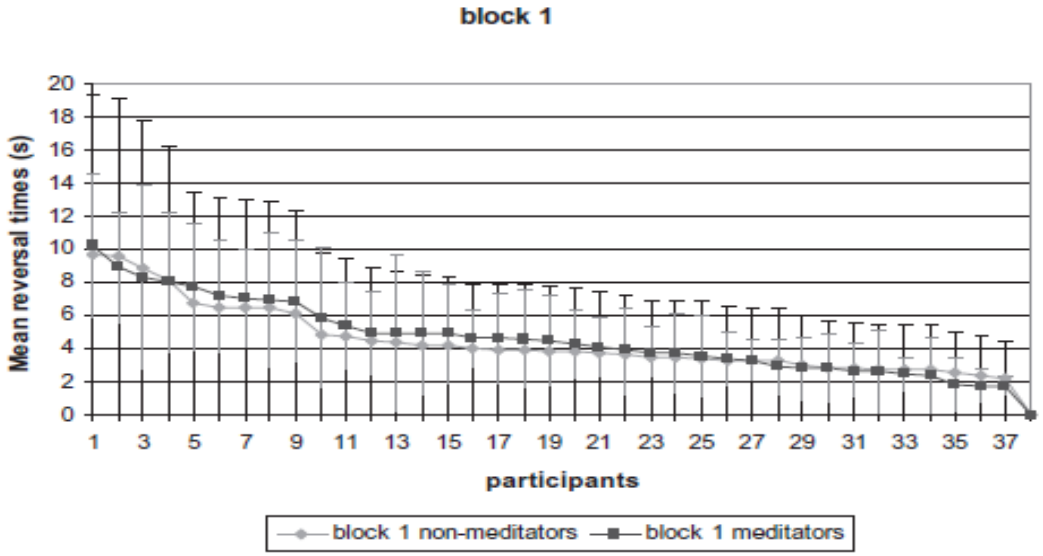
Mindfulness & Concentration

How long is now?



The Necker Cube

Panel A:



Panel B:

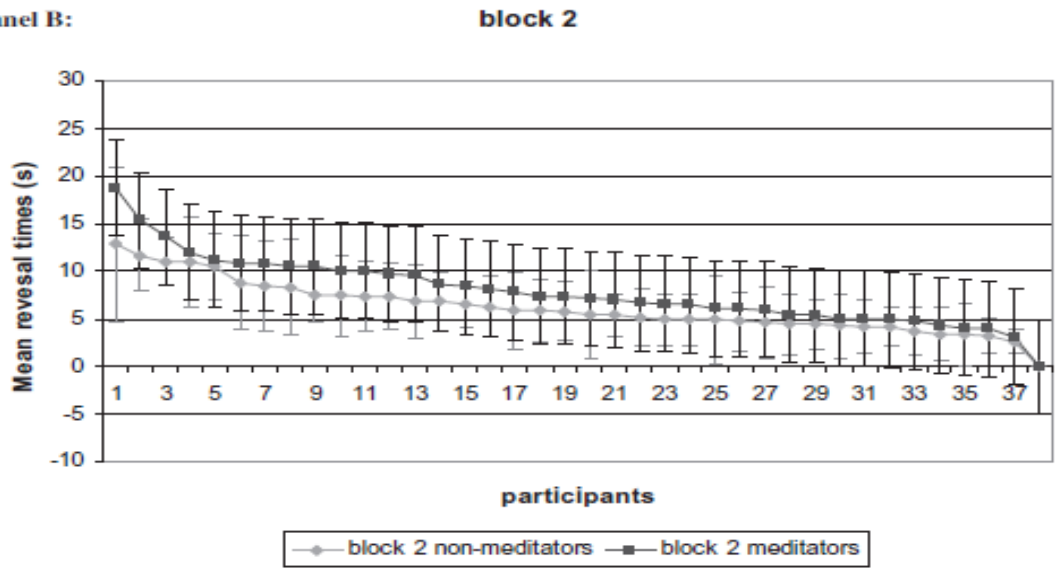


Fig. 2. Mean reversal time (RevT) and standard deviation for each non-meditator and meditators in block 1 (panel A; without instruction to hold the perspective while looking at the Necker Cube) and in block 2 (panel B; with instructions to hold the perspective while looking at the Necker Cube. RevT of participants is depicted in descending order, i.e., participants with high RevT are depicted on the left part of the *x*-axis. Visual inspection suggests that no practically relevant differences between the two groups prevailed in block 1 (panel A). In block 2 (panel B), however, visual inspection suggests that meditators showed substantially longer RevT compared to non-meditators (i.e. several seconds).

Sauer, S., Wittmann, M., Mochty, U., Lemke, J., Walach, H., & Kohls, N. (2012). How long is "now" for meditators? *Personality and Individual Differences*, 52 (2012) 750–754.

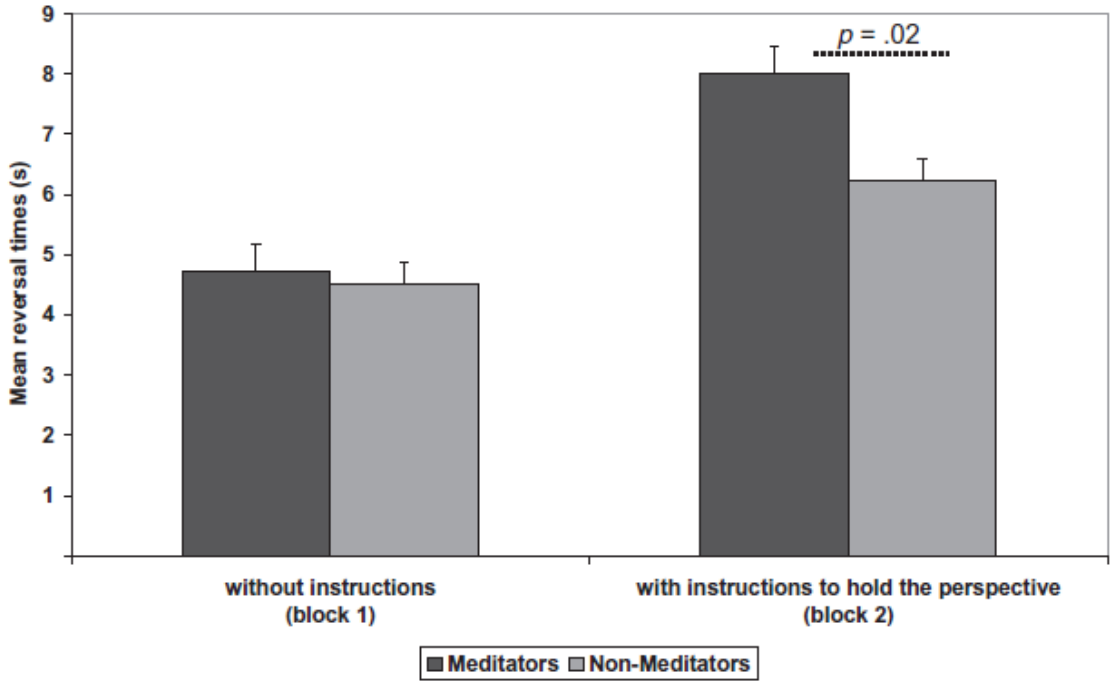


Fig. 3. Differences in mean reversal times in the Necker Cube test are significantly larger for meditators compared to non-meditators in block 2 (when instructed to hold the perception as long as possible) but not in block 1 (without further instructions). Error bars indicate two standard errors.

Achtsamkeitspraxis als (Selbst-) Zuwendung

Wie eine Mutter ihr einziges Kind
mit ihrem Leben schützt,

so möge man sich allen Lebewesen zuwenden.

Mettā-Sutta

Liebe deinen Nächsten wie dich selbst.

Mt 22, 37-39

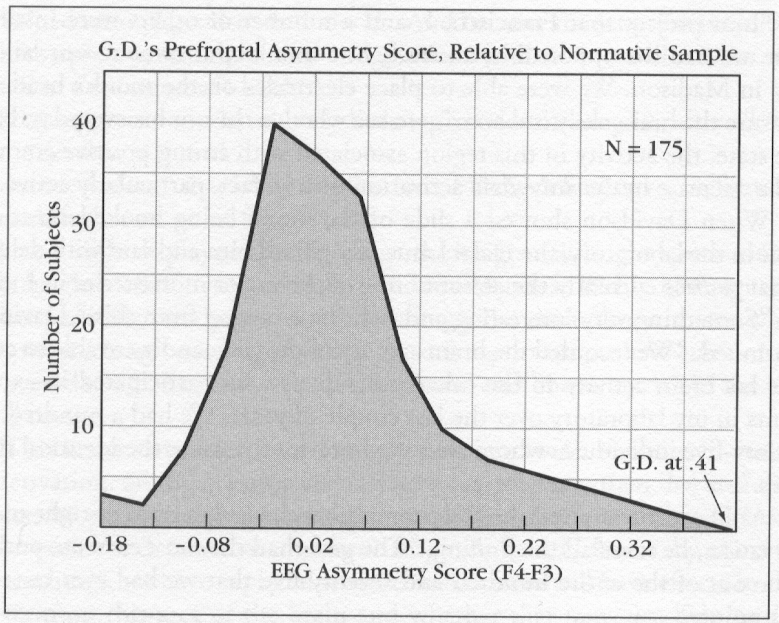
you are
breathing

His Holiness the Dalai Lama: The Art of Happiness

"The systematic training of the mind—the cultivation of happiness, the genuine inner transformation by deliberately selecting and focusing on positive mental states and challenging negative mental states—is possible because of the very structure and function of the brain…The wiring in our brains is not static, not irrevocably fixed. Our brains are also adaptable."

New York: Riverhead Books, 1998, pp. 44-45).

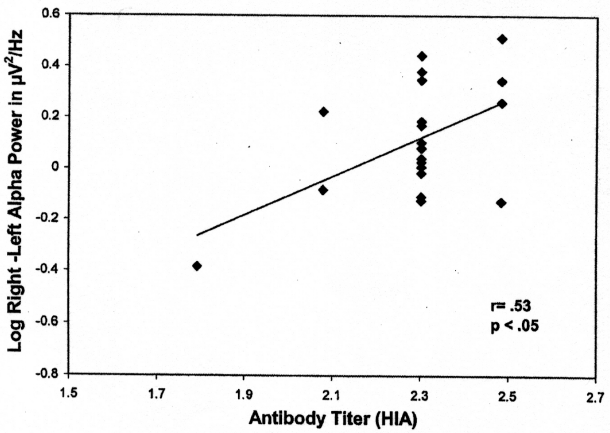
„Happyness can be learned“



The distribution of the ratio of left-to-right prefrontal activity in 175 test subjects. Negative emotions activate the right prefrontal area, positive the left; the ratio of the two predicts the range of moods a person is likely to feel day to day. The *geshe* ("G.D.") had a value higher—that is, more positive—than any of the 175 other people tested.

Richard Davidson: Links-rechtsseitige Verteilung im EEG der alltäglichen prefrontalen Hirnaktivität bei 175 Personen und einem tibetischen Mönch

Psychoneuro(endokrino)immunologie



atter plot for the meditation group only showing the relation between the change in asymmetric anterior activation at baseline from Time 1 to Time in C3/C4 and the magnitude of rise in antibody titers to the influenza vaccine from the week 3 to 5 to the week 8 to 9 blood draw. The meditators at showed the largest magnitude increase in left-sided anterior activation from Time 1 to Time 2 also showed the largest rise in antibody titers from e 3- to 5- to 8- to 9-week blood draws. There was no significant relation between these variables in the control group.

Psychosomatic Medicine 65:564–570 (2003)

Richard Davidson, University of Wisconsin, zeigte 2003 anhand bildgebender Verfahren, dass die Teilnahme an einem achtwöchigen Achtsamkeits-Programm bei Gesunden positive Gestimmtheit und damit korrelierend auch die Immunfunktion förderte.

Stressreduction & Immunsystem

plasma and salivary cortisol can be reduced by MBSR.[22]

In patients with cancer, MBSR tended to return cytokine levels and natural killer cell activities toward normal levels. [23,24]

In healthy people,
meditation increased the anti body titer to influenza vaccine, [25]
lowered the stress-induced increase in interleukin-6 [26]
and decreased C-reactive protein[27] (inflammation markers)

Fang et al. (2010): Enhanced psychosocial well-being following participation in a MBSR program is associated with increased natural killer cell activity. in: J Altern Complement Med, 16. Jg., 5, S. 531-8.

24 MBSR participants with chronic pain (44%), symptoms of anxiety and depression (39%), hypertension (11%), and cancer (6%).
mean age 50.82 years (SD = 14.06, range = 28–72).

Well-being measures: Brief Symptom Inventory-18 and the Medical Outcomes Survey Short-Form Health Survey

Immunologic measures included **natural killer cell cytolytic activity** (peripheral blood mononuclear cells - **PBMC effector cells**) and C-reactive protein (CRP), an inflammation marker.

Ps. completed psychosocial assessments and provided a blood sample at baseline (pre-MBSR) and within 2 weeks post-MBSR.

Fang et al. (2010): Enhanced psychosocial well-being following participation in a MBSR program is associated with increased natural killer cell activity, in: J Altern Complement Med, 16. Jg., 5, S. 531-8.

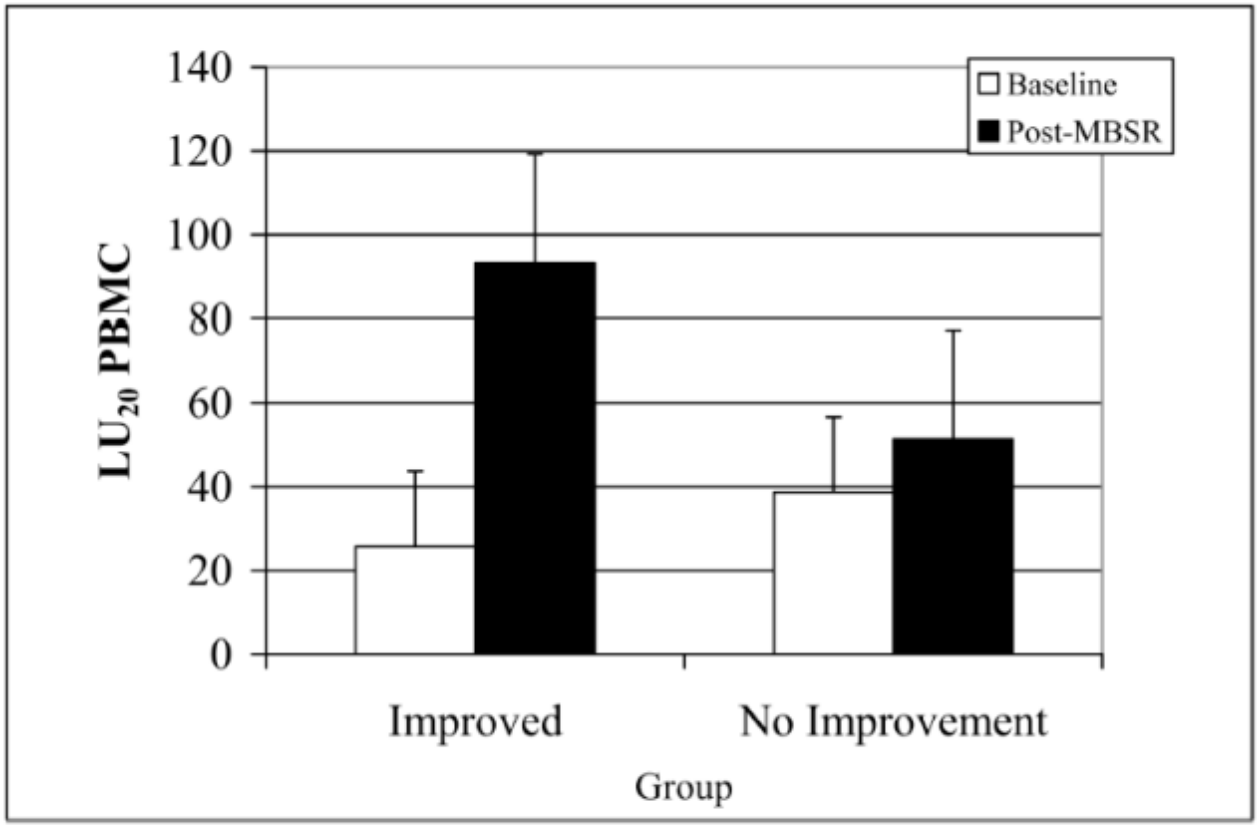


Figure 1.
Change in LU_{20} PBMC among patients who showed Improvement vs. No Improvement in psychosocial functioning following MBSR

Fang et al. (2010): Enhanced psychosocial well-being following participation in a MBSR program is associated with increased natural killer cell activity, in: J Altern Complement Med, 16. Jg., 5, S. 531-8.

Enhanced mental health was also significantly correlated with increases in LU20 NK and LU20 PBMC (rs = 0.69 and 0.71, respectively, ps < 0.01).

Improvement in general health was positively correlated with increased LU20 PBMC ($r = 0.54$, $p < 0.05$).

Reductions in anxiety and overall distress were significantly correlated with reductions in C-reactive protein (CRP), an inflammation marker (rs = 0.64 and 0.52, ps < 0.05).

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Ist dir eigentlich klar, wie spät es bereits ist ?!?!
Ich bin nicht am pennen – ich spüre der Nacht nach!

you are
breathing

Literatur

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Weaver, I. C., N. Cervoni, et al. (2004). "Epigenetic programming by maternal behavior." Nat Neurosci 7(8): 847-54.

O-Ton

Who knows what all this is about?

I don't even try to interpret.

This is wonderful!... And it's affecting everything! ….
I'm going to live the rest of my life differently ….

I'm so glad I'm doing this!

(Anna)

Yang Y, Decelle S, Reed M, Rosengren K, Schlagal R, Greene J.
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J Aging Res. 2011;2011:650210. Epub 2011 Jun 26.