



# **Scientific Research on Yoga and Meditation: The Relaxation Response**

**Yoga Alliance CE Workshop Webinar  
May 24, 2022**

**Sat Bir S. Khalsa, Ph.D.**

Associate Professor of Medicine, Harvard Medical School

Director of Yoga Research, Yoga Alliance

Director of Research, Kundalini Research Institute

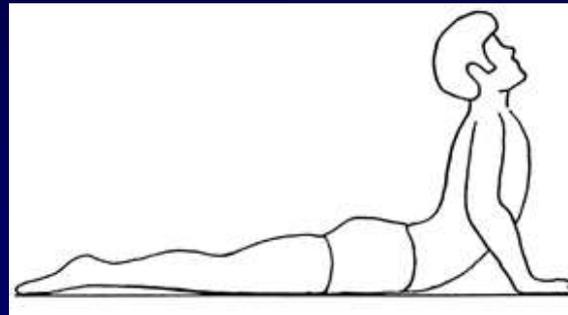
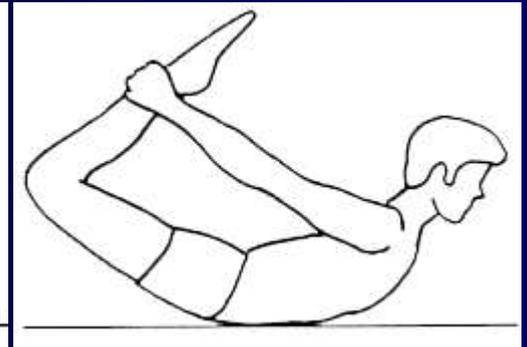
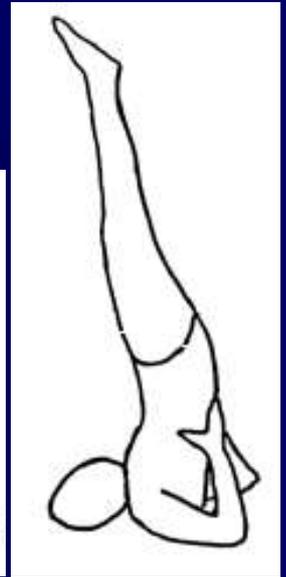
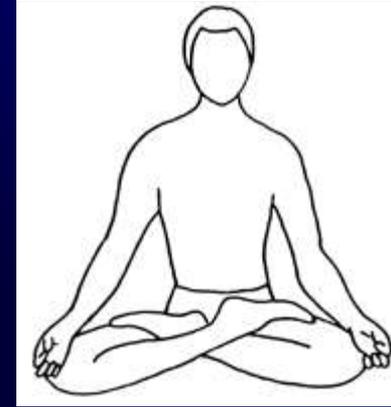
Editor in Chief, International Journal of Yoga Therapy

Research Associate, Benson Henry Institute for Mind Body Medicine

Research Affiliate, Osher Center for Integrative Medicine

# Basic Elements of Yoga Practice

- Physical postures/exercises
- Breathing exercises
- Deep Relaxation
- Meditation



## **Meditation Definition**

Relaxed, non-analytical, non-judgmental focused attention that includes disengagement from habitual mind wandering and ruminating thoughts



<https://www.harappa.com/indus/33.html>

## Annapurna Upanishad

III-5. ...this mind of mine is extremely restless’.

III-6. The mind wanders among objects as a monkey does from tree to tree.

## Katha Upanishad

1-III-9. But the man who has a discriminating intellect as his driver, and a controlled-mind as the reins, reaches the end of the path – that supreme state of Vishnu.

From: *Vedanta Spiritual Library* <http://www.celextel.org/>

Yoga is the stilling of  
the fluctuations of the  
mind.

*Patanjali*

“Do not dwell in the  
past, do not dream of  
the future, concentrate  
the mind on the  
present moment.”

*Buddha*



“We are shaped by our thoughts; we become  
what we think.”

*Buddha*

“Your worst  
enemy  
cannot harm  
you as much  
as your own  
unguarded  
thoughts.”

*Buddha*



# Major Meditation Practices

Single-point focus, closed-focus, concentrative meditation

- Attention on a single target (e.g. word, phrase, candle, image, breath)
- Mantra meditation, Transcendental Meditation, relaxation response, breath-focused, Jesus prayer, Om chanting

Open-focus, mindfulness

- Attention on the flow of sensation or thought
- Vipassana, MBSR, mindfulness as lived

Guided meditation

- Guided focus on a specific theme or content
- Religious/spiritual, loving kindness meditation, guided imagery, autogenic training, self-hypnosis, body scan

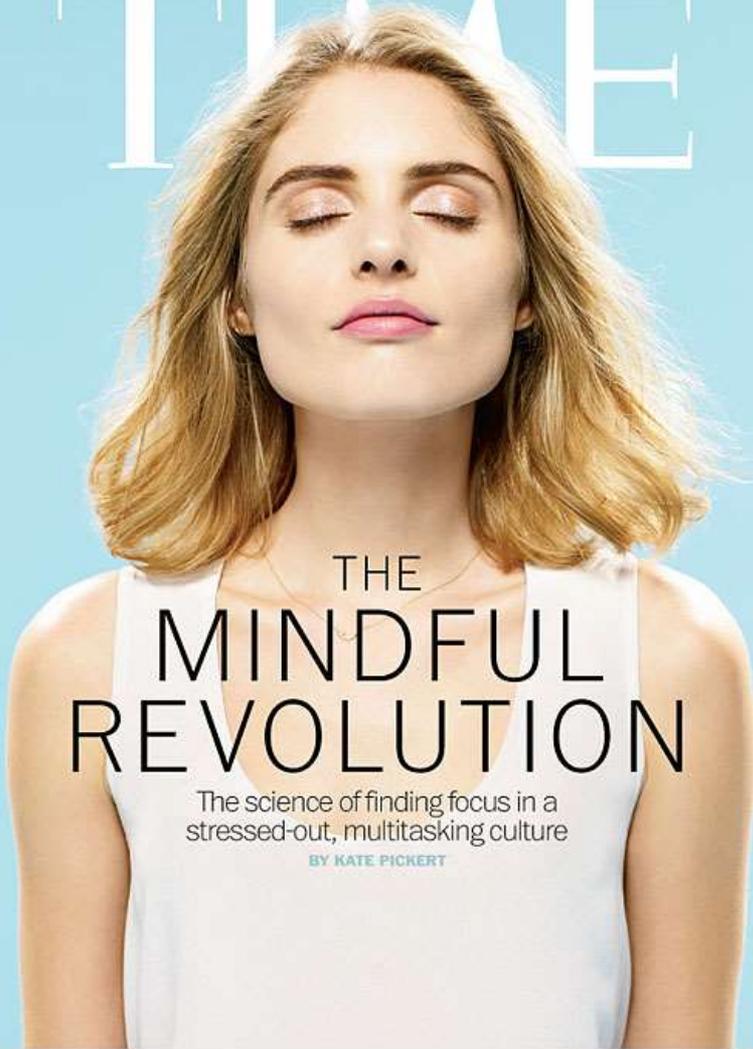


<https://www.rollingstone.com/wp-content/uploads/2018/06/beatles-in-india-9c736b8e-0cd0-4c55-9535-35db0341564d.jpg>

FEBRUARY 3, 2014

Fleeing Syria Photographs by James Nachtwey / Peyton Power / Steve McQueen

# TIME



## THE MINDFUL REVOLUTION

The science of finding focus in a stressed-out, multitasking culture

BY KATE PICKERT

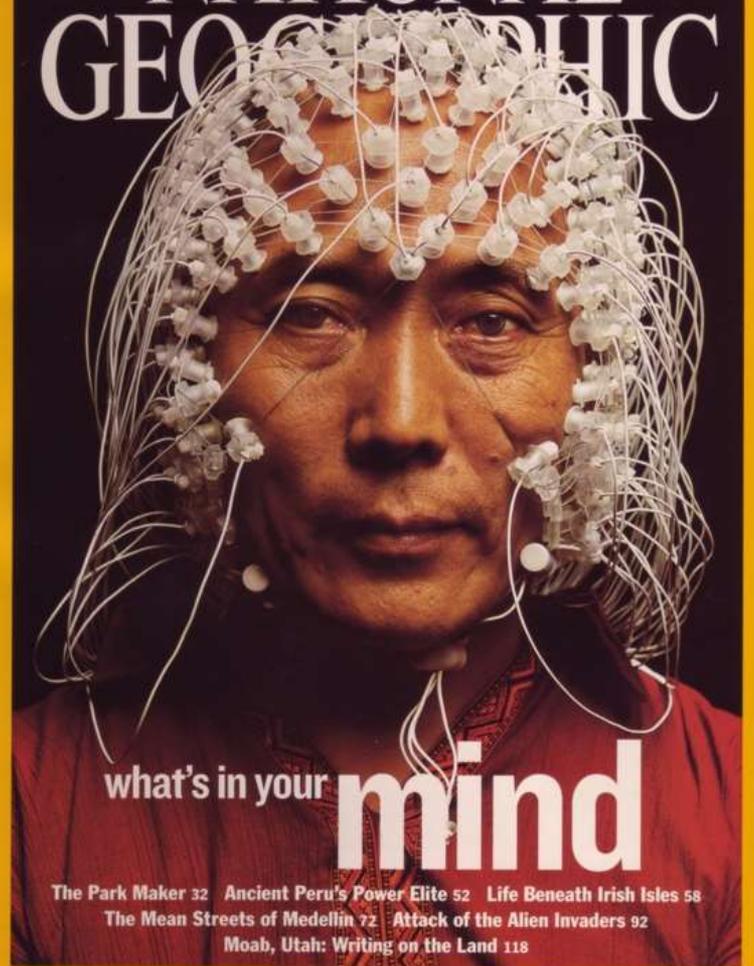
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WATCH "IN THE WOMB" ON NG CHANNEL, SUNDAY, MARCH 6, AT 8 P.M. ET/9 PT

GEOGRAPHIC.COM/MAGAZINE

MARCH 2005

# NATIONAL GEOGRAPHIC



## what's in your mind

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The Mean Streets of Medellin 72 Attack of the Alien Invaders 92

Moab, Utah: Writing on the Land 118

AUGUST 4, 2003

www.time.com AOL Keyword: TIME

# TIME

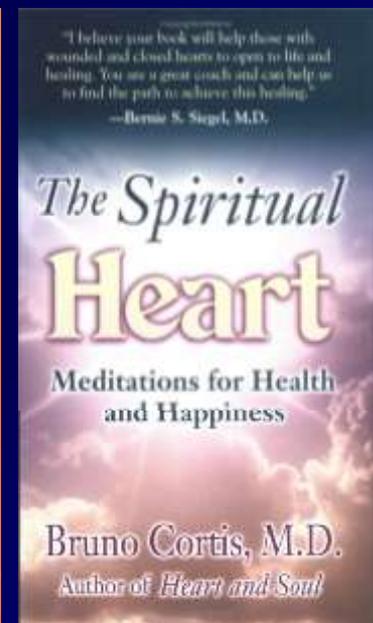
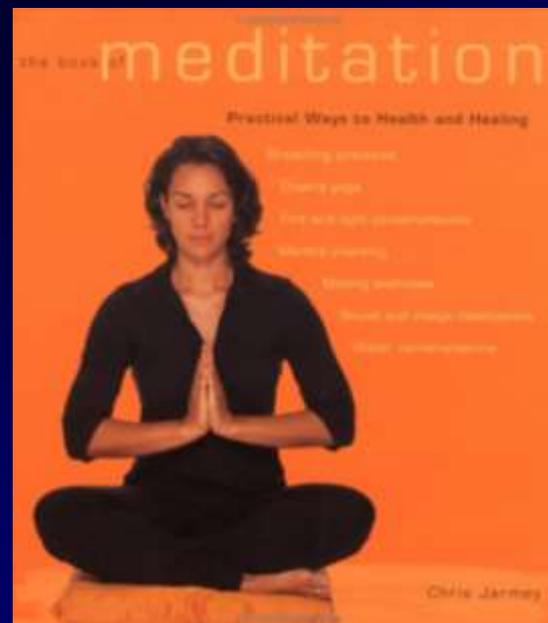
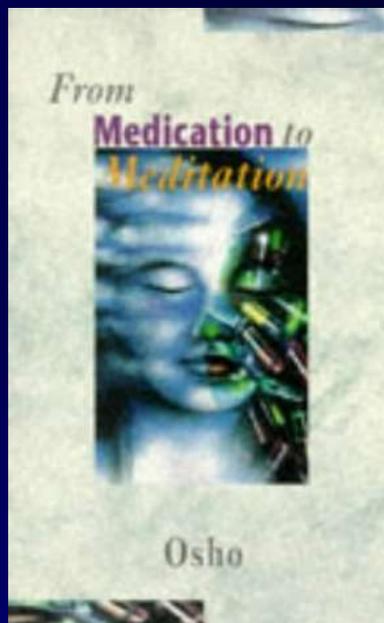
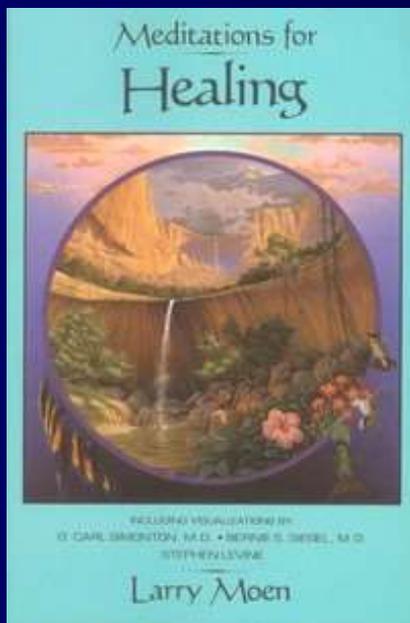
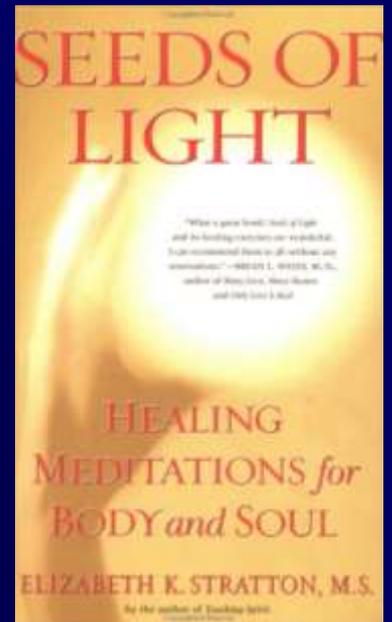
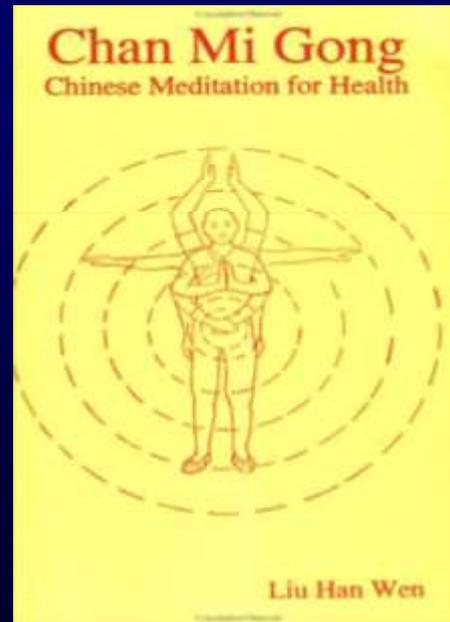
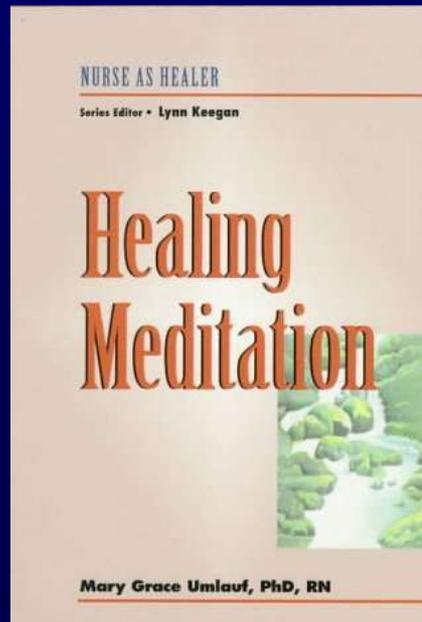
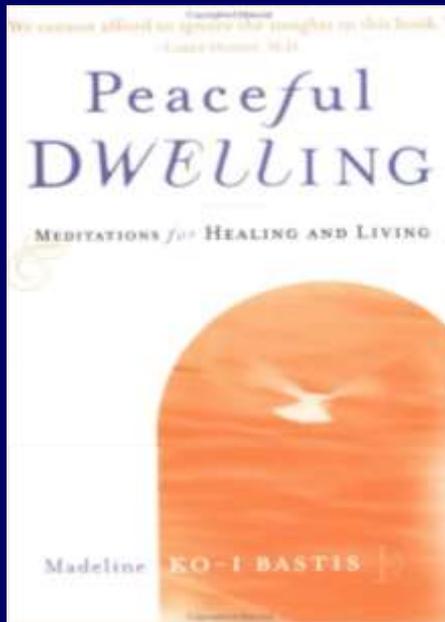
New Age mumbo jumbo?  
Not for millions of  
Americans who meditate  
for health and well-being.  
Here's how it works

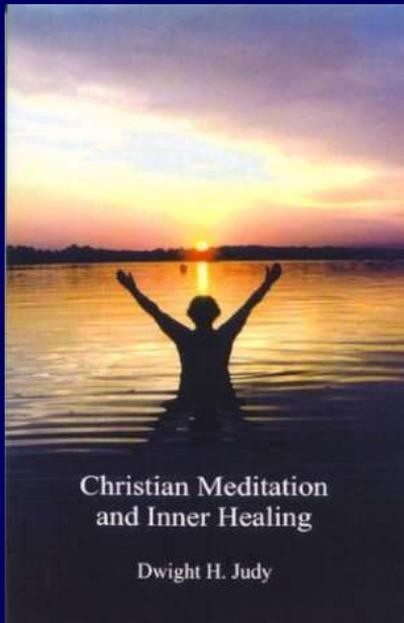
THE  
SCIENCE  
OF

# MEDITATION



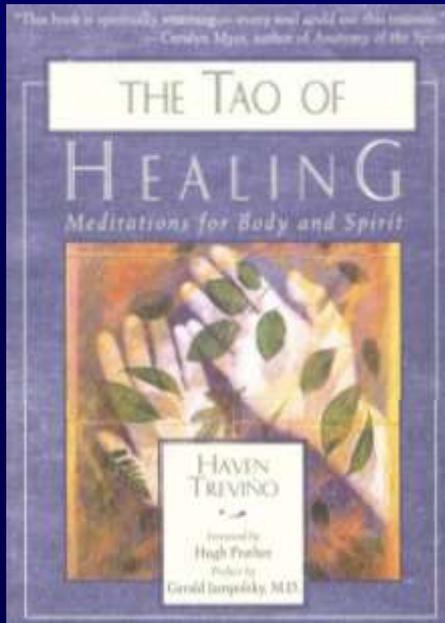
Actress Heather Graham has  
been practicing Transcendental  
Meditation since 1991





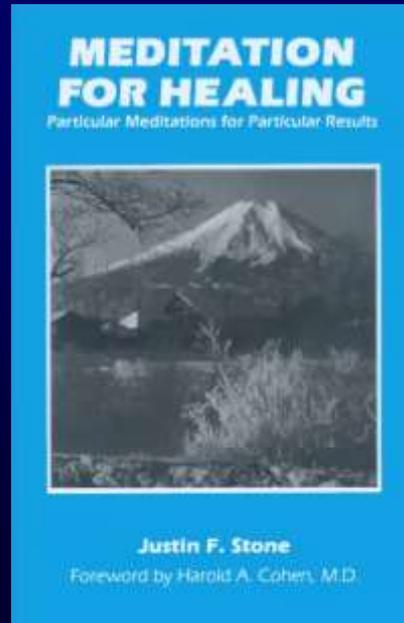
Christian Meditation  
and Inner Healing

Dwight H. Judy



THE TAO OF  
HEALING  
*Meditations for Body and Spirit*

HAVEN  
TREVINO  
Foreword by  
Hugh Prother  
Preface by  
Gerald Samplosky, M.D.



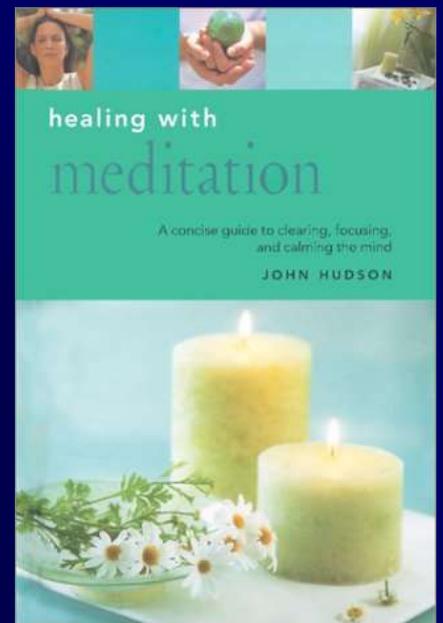
MEDITATION  
FOR HEALING

Particular Meditations for Particular Results



Justin F. Stone

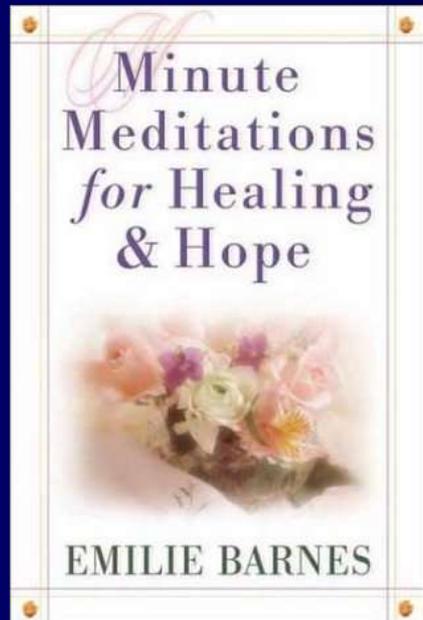
Foreword by Harold A. Cohen, M.D.



healing with  
meditation

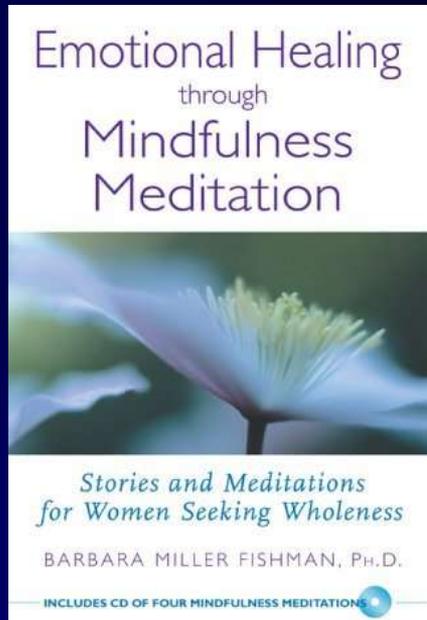
A concise guide to clearing, focusing,  
and calming the mind

JOHN HUDSON



Minute  
Meditations  
for Healing  
& Hope

EMILIE BARNES



Emotional Healing  
through  
Mindfulness  
Meditation

*Stories and Meditations  
for Women Seeking Wholeness*

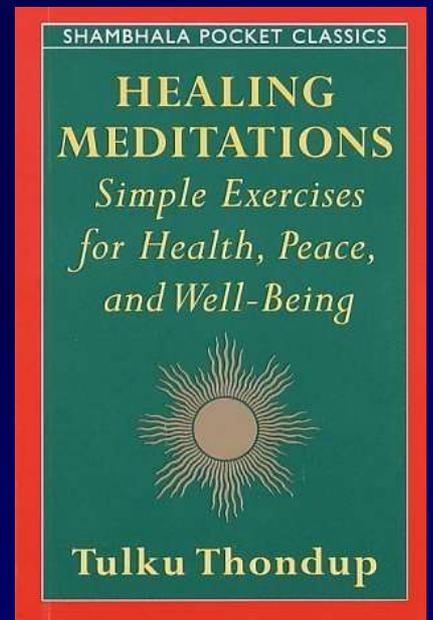
BARBARA MILLER FISHMAN, Ph.D.

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The Natural Healing Power of  
Meditation



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MEDITATIONS  
*Simple Exercises  
for Health, Peace,  
and Well-Being*



Tulku Thondup



# Harvard Mental Health Letter

VOLUME 21 • NUMBER 10 | APRIL 2005

## Meditation in psychotherapy

*An ancient spiritual practice is finding new uses in the treatment of mental illness.*

**T**he systematic method of regulating attention known as meditation is now being incorporated into psychotherapeutic practice and linked in surprising ways to other healing traditions, including cognitive behavioral therapy. The most highly developed forms of meditation are associated with Buddhism, but there are parallels in other spiritual and religious traditions, as well as modern secular versions under the names of relaxation response training or mindfulness meditation.

One typical practice is to choose a word, sound, or short phrase (sometimes called a mantra) and repeat it with each breath while sitting in a relaxed position with eyes closed, while calmly dismissing distracting thoughts

before, immediately after, and four months after a two-month course in mindfulness meditation. They found persistent increased activity on the left side of the prefrontal cortex, which is associated with joyful and serene emotions. They also found increased antibody responses to an influenza vaccine. Studies are now looking at the effects of meditation on the amygdala, the brain's fear center, and the caudate nucleus, which is associated with obsessional thoughts and compulsive behavior.

### Psychotherapeutic uses

In meditative traditions, the purpose of drawing attention away from the outside world and abandoning habitual patterns of perceiving

## INSIDE

### Conduct disorder

Psychiatric views of children's misbehavior. . . . . 4

### In Brief

#### The danger of playing it safe

Why people with anxiety disorders must risk it all. . . . . 7

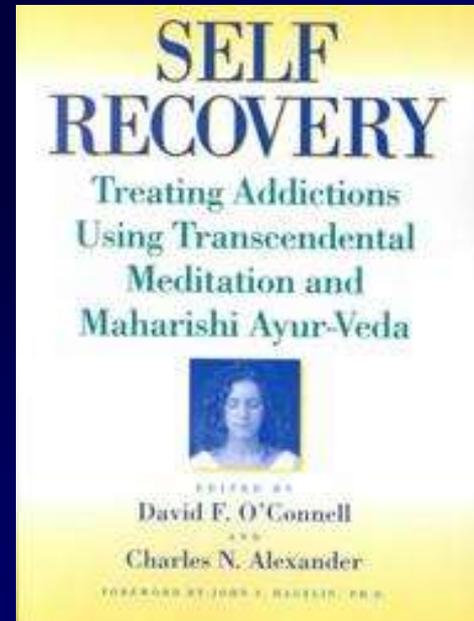
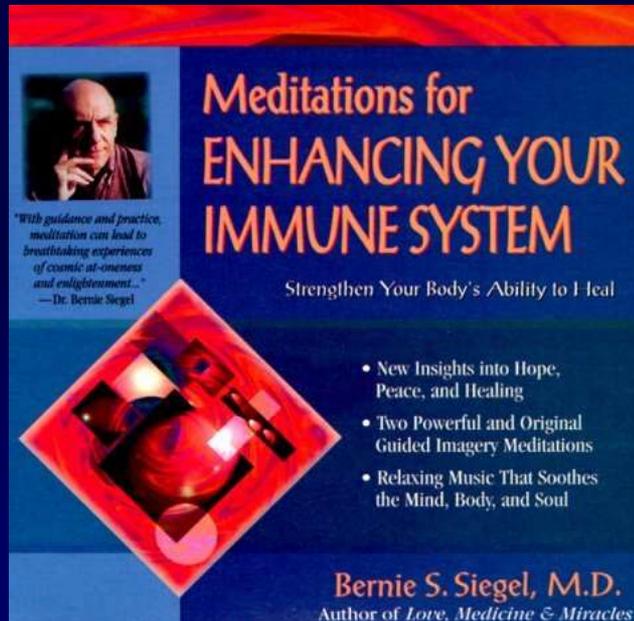
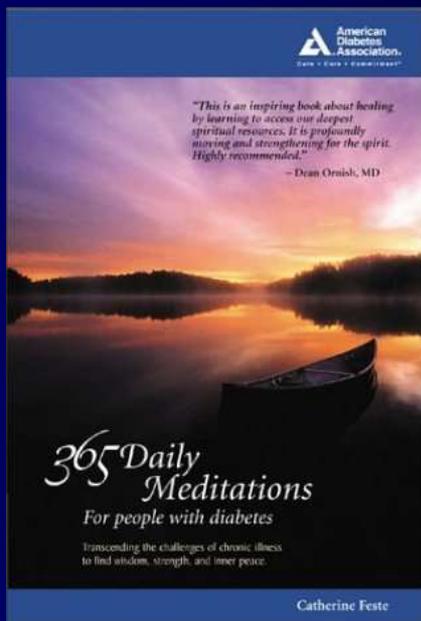
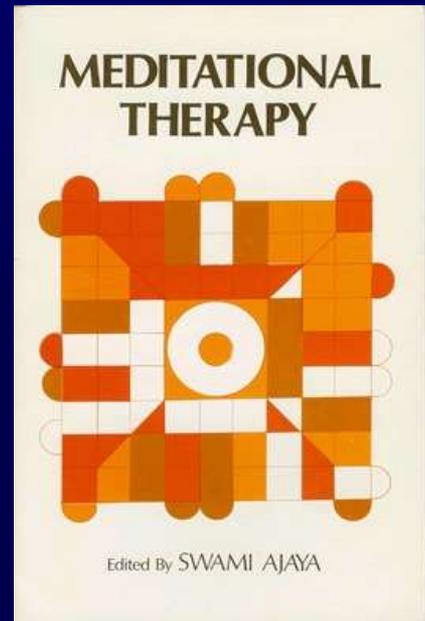
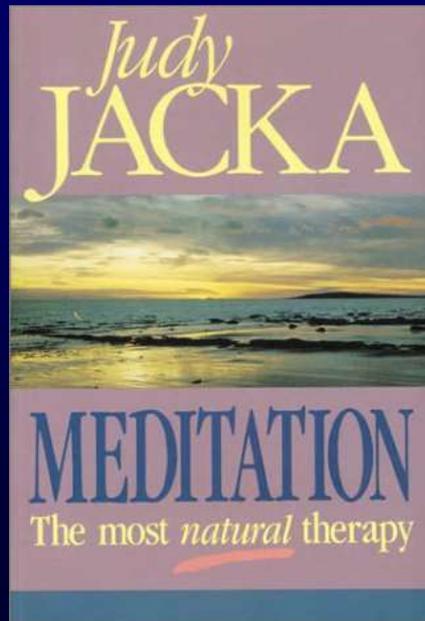
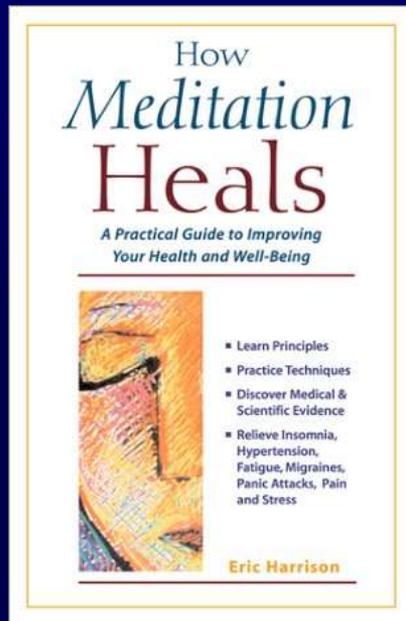
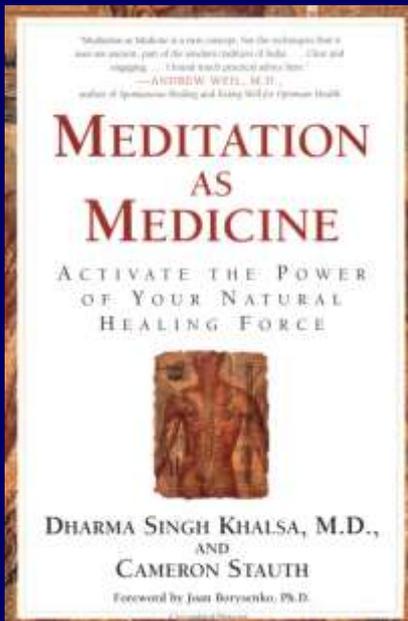
### Q&A

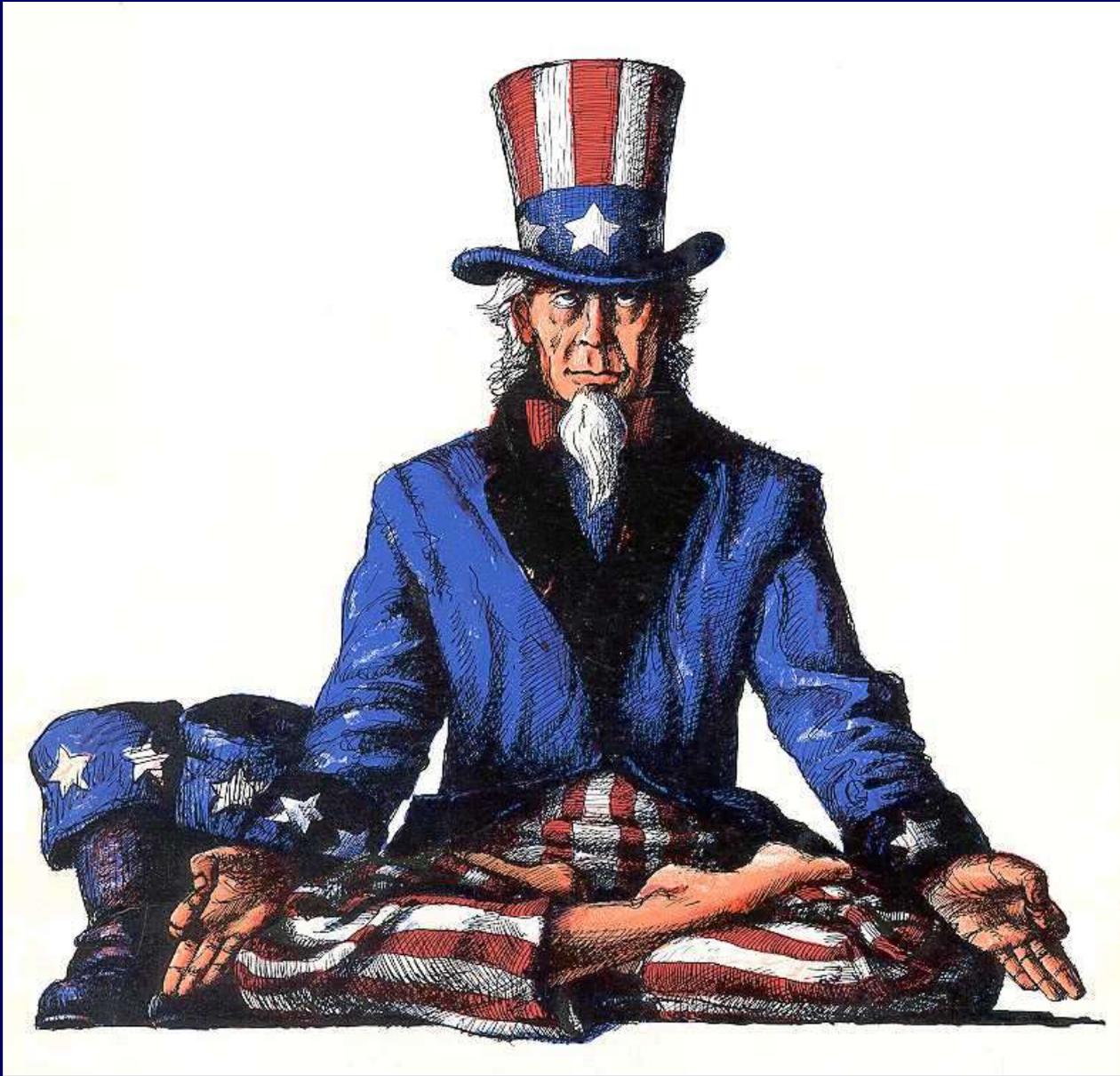
#### What is different about the new sleep medicine Lunesta?

. . . . . 8

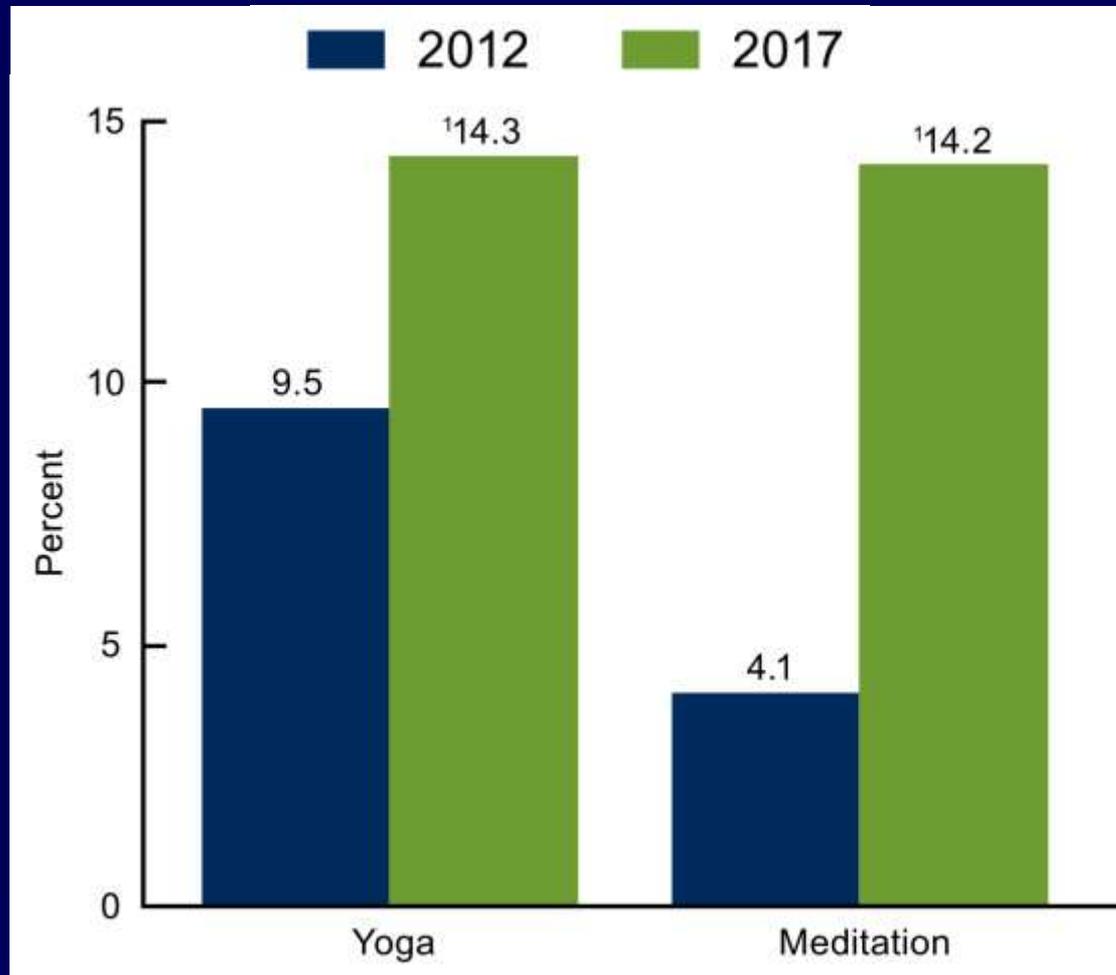
### In future issues

Homelessness and mental illness



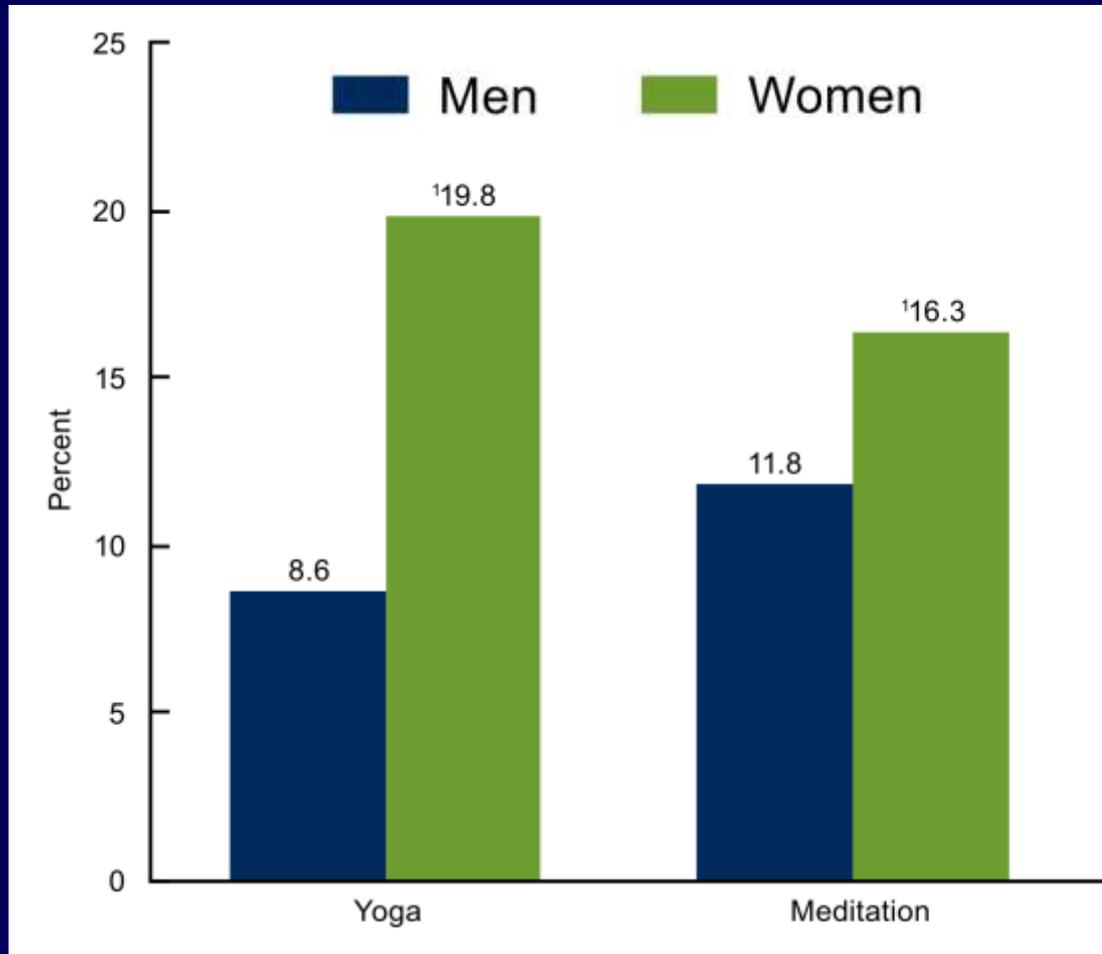


# Meditation Demographics



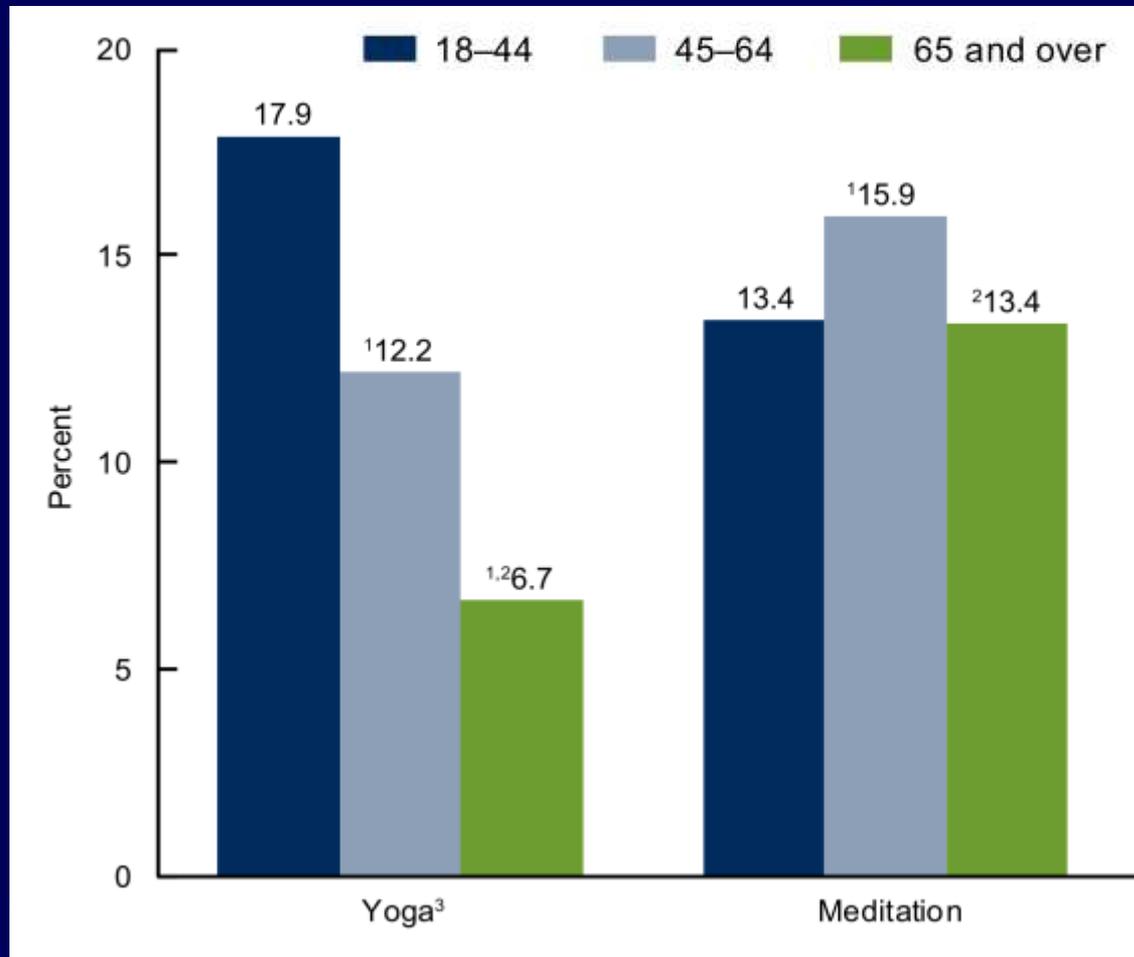
From: *Use of Yoga, Meditation, and Chiropractors Among U.S. Adults Aged 18 and Over.*  
Clarke TC, Barnes PM, Black LI, Stussman BJ, Nahin RL. *NCHS Data Brief.* 325:1-8, 2018.

# Meditation Demographics



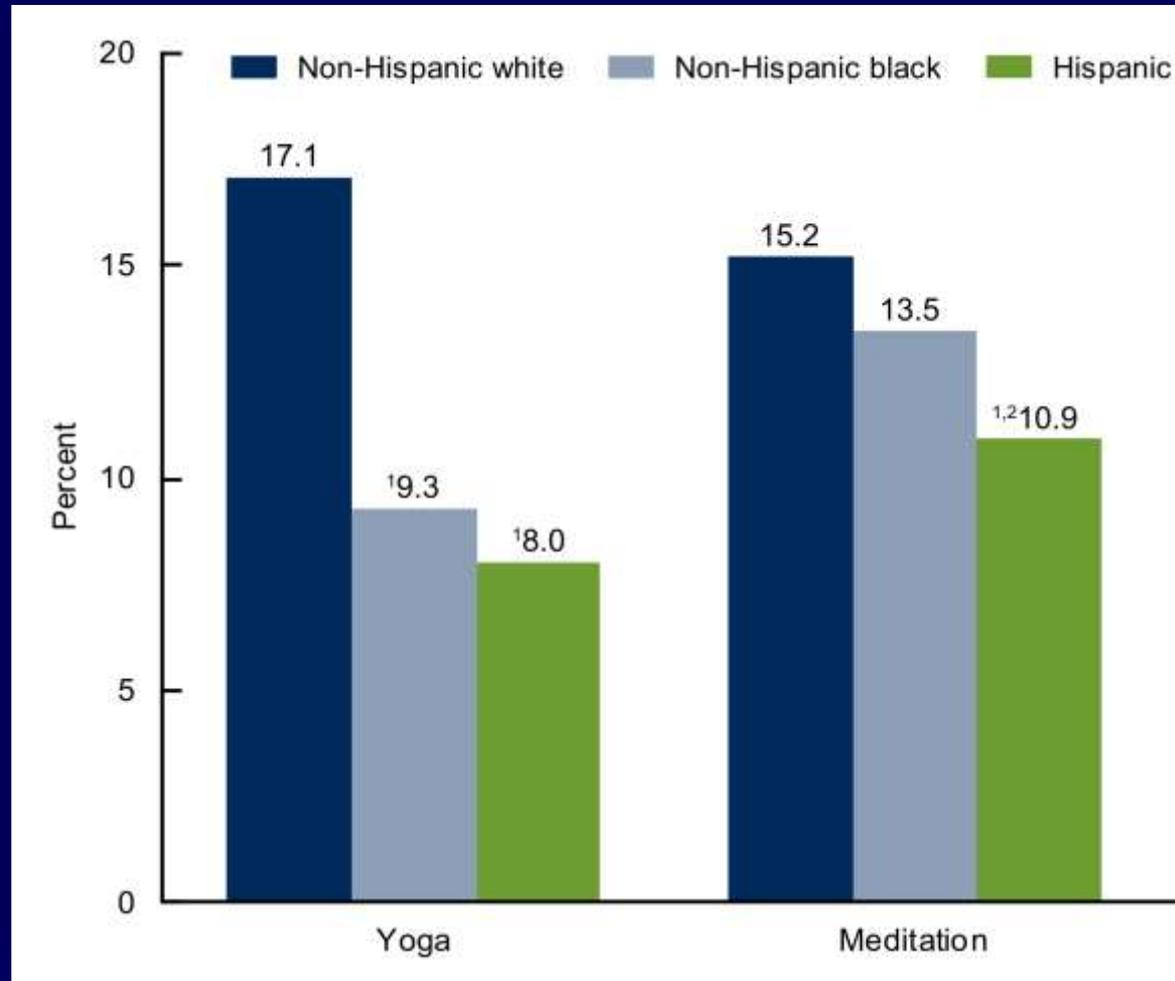
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# Meditation, Gender and Type

TABLE 3. PREVALENCE OF PAST-YEAR MEDITATION USE BY GENDER AMONG US ADULTS AGED ≥18 YEARS, NATIONAL HEALTH INTERVIEW SURVEY 2012

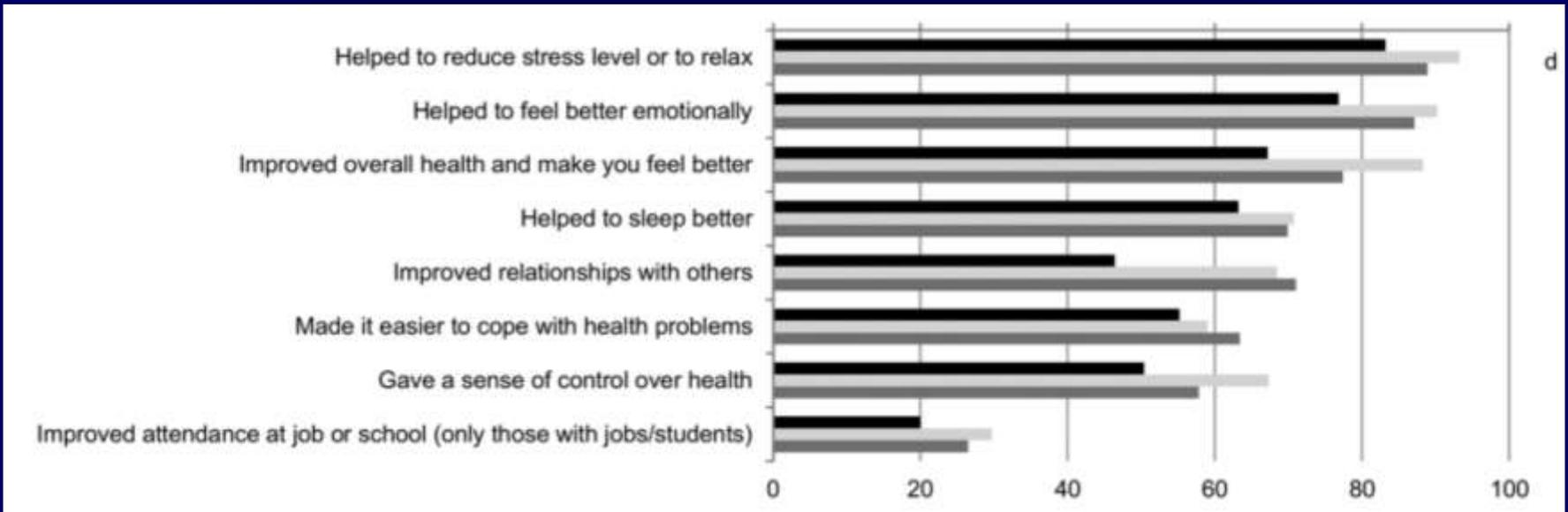
|  | <i>Gender</i>    |                | <i>Total (%)</i> | <i>p</i> <sup>a</sup> |
|--|------------------|----------------|------------------|-----------------------|
|  | <i>Women (%)</i> | <i>Men (%)</i> |                  |                       |
| Among all adults ( <i>n</i> = 33,379 unweighted)             |                  |                |                  |                       |
| Meditation practices <sup>b</sup>                            |                  |                |                  |                       |
| Mantra meditation  | 1.8              | 1.3            | 1.6              | <0.001                |
| Mindfulness meditation                                       | 2.1              | 1.7            | 1.9              | <0.001                |
| Spiritual meditation   | 3.7              | 2.3            | 3.0              | <0.001                |
| Yoga, tai chi, qi gong w/meditation                          | 7.6              | 3.0            | 5.4              | <0.001                |
| Overall meditation use                                       |                  |                |                  |                       |
| Past-year (stand-alone) meditation practice                  | 4.9              | 3.2            | 4.1              | <0.001                |
| Any past-year meditation, including w/yoga, tai chi, qi gong | 10.3             | 5.2            | 7.9              | <0.001                |
| Among meditators ( <i>n</i> = 2560 unweighted)               |                  |                |                  |                       |
| Meditation practices <sup>b</sup>                            |                  |                |                  |                       |
| Mantra meditation  | 17.8             | 25.3           | 20.2             | 0.001                 |
| Mindfulness meditation                                       | 20.6             | 31.5           | 24.1             | <0.001                |
| Spiritual meditation   | 35.8             | 44.1           | 38.5             | 0.002                 |
| Yoga, tai chi, qi gong w/meditation                          | 73.9             | 56.6           | 68.4             | <0.001                |
| No. of meditation types                                      |                  |                |                  |                       |
| One  | 70.4             | 64.7           | 68.6             | 0.102                 |
| Two  | 15.9             | 18.1           | 16.6             |                       |
| Three  | 9.0              | 12.1           | 10.0             |                       |
| Four   | 4.8              | 5.1            | 4.9              |                       |

<sup>a</sup>*p* Values from design-based F-test for gender differences in each covariate distribution.

<sup>b</sup>Not mutually exclusive.

From: *Gender Differences in Prevalence, Patterns, Purposes, and Perceived Benefits of Meditation Practices in the United States*. Upchurch DM, Johnson PJ. *Journal of Womens Health (Larchmt)* 28:135-142, 2019.

# Reported Outcomes of Meditation Use



Mantra



Mindfulness

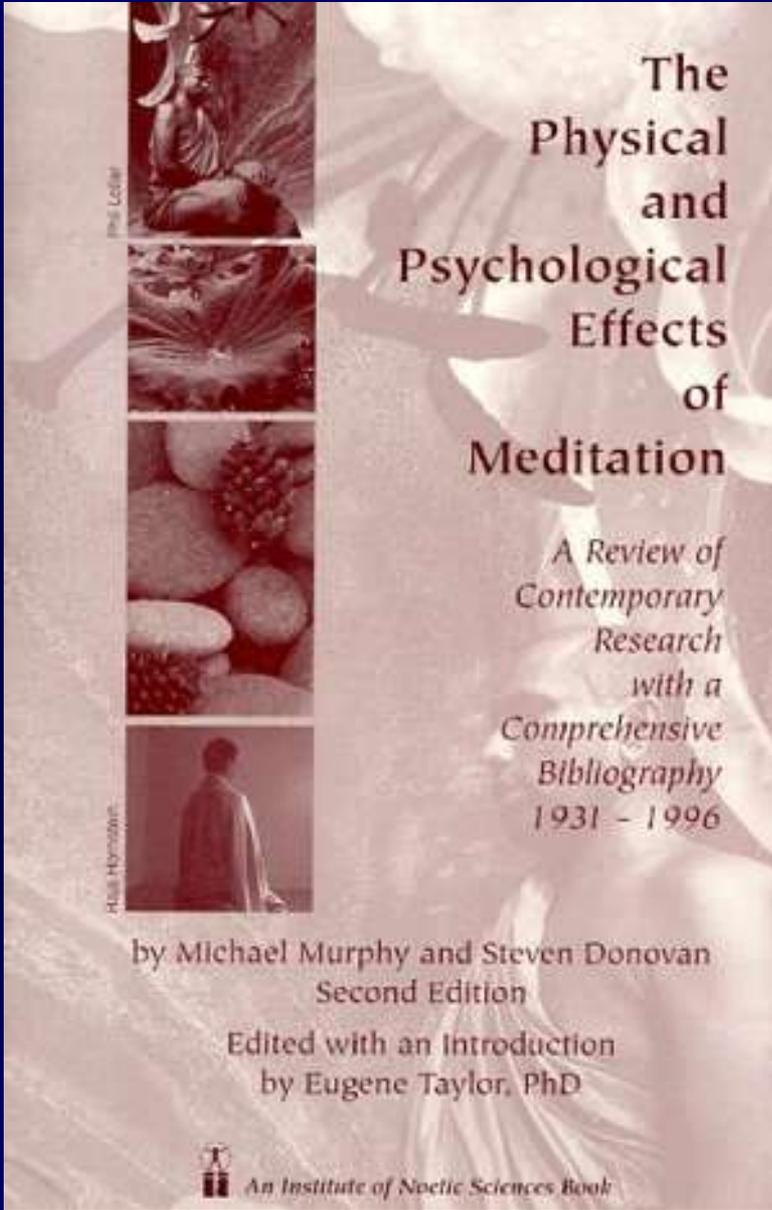


Spiritual



From: *Prevalence, patterns, and predictors of meditation use among US adults: A nationally representative survey.* Cramer H, Hall H, Leach M, Frawley J, Zhang Y, Leung B, Adams J, Lauche R. *Science Reports.* 2016 Nov 10;6:36760.

# Meditation Research



The  
Physical  
and  
Psychological  
Effects  
of  
Meditation

*A Review of  
Contemporary  
Research  
with a  
Comprehensive  
Bibliography  
1931 - 1996*

by Michael Murphy and Steven Donovan  
Second Edition

Edited with an Introduction  
by Eugene Taylor, PhD



An Institute of Noetic Sciences Book

Trends Cogn. Sci. April 2008 Vol. 12 No. 4, pp. 123–170 ISSN 1364-6713

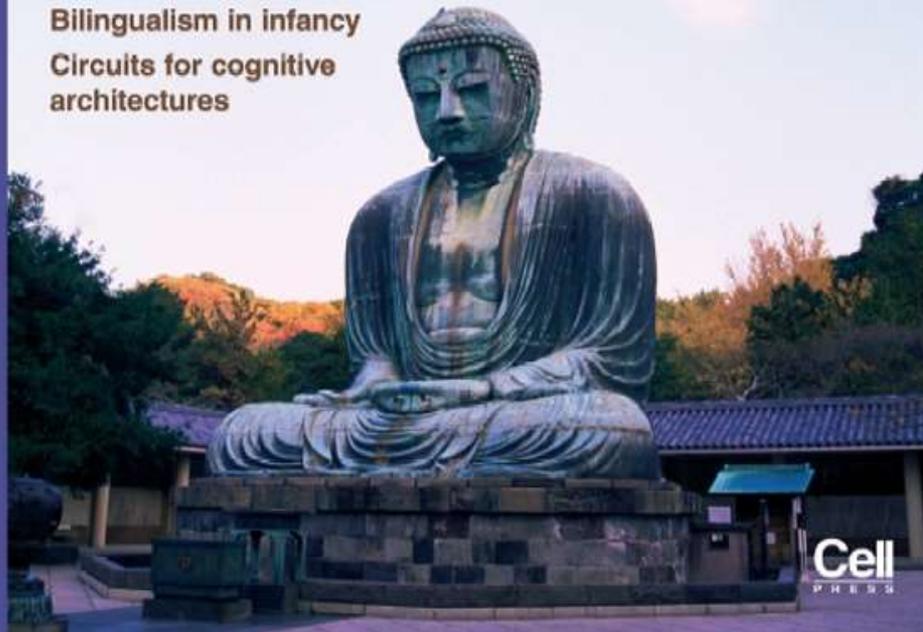
# Trends in Cognitive Sciences

## The impact of meditation on attention and emotion

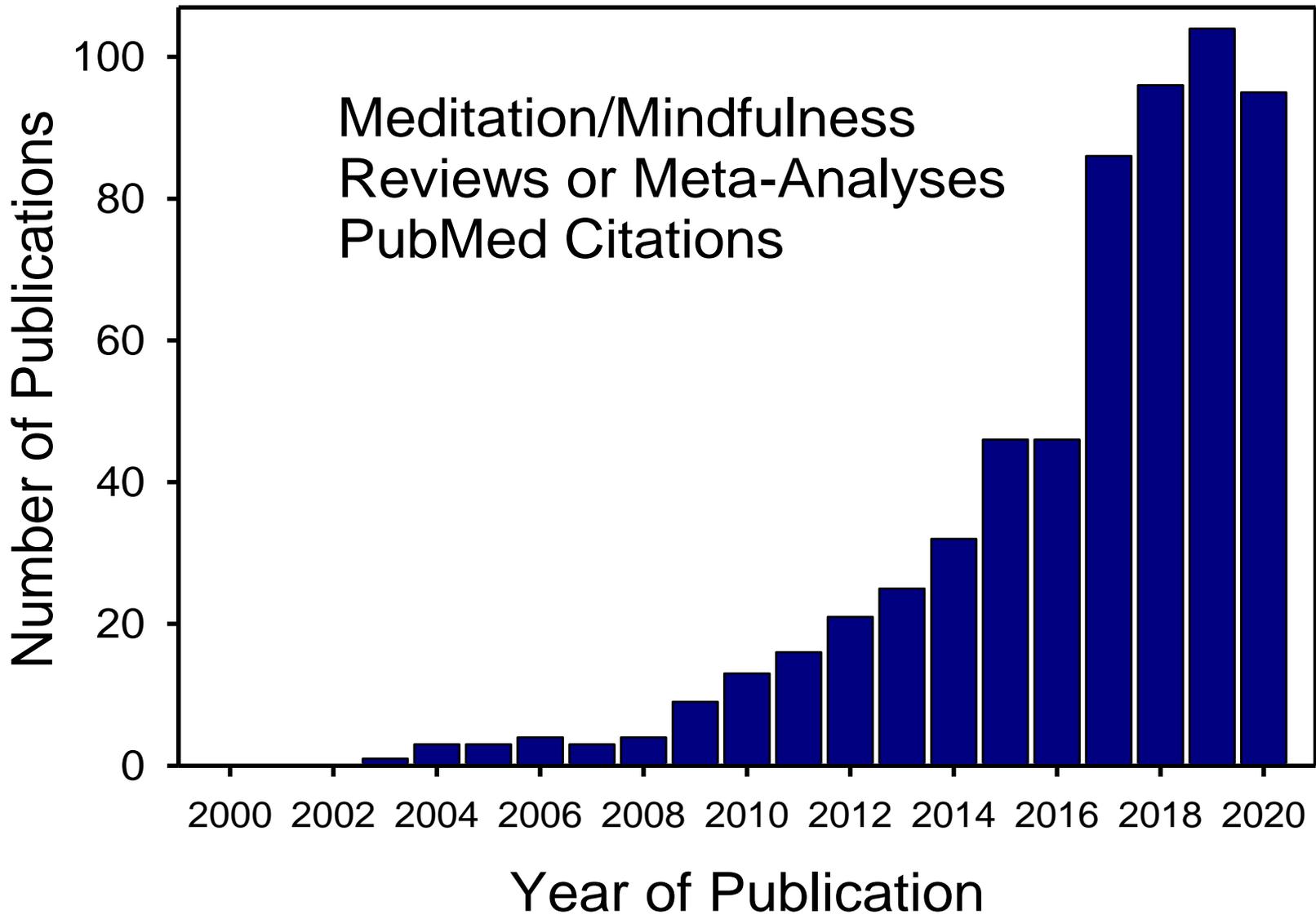
Categorization in the wild

Bilingualism in infancy

Circuits for cognitive  
architectures

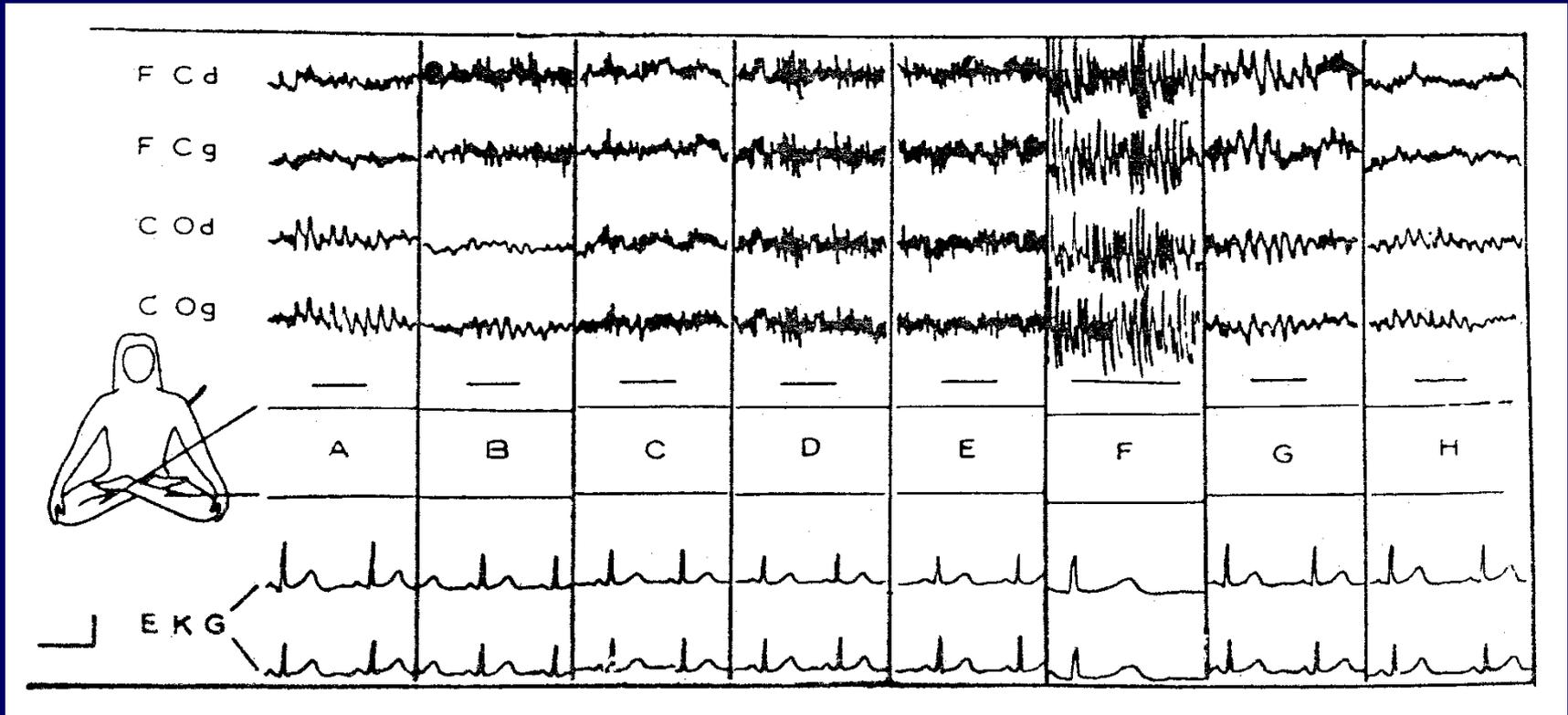


Cell  
PRESS



Search term: (review [ti] OR meta-analysis [ti] or metaanalysis [ti]) (meditation [ti] OR mindfulness [ti])

# Das and Gastaut, 1955



From: *Variations de l'activite electrique du cerveau, du coeur et de muscles squelettiques au cours de la meditation et de l'extase yogique* [Variations in the electrical activity of the brain, heart, and skeletal muscles during yogic meditation and trance], Das N, Gastaut H, *Electoencephalography and Clinical Neurophysiology*, Suppl. 6:211-219, 1955.

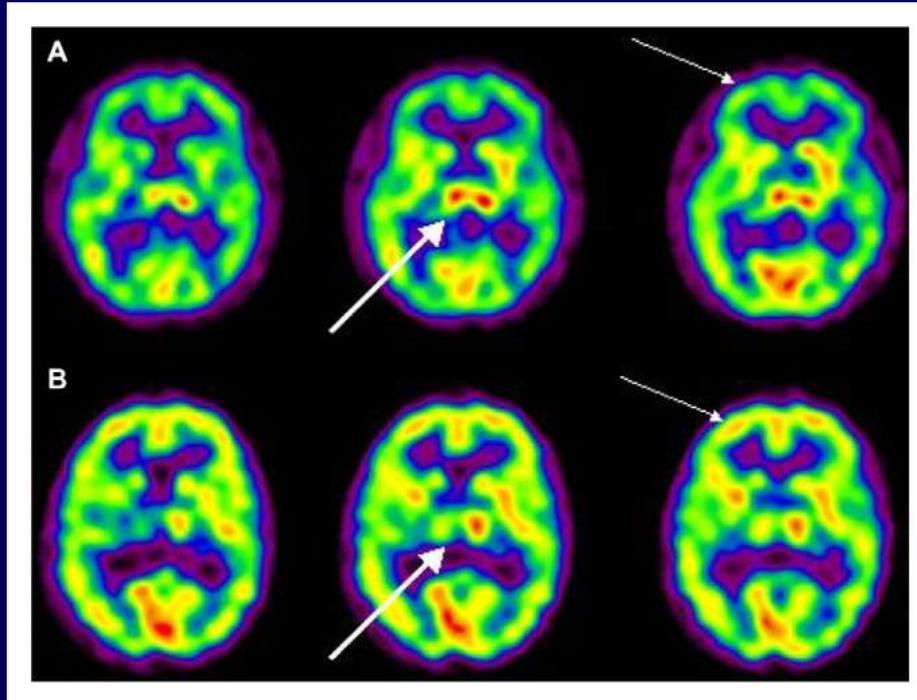
# Self-Regulation

“...physiologically  
Yogic meditation  
represents deep  
relaxation of the  
autonomic nervous  
system ...”



From: *Electro-physiological correlates of some Yogi exercises*, Bagchi BK, Wenger MA, *Electroencephalography and Clinical Neurophysiology*, 7 (Suppl):132-149, 1957.

# Yoga Meditation and Cerebral Blood Flow



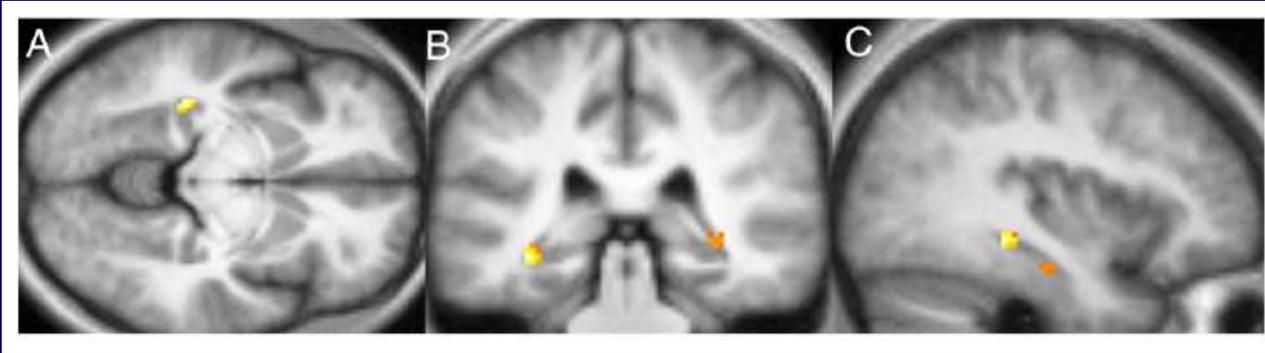
Non-meditators

Meditators

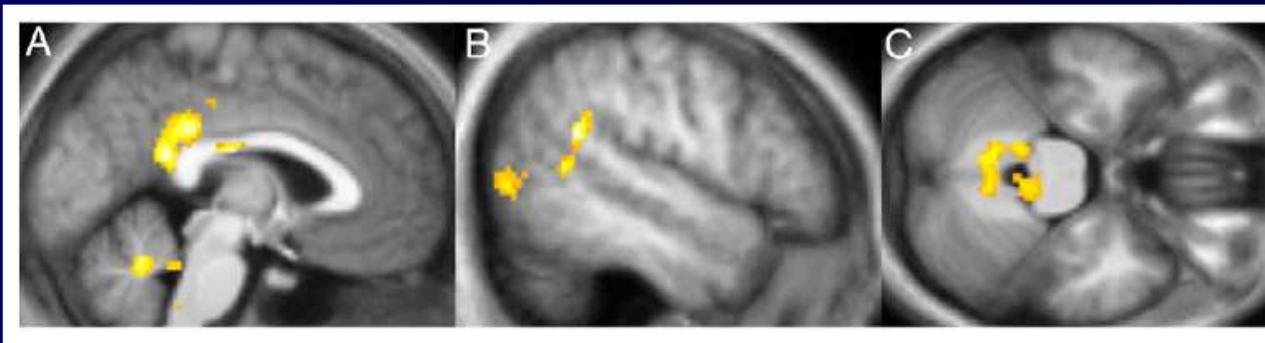
CBF of long-term meditators was significantly higher ( $p < .05$ ) compared to non-meditators in the prefrontal cortex, parietal cortex, thalamus, putamen, caudate, and midbrain...The observed changes...appear in structures that underlie the attention network and also those that relate to emotion and autonomic function.

From: *Cerebral blood flow differences between long-term meditators and non-meditators*, Newberg AB, Wintering N, Waldman MR, Amen D, Khalsa DS, Alavi A. *Conscious Cognition*, 19:899-905, 2010.

# MBSR and Gray Matter Density



L Hippocampus



Posterior Cingulate  
Temporo-parietal  
Junction  
Cerebellum

...participation in MBSR is associated with changes in gray matter concentration in brain regions involved in learning and memory processes, emotion regulation, self-referential processing, and perspective taking.

From: *Mindfulness practice leads to increases in regional brain gray matter density*, Hölzel BK, Carmody J, Vangel M, Congleton C, Yerramsetti SM, Gard T, Lazar SW, *Psychiatry Research Imaging*, 191:36-43, 2011.

BREVIA

# A Wandering Mind Is an Unhappy Mind

Matthew A. Killingsworth\* and Daniel T. Gilbert

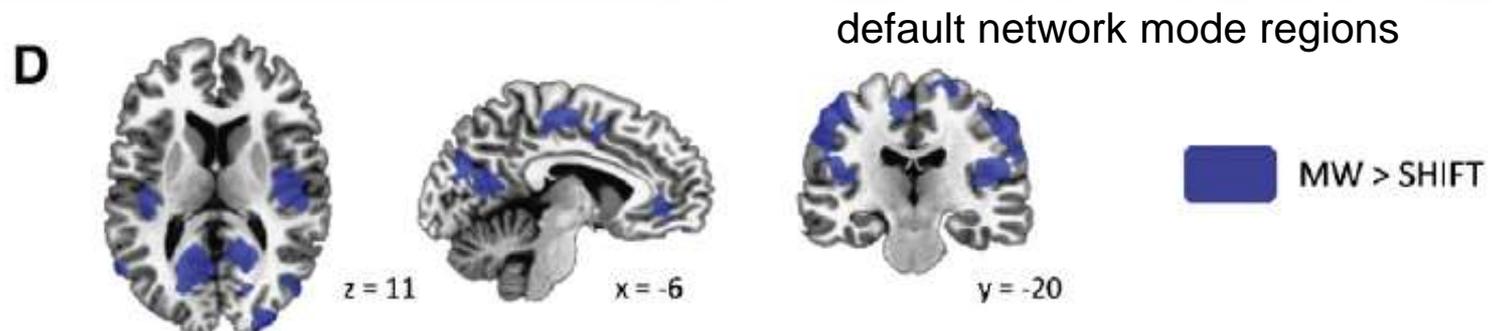
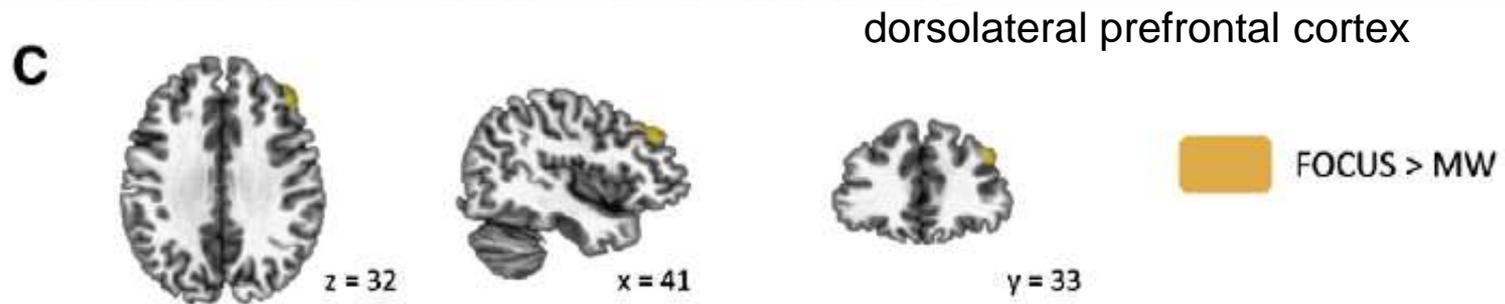
12 NOVEMBER 2010 VOL 330 SCIENCE [www.sciencemag.org](http://www.sciencemag.org)

...people's minds wandered frequently, regardless of what they were doing.

...people were less happy when their minds were wandering than when they were not

The ability to think about what is not happening is a cognitive achievement that comes at an emotional cost.

# Meditation & the Default Mode Network



From: *Mind wandering and attention during focused meditation: A fine-grained temporal analysis of fluctuating cognitive states*, Hasenkamp W, Wilson-Mendenhall CD, Duncan E, Barsalou LW, *Neuroimage*, 59:750-60, 2012.

## Yoga Practices

Postures, Breathing, Relaxation, Meditation

### Fitness

↑Flexibility  
↑Strength  
↑Coordination/Balance  
↑Respiratory Function  
↑Self-Efficacy

### Self-Regulation

↑Stress Regulation  
↑Emotion Regulation  
↑Resilience  
↑Equanimity  
↑Self-Efficacy

### Awareness

↑Attention  
↑Mindfulness  
↑Concentration  
↑Cognition  
↑Meta-cognition

### Spirituality

↑Unitive State  
↑Transcendence  
↑Flow  
↑Transformation  
↑Life Meaning/Purpose

## Global Human Functionality

↑Physical & Mental Health, ↑Physical Performance  
↑Stress & Emotion Regulation, ↑Awareness/Mindfulness, ↑Meta-cognition  
↑Positive Behavior, ↑Wellbeing, ↑Values, ↑Life Purpose & Meaning, ↑Spirituality

## Scientific Research on Yoga

Substantial research has been done on many of the populations and parts of the body that COVID-19 preys on most. Use this section of Yoga Alliance's website to learn more about scientific research on the effects of yoga on the **elderly**, **respiratory function**, **anxiety**, and **depression**, to name a few.

Perhaps more than ever, yoga is being widely studied and evaluated for its positive effects and benefits. At Yoga Alliance, we curate the latest and most relevant research on yoga's applications in health, wellness, and disease. We have filtered it in a digestible manner for our Registered Yoga Schools and Registered Yoga Teachers as well as for the broader yoga community.

This evidence-based research not only reveals the science of yoga, it also explains its therapeutic efficacy when used in conjunction with conventional medicine. Our goal is that this impactful content will be utilized in a way that highlights even more of yoga's ancient, multi-faceted ability to improve lives.

Join us! Let us know how research on yoga is important or valuable to you on social media (@YogaAlliance) or by emailing us at [research@yogaalliance.org](mailto:research@yogaalliance.org). We honor and value your personal experiences and look forward to featuring your stories.

### Main Research Categories



Basic Research



Special Populations



Disease and Disorders

### Our Research Conversation

#### Our Director of Yoga Research



#### Yoga Research Videos



#### Yoga Research Webinars



[https://www.yogaalliance.org/About\\_Yoga/Scientific\\_Research\\_on\\_Yoga](https://www.yogaalliance.org/About_Yoga/Scientific_Research_on_Yoga)