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Review article

## Mindfulness meditation and consciousness: An integrative neuroscientific perspective



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### ABSTRACT

Although mindfulness meditation has been practiced in the East for more than two millennia, Western scientific research and healthcare programs have only recently drawn their attention to it. Basically, the concept of mindfulness hinges on focusing on one's own awareness at the present moment. In this review we analyze different hypotheses about the functioning and the cerebral correlates of mindfulness meditation. Since mindfulness is strictly associated with a particular state of consciousness, we also examine some of the most relevant theories that have been proposed as accounts of consciousness. Finally, we suggest that consciousness and mindfulness meditation can be integrated within a neuroscientific perspective, by identifying the brain areas which seem to play an essential role in both, namely the anterior cingulate cortex, posterior cingulate cortex, insula and thalamus.

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## 1. Introduction

Meditation is a practice that has existed for many centuries. It involves different techniques and can be found in a variety of cultural traditions, ranging from Indian and Chinese to the Arab and Western worlds. However, meditation has traditionally been associated with the Eastern culture and spirituality, especially with the Indian religion of Hinduism – whose ancient scriptures (The Vedas) report the earliest references to this practice – and the philosophy of Buddhism, which holds meditation as a key part of its doctrine (Siegel, Germer, & Olendzki, 2008).

In recent years Western societies have become more accustomed to meditation, in particular through the interest that Buddhism has attracted by virtue of the charismatic figure of the current Dalai Lama Tenzin Gyatso. Moreover, meditative practices have been investigated by a number of scientific studies, whose findings have gained increasing attention in healthcare treatment programs within psychotherapeutic contexts (Samuel, 2014; Tang, Holzel, & Posner, 2015).

Although meditation escapes a univocal definition, it is nonetheless possible to intuitively deduce what it is by saying what it is not. Meditation is neither a method for clearing the mind nor a method for reaching emotional imperturbability. It is not a way to pursue a state of beatitude or a way to avoid sorrow and pain (Siegel et al., 2008). Nor does it imply a secluded life.

Often the meditative state is improperly associated with esotericism and mysticism. But as the Theravada monk Nyana-ponika Thera clearly highlights: “Mindfulness [...] is not at all a ‘mystical’ state, beyond the ken and reach of the average person. It is, on the contrary, something quite simple and common, and very familiar to us. In its elementary manifestation, known under the term ‘attention’, it is one of the cardinal functions of consciousness without which there cannot be perception of any object at all.” (Thera, 1962). As we shall see, this position places meditation directly in the spotlight of neuroscience.

Although there are many different meditation techniques, all of them share the fundamental aspect of “sati”, a Pali word translated into English as “mindfulness” for the first time in 1921 (Awasthi, 2012; Siegel et al., 2008). Sati is also a core concept of Buddhist philosophy. Jon Kabat-Zinn, who pioneered the mindfulness approach within the therapeutic context, defines this state of mind as “the awareness that emerges through paying attention on purpose, in the present moment, and nonjudgmentally to the unfolding of experience moment to moment” (Kabat-Zinn, 2003).

This review aims to integrate the findings of studies that have used functional Magnetic Resonance Imaging (fMRI) to investigate the morphological and functional modifications observed in people practicing meditation with what neuroscientists have thus far discovered about the neural processes that promote the emergence and maintenance of consciousness.

## 2. Different styles of meditation

According to Siegel et al. (2008) we can distinguish three meditative techniques within the general framework of “Mindfulness Based Meditation” (MBM)

### 2.1. Concentration meditation

This technique is based on focusing on a specific object, such as the breath or a mantra. The guideline is to gently bring the mind back to the focal object whenever you notice that you are wandering. The Pali term for this technique is “Samatha bhavana”, which can be translated into English as “to foster concentration”.

### 2.2. Mindfulness meditation

This technique does not use a focal object but rather encourages the exploration of the ever-changing experience as it unfolds through time. The guideline is to pay attention to whatever flickers across consciousness from one moment to the next. The Pali term for this technique is “Vipassana bhavana”, which translates as “to foster interior awareness”.

### 2.3. Loving-kindness meditation

With this technique the mind is led to concentrate on gentle statements such as “May I and all the other creatures be safe, happy, healthy and live in simplicity”. The aim is to soften emotions and observe the experience with a non-judgmental

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