Science of Mindfulness

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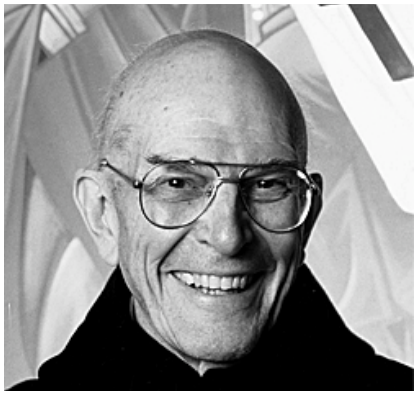


Father Thomas Keating

The Kabbalist, Rembrandt

Maharishi Mahesh Yogi

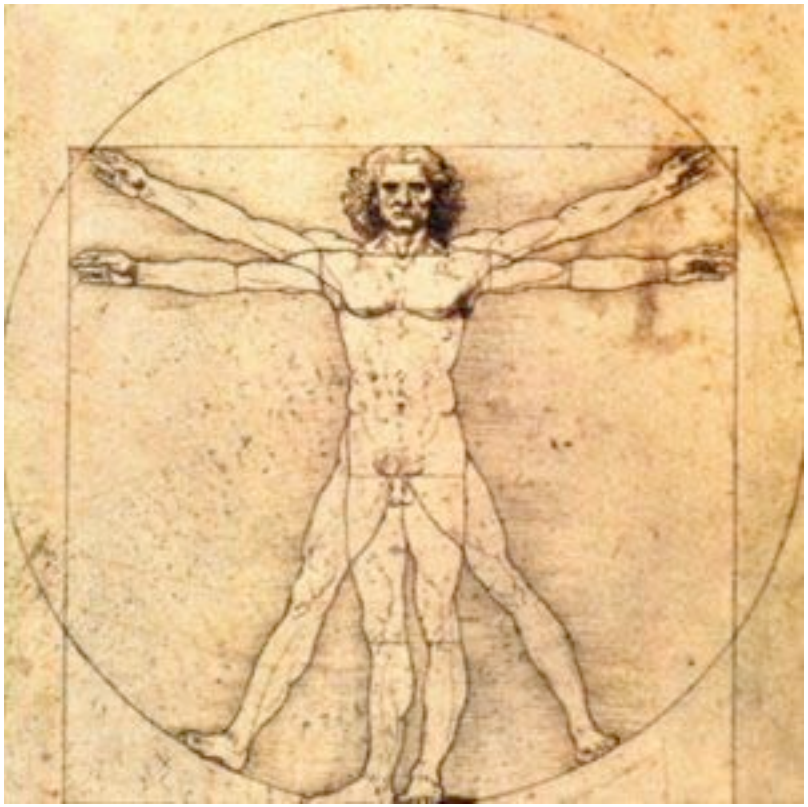
Types of Meditation

- Centering prayer
- Kabbalah
- Transcendental
- Buddhism
  - Zen
  - Tibetan
- Ridhwan/Diamond
- Mindfulness (e.g., MBSR)

Dalai Lama

A. Hameed Ali

John Kabat-Zinn



State of Treatment Research

Table 2
Mean effect size, *d*, 95% confidence intervals (CIs) and *P* values (two-tailed) calculated for the difference between mindfulness meditation and control group on mental health and physical health variables for all controlled studies

	k	*N*	*d*	95%-CI	*P*
Mental health variables					
All studies	10	771	0.54	0.39–0.68	<.0001
Patients	5	236	0.56	0.29–0.83	<.0001
Nonpatients	5	535	0.53	0.36–0.70	<.0001
Randomized	7	434	0.54	0.35–0.74	<.0001
Quasiexperimental	3	337	0.54	0.32–0.76	<.0001
Physical health variables					
All studies (4 patients and 3 randomized)	5	203	0.53	0.23–0.81	<.0004

Subgroups of studies with patients, nonpatients, randomized design and quasi-experimental-design are noted only for mental health measures. The very limited number of studies with physical health variables precluded the usefulness of calculating separate CIs.

Grossman, Niemann, Schmidt, & Walach (2004)

Table 3
Effect of mindfulness training based on a pre–post comparison for mental and physical health variables (k, number of studies; N, number of subjects; d, mean effect size; P value, two-tailed)

Variables	k	N	d	95%-CI	P
Mental health	18	894	0.50	0.43–0.56	$P < .0001$
Physical health	9	566	0.42	0.34–0.50	$P < .0001$

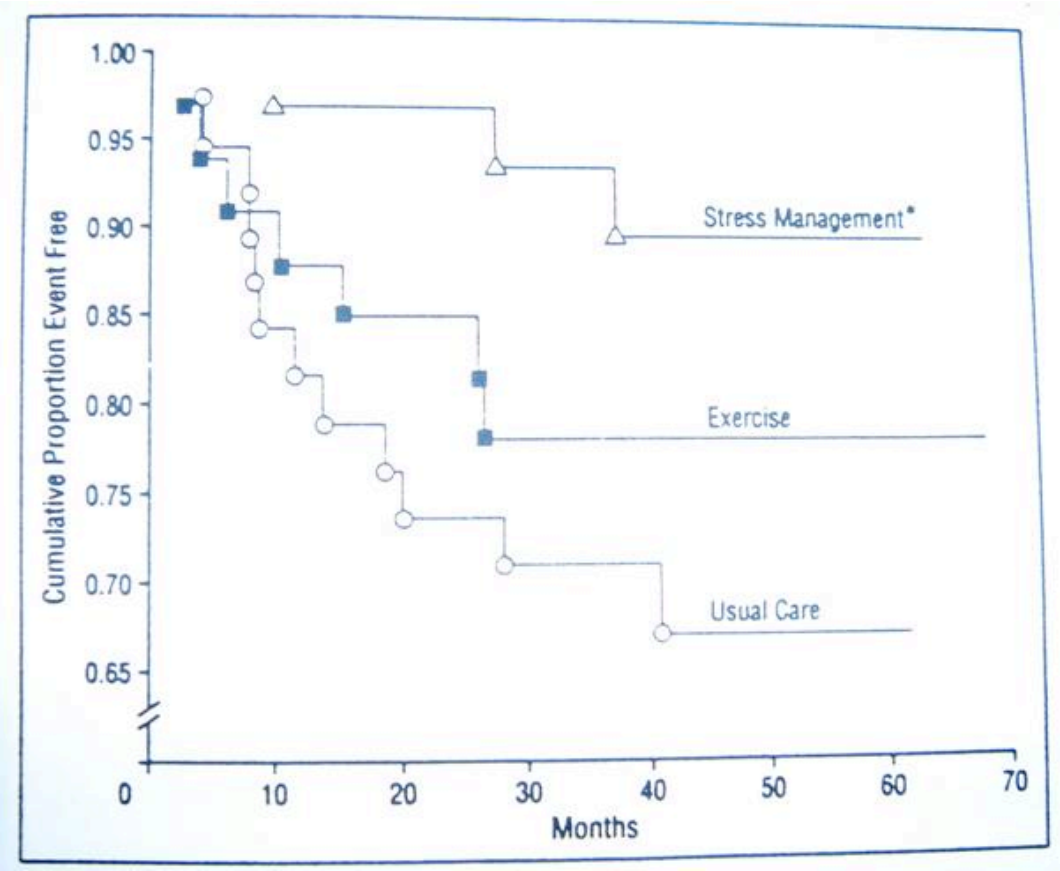
Grossman, Niemann, Schmidt, & Walach (2004)

Mindfulness effective for...

- Anxiety, depression, stress, burnout (e.g., Cohen-Katz, Wiley, et al ., 2005)
- Chronic pain (Kabat-Zinn, 1982; Kabat-Zinn, Lipworth, & Burney, 1985)
- Substance abuse (Bowen, Witkiewitz, Dillworth, et al., 2006)
- Arthritis (Pradhan et al., 2007)
- Diabetes (Gregg, Callaghan, et al., 2007)
- Fibromyalgia (Sephton et al., 2007)
- Positive resting frontal alpha-asymmetry (Barnhofer et al., 2007)
- Psoriasis (Kabat-Zinn et al., 1998)

...and different types of people

- Cancer patients (Speca, Carlson, et al., 2000; Monti, Peterson, et al., 2005; Carlson, Speca, et al., 2007)
- Health care professionals (Shapiro, et al, 2005)
  - Medical Students (Shapiro, et al., 1998)
  - Nurses (Cohen-Katz, Wiley, et al ., 2005)
- Women with heart disease (Tacon, McComb, Caldera, Randolph, 2003)
- Prisoners (Bowen, Witkiewitz, Dillworth, et al., 2006)
- Borderline Personality Disorder (DBT, Linehan, 1993)



Cardiac events. Controlling for age, baseline left ventricular ejection fraction, & history of myocardial infarction (N=107)

Blumenthal, Jiang, Babyak, et al., *Arch Intern Med* (1997)

Factor	Odds ratio for ECRH*	*P*	Odds ratio for event†	*P*
Psychologic distress‡	3.05	0.013	4.39	0.003
No bypass surgical procedure§	2.73	0.026	3.29	0.030
Diabetes	2.65	0.042	2.99	0.048
Ejection fraction <40%	1.98	0.079	2.21	0.080
Previous cardiac event	1.55	0.312	2.08	0.141
Smoking at index event	1.55	0.268	1.55	0.358
Use of β-adrenergic blocker	1.11	0.774	1.18	0.700
Coronary angioplasty§	1.10	0.814	0.99	0.975
Continued smoking	1.03	0.960	1.03	0.975
χ^2	27.018		31.898	
P	<0.0014		<0.0002	

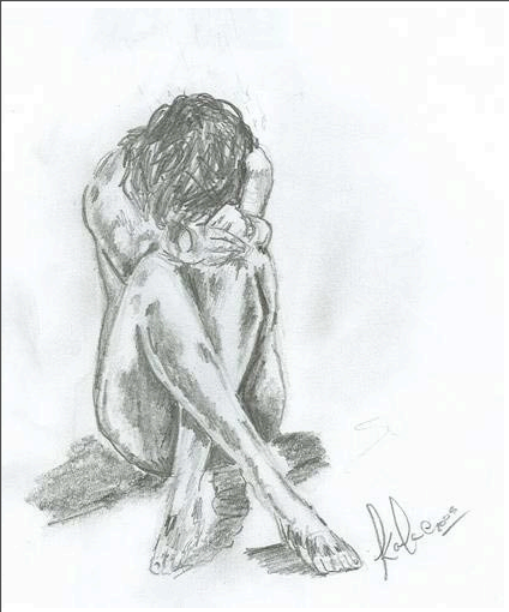
*ECRH = early cardiovascular rehospitalization.
†Recurrent cardiovascular event.
‡Defined as a t score of ≥63 on the General Severity Index of the SCL-90-R (Symptom Checklist-90—Revised).
§During index hospitalization.

Allison, Williams, Miller, et al. *Mayo Clin Proc*. (1995)

Depression: Preventing Relapse

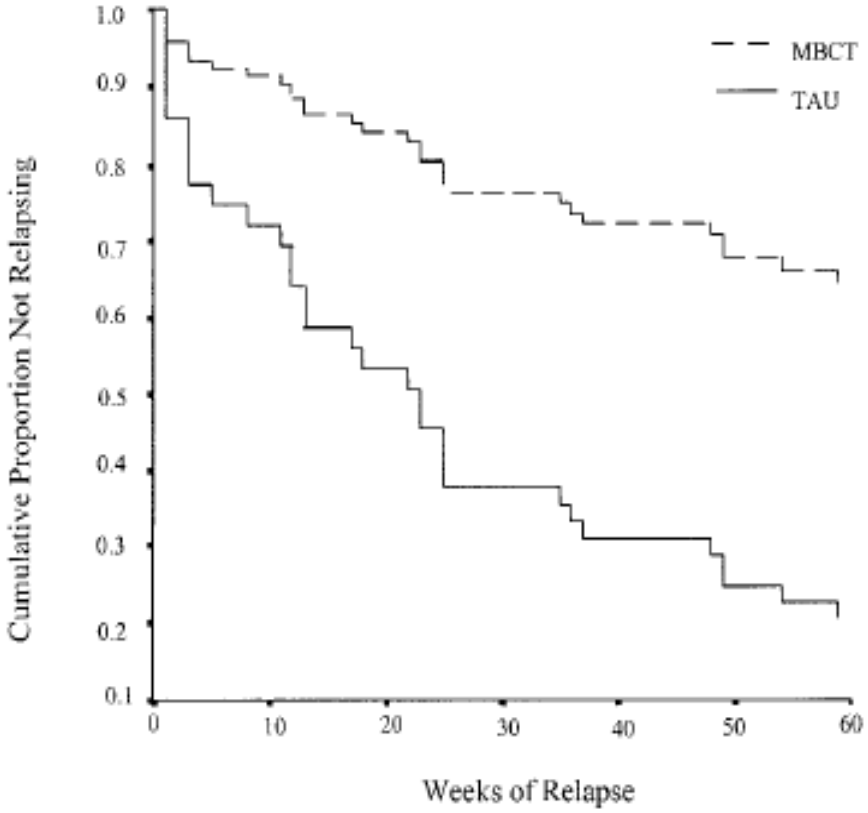
- In remission MDD (n=75)
- Randomly assigned MBCT+TAU vs. TAU
- Measures
  - Measures for treatment inclusion (baseline only)
    - HAM-D (severity of depression)
    - BDI (severity of symptoms of depression)
    - Measures of parenting style (MOPS)
  - Relapse/Recurrence
  - Life events: circumstances provoking relapse if it occurred

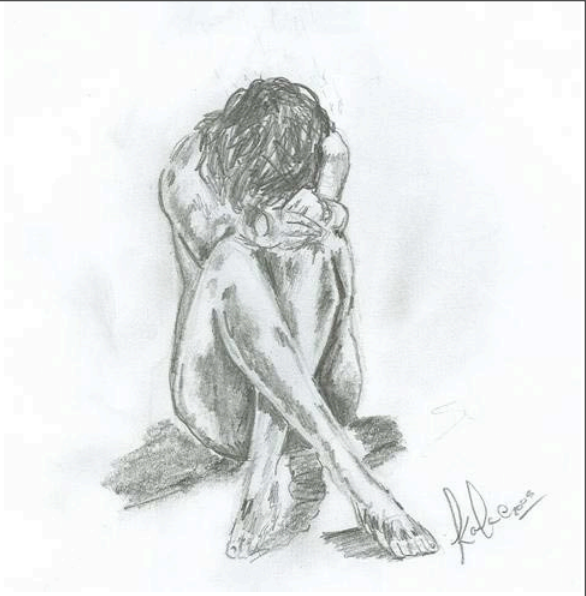
Ma, S. H., Teasdale, J. (2004); see also, Teasdale, Segal, Williams, et al. (2000)



		2 episodes		3 episodes		≥ 4 episodes	
Group	*n*	Rel/Rec	%	Rel/Rec	%	Rel/Rec	%
MBCT	36	4/8	50	4/12	33	6/16	38
TAU	37	2/10	20	9/15	60	12/12	100

- no difference in relapse rate for participants who suffered 2 episodes previously
- results for those who suffered 3 or more



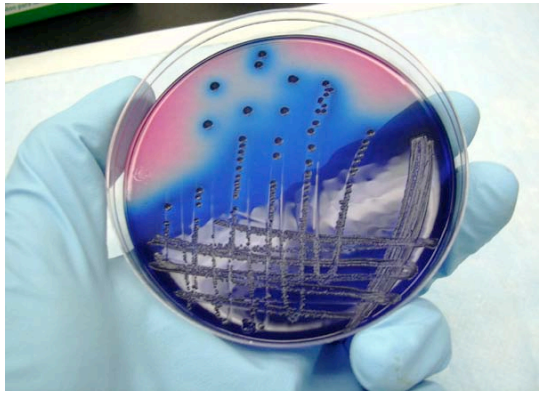


- MBCT > halved relapse rate vs. TAU
- Cost effective
- Limitation: lack of active control matched for MBCT components
- 2-episode and 3-or-more-episode groups different base populations?
  - 2-episode group reported normal childhood, later initial onset of depression, relapse associated with life events
  - MBCT contraindicated for those with less than 3 episodes?

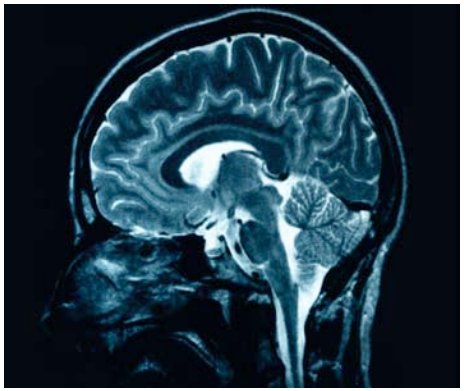
Medical Students

- Randomly assign to MBSR or wait-list (n=78)
- MBSR Results
  - Reduced state and trait anxiety (STAI)
  - Reduced psychological distress (GSI on SCL-90-R)
  - Reduced depression (SCL-90-R)
  - Increased empathy (Empathy Construct Rating Scale)
  - Observed during exam period
  - Replicated in wait-list group

Shapiro, et al, *Jo of Behavioral Med*, 1998



Brain & Immune Function



- Biotech employees randomly assigned to 8-week MBSR or WL
- Results
  - Decreased anxiety (STAI-T & S) & negative affect (PANAS-trait)
  - Increased baseline left-sided anterior brain activation (EEG)
  - Increased antibody titers to influenza vaccine

Davidson, Kabat-Zinn, Schumacher, et al. *Psychosomatic Medicine* (2003)

Fibromyalgia

- Quasi-random to MBSR or Active control
- MBSR more improvement on...
  - Anxiety
  - Depression
  - Pain regulation
  - Quality of life
- Many results held at 3-year follow-up

Grossman, et al. (2007)

Mechanisms of Change?

- Increased control of habitual responding
- Better reality sampling
- Meta-cognitive awareness (Teasdale, et al. 2002)
  - CT & MBST --> increased meta-cog awareness --> decreased depression
  - MBCT reduces overgeneral memory bias (Williams, Teasdale, Segal, & Soulsby, 2000)

Stroop Task

XXXX XXXX XXXX XXXX XXXX
XXXX XXXX XXXX XXXX XXXX XXXX
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XXXX XXXX XXXX XXXX XXXX

Read the font color – as quickly and accurately as possible

Stroop Task

RED BLUE GREEN YELLOW BLUE
YELLOW GREEN RED BLUE GREEN
YELLOW RED GREEN BLUE RED
YELLOW YELLOW GREEN RED BLUE
RED GREEN BLUE YELLOW YELLOW
BLUE RED YELLOW GREEN BLUE RED
GREEN BLUE YELLOW RED

Read the font color – as quickly and accurately as possible

Increased control of habitual responding

- Students randomly assigned to 20 minutes of either…
  - Zen meditation: Focus & return attention to the breath (audio-tape guided)
  - Learning condition: Visualize room & learn list of Yale presidents
  - Sit, rest, & let your minds wander
- 2 training sessions for above & then session 3
  - Pre-post Stroop OR Pre-post Category production & word-stem completion
  - GSR recorded to assess arousal

Wenk-Sormaz, 2005

Results

- GSR % change sig lower in meditation group. Used as covariate in subsequent
- Predict reduced Stroop interference (sig)
- Predict less typical responses to category production & stem completion (n.s.)

Wenk-Sormaz, 2005

Cluttered Room: Attentional Blink

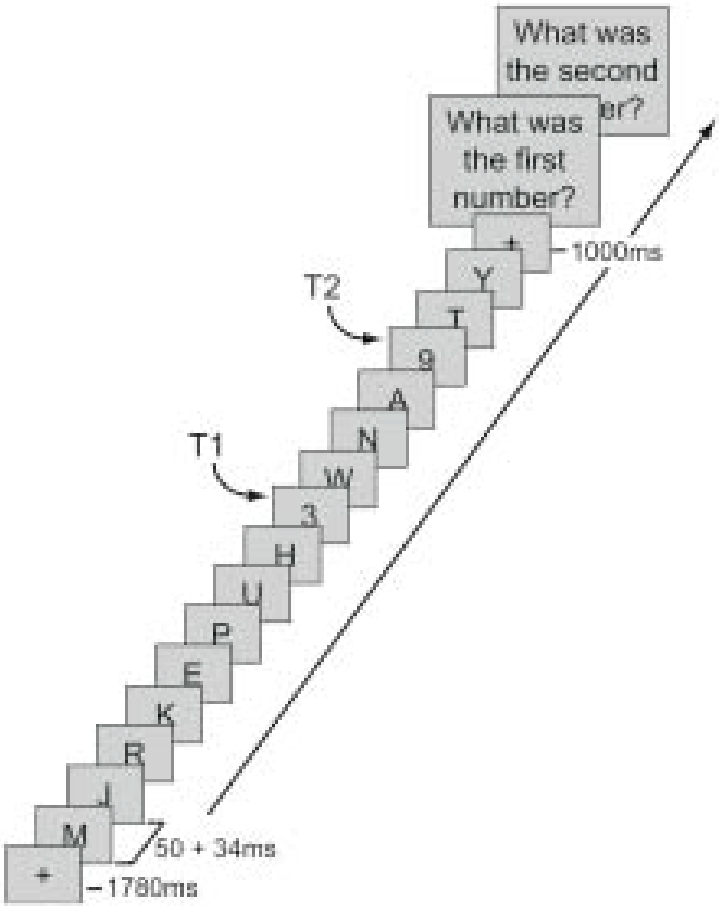
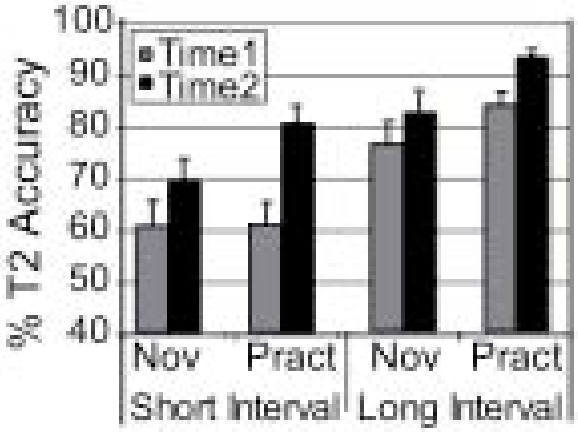


Figure 1. Attentional-Blink Task

- Attention capacity is limited
- Evidenced when 2nd of 2 close targets not seen (close means < 500 ms)

Slagter, Lutz, Greischar, et al. (2007; PLOS Biology)

- 17 experienced practitioners (Ps) vs. 23 novices (Ns)
- Pre-post 3 months (retreat for Ps)
- No diffs at time 1
- Training changes distribution of limited capacity attention
  - reduced blink (increased T2 accuracy)
  - reduced P3b amplitude at 400 ms
  - Greater reductions in P3b associated with better accuracy



336 ms 672 ms

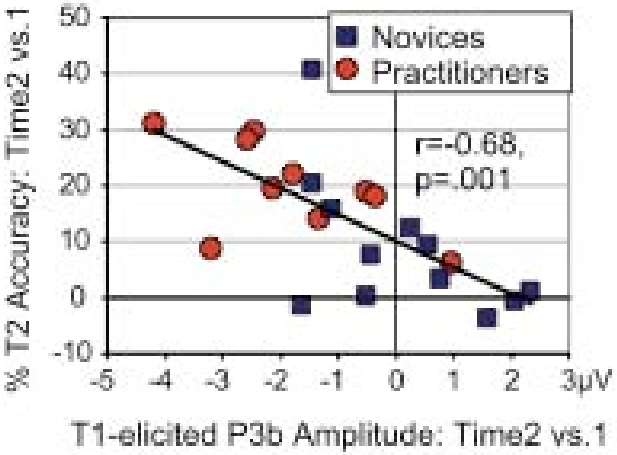


Figure 4. The Ability to Accurately Identify T2 Depends upon the Efficient Processing of T1

Slagter, Lutz, Greischar, et al. (2007; PLOS Biology)

“Spirituality and speed do not go together”

“I do only one thing at a time…

I’m not thinking about anything else...
that I have too much [to do]

totally present in that moment…

in that way I do not feel stress.”

Satish Kumar

“Spirituality and speed do not go together”

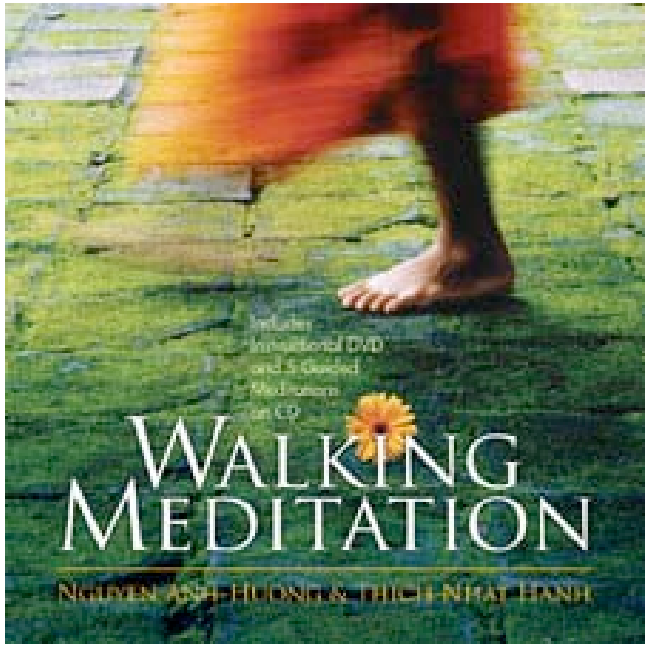
“Whatever work I’m doing...I never hurry.

I say, there’s plenty of time.

“You don’t have to get somewhere quickly.
Getting somewhere is not as important as
how you get there.

So the process of living,
the process of walking,
is more important...”

Satish Kumar

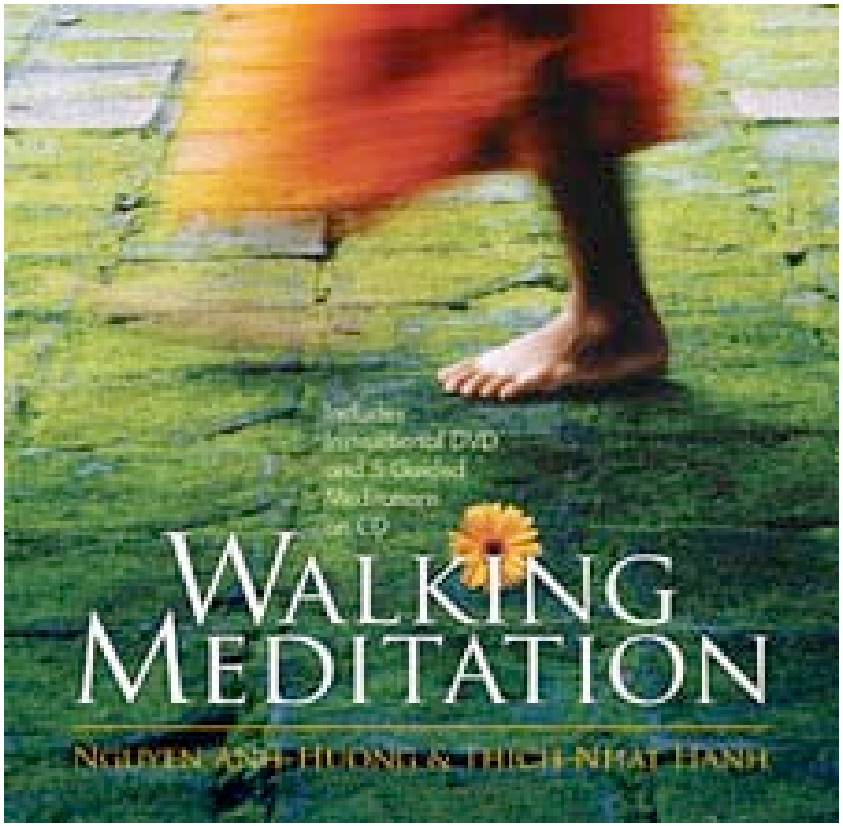


"Going Without Arriving...

In our daily lives, we usually feel pressured to move ahead. We have to hurry. We seldom ask ourselves where it is that we must hurry to.

When you practice walking meditation, you go for a stroll. You have no purpose or direction in space or time. The purpose of walking meditation is walking meditation itself. Going is important, not arriving. Walking meditation is not a means to an end; it is an end. Each step is life..."

-Thich Nhat Hahn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