Learning Objectives

Upon completing this one hour CME presentation, participants will be able to:

1. List 4 or more health benefits of meditation
2. Explain how meditation employs neuroplasticity to enhance brain function
3. Utilize relaxation meditation for personal and professional purposes
4. Learn one additional form of meditation for personal purposes

Outline

I. Neuroplasticity

II. Review the Science of Meditation and Practice Briefly

III. Introduce a New (Ancient) Contemplation Method

Pre-Test

1. New brain neurons are not generated after middle to late adolescence (T) (F)
2. Childhood development and genetic inheritance are the sole determinants of the “happiness set point” (T) (F)
3. Neuroplastic changes develop equally well in both attended and unattended states (T) (F)
Neuroplasticity Mechanisms

1. Changing activity in activation/inhibition (glutamate/GABA)
2. Long Term Potentiation (NMDA receptor)
3. Increase of synaptic activity
4. Increase of gray matter-neuronal connections
5. Increase of gray matter-neurons

Centers Involved with Researching Meditation and Positive Emotions

Can You Build a Better Brain?

Sharon Begley January 03, 2011 Newsweek

Functional Neuroimaging Laboratory, Brigham & Women's Hospital
Harvard Medical School
Institute for Empirical Research in Economics
University of Zürich
The Jha Lab – University of Miami
Mind Führung Awareness Research Center – LMU
National Institute of Advanced Studies
Neuropsychology, Emotion, and Memory Lab
University of Arizona Department of Psychology
Omega Institute for Holistic Studies – University of Toronto
Positive Emotions and Psychophysiology Lab
University of North Carolina at Chapel Hill
Prevention Research Center – Penn State
Social Neuroscience Department – Max Planck Institute for Human Cognitive and Brain Sciences, Leipzig

Neuroplasticity

Brain changes that occur in response to experience

Davidson and Lutz 2010
London Black Cab

TX1

“The Knowledge” Website

“All-London drivers - need a detailed knowledge of London within a six mile radius of Charing Cross.

All-London drivers have to learn 320 routes. They also need to know all the landmarks and places of interest along the runs.

It takes between two and four years to pass the All-London Knowledge.”

“The Knowledge”

- The Knowledge makes your brain grow
- Doing the Knowledge makes your brain bigger, says research by the Wellcome Department of Imaging Neuroscience.
- Researchers scanned the brains of 16 London taxi drivers who had spent an average of two years learning the Knowledge. They found the cabbies had a larger hippocampus - an area associated with memory - than control subjects.

Navigation-related structural change in the hippocampi of taxi drivers  Maguire et al. 2000

Posterior Hippocampus – Navigation
Other Findings

- Positive correlation between posterior hippocampal volume and years served as a black cab driver

- What causes the increase in volume, neurogenesis or synaptogenesis?

- What are the implications of smaller anterior hippocampus sizes in drivers?

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Neuroplasticity – Increases in Gray Matter

In medical students’ hippocampi after preparing for major exams in Germany

Increases of dentate gyrus volume with exercise-synaptogenesis vs neurogenesis (in mice neurogenesis is meaningful only in the context of an enriched environment)

Increase of gray matter in visual cortex in those recently taught juggling

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Neuroplasticity Summary

1. We’ve known that children and adolescents have remarkable neuroplasticity, but we now find this in adults
2. These are “attended” activities, i.e., people direct their attention with some degree of effort
3. This suggests that all attended activities have the potential to evoke neuroplastic changes
Can we use our mind to transform our brain?

Would we like to:
- slow brain aging?
- increase attention?
- shift the happiness set point?

Is this possible?

Meditation: The act of utilizing attention to guide changes in brain function and structure

Barnes and Bloom 2008

Individuals who used meditation in the previous 12 months

<table>
<thead>
<tr>
<th>Year</th>
<th>Percentage of the population</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>7.6</td>
</tr>
<tr>
<td>2007</td>
<td>9.2 (20 million)</td>
</tr>
</tbody>
</table>

Meditation

Meditatum (latin): to ponder

India >4000 years ago

Even earlier?
Did Meditating Make Us Human?

“Campfire rituals of focused attention created Baldwinian selection for enhanced working memory among our Homo sapiens ancestors....”

Rossano 2007 Cambridge Archeological Journal

II. Review the Science of Specific Meditation Techniques and Practice

Meditation Techniques

1. Concentration
2. Mindfulness
3. Compassion
4. Contemplation

Relaxation Response

H. Benson, M.D.

1. Sit in a quiet area for 20 minutes or more
2. Direct your mind to an object of focus such as your breath, thinking “In” as you breathe in and “Out” as you breathe out
3. When your mind drifts away as it inevitably will, passively direct it back
Relaxation Response

1. Is effective even though the mind drifts away as long as it is returned to the object of concentration without judging the “monkey mind”
2. Practice 20 minutes
3. Every patient who experiences anxiety and especially every patient who is prescribed a benzodiazepine is requested to add this technique to their “tool kit”
4. Can be used in clinic

Meditation Techniques

1. Concentration – directing attention to a point of focus
2. Mindfulness - awareness that new objects have arisen in the mind
**Mindfulness Meditation**

1. Awareness of the mind drifting away from the breath
2. Observe objects arising in the mind
3. Recognize and accurately label emotions
4. More refined self-awareness
5. Psychotherapists are taught mindfulness and utilize mindfulness
6. **Practitioners can use this in clinic**

**Mindfulness Meditation**

1. Treats anxiety, pain, depression
2. Mindfulness based CBT was no less effective than antidepressant medications in the long term treatment of depression
3. Reduces stress
4. Improving emotional regulation
5. Changes frontal cortex dominance (positive emotions)

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**Meditation experience is associated with increased cortical thickness**  
Lazar et al. 2005

Meditators (n=20) with 9.2 years of experience who practiced 6.3 h per week compared to controls (n=15)

- Increases of gray matter volume at Broadman area 9/10 and the insula
- “Area 9/10 has been shown to be involved in the integration of emotion and cognition”
- Older meditators demonstrated less cortical thinning compared to age-matched controls
Mindfulness practice leads to increases in regional brain gray matter density
Holzel et al. 2011

8 week intervention of mindfulness versus waitlist controls (n=16/17)
Weekly 2.5 hour group meetings plus 1 full day (6.5 h) during week 6 of the course
Include a body scan, mindful yoga, and sitting meditation. Use mindfulness when possible throughout the day
Results: mindfulness group practiced 27 minutes a day
Brain volume increased at left hippocampus-emotional regulation, posterior cingulate cortex-relevance or significance of a stimulus to oneself, temporo-parietal junction-conscious experience of the self

Change in Left Hippocampus Volume Over 8 weeks Holzel et al. 2011

The Method
1. Establish concentration on the breath
2. When extraneous thoughts or feelings arise simply observe them
3. Do not judge the thoughts or feelings
4. When you find that you are no longer observing these phenomena, then either redirect your attention back to them or return your focus to the breath

Gray Matter Increases Associated with Meditation
Adapted from Holzel et al. 2011
Learning Objectives

Upon completing this one hour CME presentation, participants will be able to:

2. Explain how meditation employs neuroplasticity to enhance brain function-

Repetitive, attention-directed brain activity reinforces brain circuitry and increases gray matter volume. Increased gray matter volume likely reflects greater numbers of neuronal interconnections (and possibly increases of hippocampal neurons)

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Individual Differences in Anterior Brain Asymmetry and Fundamental Dimensions of Emotion Tomarken et al. 1992
Happiness Set Point

Left prefrontal dominance (EEG and FMRI) correlates with positive affect
Right sided dominance is associated with negative affect
Stroke victims- left sided strokes produce sadness and right sided strokes produce elevations of affect

Alterations in Brain and Immune Function Produced by Mindfulness Meditation
Davidson et al. 2003

25 active; 15 controls
8 week intensive mindfulness meditation retreat
Obtained data before, after, 4 months after
Significant left sided asymmetry in the meditation group after the intervention

State Effects of Two Forms of Meditation on Prefrontal EEG Asymmetry in Previously Depressed Individuals
Thorsten Banhofer 2010

Three groups: mindfulness meditation (n=8), loving kindness (n=7), and controls (n=8)
Response Style Questionnaire (RSQ) total and RSQ brooding subscale
continuing attempts to reduce discrepancies between current and desired states
Alpha asymmetry in the PFC
High brooding demonstrated increased LPFC activity with concentration meditation
Low brooding demonstrated increased LPFC activity with loving kindness intervention

Brain activation during compassion meditation: a case study
Engstrom and Soderfeldt 2010

Advance meditator practicing compassion meditation
Left medial prefrontal cortex extending to the anterior cingulate gyrus
Activation in brain areas involved with empathy as well as with happy and pleasant feelings (i.e., the left medial prefrontal cortex and the anterior cingulate gyrus).
Compassion Meditation

Begin by hoping for happiness and well-being

Then extend this to friends and family

Then generalize this so that you are hoping that all beings are happy and well

A Contemplation on Impermanence to Decrease the Emotional Effects of Change

Everyone in this room has observed nature and its changes

Seasons pass, trees change, our bodies change, our minds change

Thoughts and feelings arise and pass

Everything with a material basis is subject to cause and effect

Impermanence

Stress arises because we seek to make that which is impermanent permanent

Anything that our mind clings onto in a way that conflicts with nature will produce stress

The stronger the clinging the greater the discomfort when the object passes according to nature

We are not “judging” as to whether or not such clinging is good or bad

We are simply seeing the truth of attachment and letting it go

If performed accurately negative affects will not arise

Summary

1. Data indicate meditation has the potential to enhance physical and mental health
2. It adjusts brain circuitry and structure
3. Benefits are gained even by brief periods of practice
4. Using sophisticated strategies tailored to the individual may optimize its benefits
5. The greatest benefits may be gained by using these techniques in combination