

A mindful approach to the year: will your brain thank you for it?

Now that the champagne has long gone flat and New Year's celebrations are a distant memory, it is time to turn your thoughts to the months ahead. Just as in previous years, the most popular resolutions for 2018 **(1)** concern health-related habits and behaviours such as eating better, exercising more, getting more sleep, learning a new skill, finding a new hobby and making new friends.

Neuroscientists at the University of Oxford are writing a series of blog posts about how the brain works in an attempt to answer the many questions submitted by members of the public to The Big Brain Competition **(2)**, part of the Brain Diaries exhibition. The first posts explored what we know about the benefits of physical and social activity, and the right amount of sleep for the brain **(3)**, as well as how changes in the brain allow you to learn a new skill **(4)**. But what do we know about the effects of mindfulness meditation and yoga on the brain? Could it be that taking up or continuing with one of these fashionable practices in 2018 will benefit your brain?

Stress and the brain

Stress is inevitable, but the amount of it and how you approach it can make a huge difference to its effect on your performance, your health and happiness in the long run. If a stressful event is brief or is perceived positively, it can give your performance a boost, for example when you are running a half-marathon. Your brain has an important role in evaluating a stressful situation (via the amygdala, an almond shaped group of neurons that sits deep on each side of the brain and is responsible for our emotions) as well as responding to it (via the hypothalamus, which links the nervous and endocrine systems via secretion of hormones from the pituitary and adrenal glands). Your brain makes sure your adrenalin levels are increased to keep you running throughout the race. When the event is over, feedback loops in the stress system shut the response down and bring it back to baseline (via the hippocampus, a seahorse-shaped structure responsible for emotions and memory formation, and the frontal cortex, involved in decision making and executive function).

This system served us well during evolution, when challenging events were immediate and brief, such as being chased by a predator. Modern life, however, has its hidden sources of psychological stress. Unexpected, traumatic, recurring or ongoing stressful events can damage the feedback loops of the stress system, either attenuating the stress response or sending it into overdrive. Both these outcomes are harmful for the brain regions that regulate the stress response, which are also implicated in mental illness such as post-traumatic stress disorder, depressive and cognitive disorders.

In a study of healthy post-menopausal women, self-reported, perceived levels of stress were associated with a smaller hippocampus, 20 years after the stress was experienced **(5)**. At the Department of Psychiatry, University of Oxford we enrolled 800 British Civil servants in the Whitehall II study **(6)** for a magnetic resonance imaging (MRI) scan to investigate how various health and lifestyle measures in mid-life predict what the brain looks like post retirement. We found that multisystem physiological markers of the repeated or prolonged

stress response measured as early as 20 years before the MRI scan were associated with lower structural brain integrity (i.e. smaller grey matter volume in regions that are involved in the stress response and those that are prone to strokes, and wide-spread lower white matter diffusivity). This is an interesting finding, because it suggests that your brain may thank you for doing something to reduce your stress levels, as early as in your 40s.

While chronic stress can speed up the ageing process and age us in the long run, immediate effects have also been observed on the brain. In an MRI study a small group of healthy adults (7), who experienced stressful events over a three-month period, ended up with reduced volumes of grey matter in brain regions regulating the stress response. This shrinkage was not due to differences in IQ or stressful events experienced before the three-month window. Although the sample size of the study was small and participants were young, these results do point to an important characteristic of the brain: that it is capable of a high degree of plasticity. If brain cells have the ability to change and adapt, is there anything we can do to protect them from stress?

Mind-body practices that minimise the effects of everyday stress

Mindfulness and mindfulness meditation originate in Buddhist traditions, where they are practised to develop insight, self-awareness and wisdom, with the ultimate goal of reaching enlightenment (freedom from suffering, detachment, and 'emptiness'). In the West, they have grown into fashionable non-pharmacological stress-reduction techniques over the past four decades. The notion behind modern mindfulness is that we can de-stress and increase psychological well-being by changing our relationship to our experience.

Mindfulness is the psychological process of being aware of the present moment, in an open, accepting, non-judgemental way. It can be cultivated through mindfulness meditation, which involves a period of physical stillness where we non-reactively engage with our immediate experience by focusing on an attentional anchor (e.g. breath, physical sensation, sounds in our surroundings). When distracting sensations or thoughts arise, we notice, acknowledge and accept them without wanting to change them, before returning our attention to the anchor. Mindfulness meditation works by enhancing attention, emotion regulation, body awareness, and self-awareness of a non-judgmental nature. Over time the practitioner will cultivate a sense of composure, which can be relied on in difficult situations. Exerting greater self-control results in better regulation of emotion and thought processes, thus in adaptive responses to stress, which indirectly alleviate its adverse effects. A regular mindfulness practice reportedly improves executive functions such as attention and working memory, immune function, mood, and happiness.

One way in which mindfulness is thought to increase our experience of happiness is by helping to reduce the gap between our current and ideal selves (i.e. how we see ourselves and our attributes now, and how we wish to be, what we aspire to). Self-compassion and acceptance, which are inherent in mindfulness practices, may help evaluate our current selves more positively, while non-judgemental awareness may help us set realistic expectations for our ideal selves, all the while focusing on our experiences in the present rather than comparing ourselves to some unachievable ideal.

Thinking of happiness as a skill which we can develop rather than something that happens to us might be the key ingredient of mindfulness (8), argued by neuroscientists Richard Davidson, Amishi Jha and mindfulness expert Jon Kabat-Zin. They also speculate that cultivating skills of mindfulness early on in life will have lasting benefits on both our mental well-being and our brains. It will be some time before we can answer this question, but relevant studies are already underway. One of them is the Mindfulness and Resilience in Adolescence (MYRIAD (9)) project, run by researchers at the University of Oxford, University College London and the Medical Research Council. It investigates whether mindfulness training improves resilience in adolescence, a crucial period when 50% of mental disorders develop, and whether implementing the training in the curriculum would be (cost-) effective.

Numerous studies have started to address how meditation may shape the structure and function of the brain. Although the studies use different types of brain imaging techniques and have varying sample sizes and timescales, some common themes and conclusions emerge. A recent meta-analysis (10) aggregated rigorously designed mindfulness meditation studies, such as longitudinal studies and randomised control trials (RCT) with active control groups that examined changes in brain activity, neural connectivity, and structure. Areas involved in cognitive processing and executive control (prefrontal cortex), attention (anterior and posterior cingulate), sensory awareness (insula), reward, learning, and motivation (striatum), and emotion processing (amygdala) were consistently positively affected.

Yoga is a physically active form of mind-body practice, a mindful physical exercise or moving meditation. It is practised in many forms and environments but is commonly characterised by the mindful placement of anatomical alignment and postures (asanas) along with breath control (pranayama). It aims to integrate the often disparate mind and body, to quieten them and achieve a state of focus or meditation. Practising yoga benefits our physical, mental and spiritual health, for example by improved posture and flexibility, respiratory function and lung capacity, cardiovascular function, pain relief, reduced levels of anxiety, stress and feelings of depression, compassion and greater sense of self.

Both meditation and yoga practices vary in aims, scope, and length, and therefore presumably in the brain regions that are affected. A recent review (11) found that the following areas of the brain were uniquely involved in yoga but not in mindfulness meditation: those that serve cognitive and executive functions, such as working memory and the evaluation of rewards, a sense of agency and self-control (dorsolateral prefrontal cortex), social cognition, such as making self-other judgments (medial frontal cortex), and language (superior temporal lobe and paracentral lobule), spatial processing and social perceptions (superior temporal lobe), tactile stimulation and movement (precentral and postcentral gyrus), and integration of sensorimotor information (superior parietal lobule). The amygdala, known for its role in processing emotionally salient information, showed less activation.

Both mindfulness meditation and yoga therefore may promote well-being via the neural circuits that regulate memory, emotions, and conscious awareness that are often disrupted by cerebrovascular and neurodegenerative changes that become more prominent as we

age. These practices may be especially useful for brain fitness in older adults; increasing resilience against mood, cognitive and physical disorders. Future studies will need to explore how strong and lasting these brain changes are, whether they are present with all types of meditation techniques and across all ages, and which aspects of mindfulness and meditation are responsible for the changes. For example, does the meditation itself result in positive outcomes, or is it about learning to be self-aware in a supportive group environment? And more crucially, why does it only work for some?

Words of caution

Mindfulness is popularised as a technique that has only positive effects, lots of them. Since most of us rarely sit alone pondering our thoughts, it is easy to see how challenging experiences might surface during meditation, which many of us are not equipped to deal with. A recent qualitative study of regular practitioners of Buddhist meditation (12), without any form of illness, reported both positive and negative experiences in eight domains. For example, in the affective domain participants reported experiencing feelings of happiness but also fear, anxiety, panic or paranoia. Buddhist meditation is practised in order to reach enlightenment, which requires a radical shift in the perception of both self and world that could result in experiencing uncomfortable thoughts. In its modern adaptations as a popular form of health promotion, such radical shifts in perception are not the aim, which is perhaps why the potential for psychological disturbance is often not highlighted or addressed by teachers and researchers. Perhaps we should keep in mind that mindfulness is not a one-size-fits-all technique without possible side effects, nor is it appropriate for everyone, in any form, anywhere at any time. Just imagine sitting with and breathing through your pneumonia, accepting it as okay and hoping it will pass without medical attention.

So, should you resolve to engage in mindfulness or meditative practices this year and many more to come? Why not try and see for yourself? But first vow to take caution and choose your teachers and sources of information mindfully.

Written by

Dr Enikő Zsoldos (13), psychologist and postdoctoral researcher in the Neurobiology of Ageing group, Department of Psychiatry.

References to link to text within article

- (1) http://d25d2506sfb94s.cloudfront.net/cumulus_uploads/document/366cvmcg44/New%20Year%20Survey,%20December%20%2011,%202017.pdf
- (2) <http://www.oum.ox.ac.uk/braindiaries/>
- (3) <https://medium.com/oxford-university/how-is-your-lifestyle-affecting-your-brain-43fb9d988a22>
- (4) <https://medium.com/oxford-university/the-amazing-phenomenon-of-muscle-memory-fb1cc4c4726>
- (5) <https://www.ncbi.nlm.nih.gov/pubmed/17275340?dopt=Abstract>
- (6) <https://www.psych.ox.ac.uk/research/neurobiology-of-ageing/research-projects-1/whitehall-oxford>

- (7) <https://www.ncbi.nlm.nih.gov/pubmed/?term=Effects+of+stressful+life+events+on+human+brain+structure%3A+A+longitudinal+voxel-based+morphometry+study>
- (8) <http://onlinelibrary.wiley.com/doi/10.1111/nyas.12203/epdf>
- (9) <http://oxfordmindfulness.org/project/myriad/>
- (10) <https://www.ncbi.nlm.nih.gov/pubmed/25783612>
- (11) <https://www.ncbi.nlm.nih.gov/pubmed/27909646>
- (12) <http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0176239>
- (13) <https://www.psych.ox.ac.uk/team/eniko-zsoldos>