

## The Yogi masters were right – breathing exercises can sharpen your mind

*New research explains link between breath-focused meditation and brain health*

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It has long been claimed by Yogis and Buddhists that meditation and ancient breath-focused practices, such as pranayama, strengthen our ability to focus on tasks. A new study by researchers at Trinity College Dublin explains for the first time the neurophysiological link between breathing and attention.

Breath-focused meditation and yogic breathing practices have numerous known cognitive benefits, including increased ability to focus, decreased mind wandering, improved arousal levels, more positive emotions, decreased emotional reactivity, along with many others. To date, however, no direct neurophysiological link between respiration and cognition has been suggested.

The research shows for the first time that breathing – a key element of meditation and mindfulness practices – directly affects the levels of a natural chemical messenger in the brain called noradrenaline. This chemical messenger is released when we are challenged, curious, exercised, focused or emotionally aroused, and, if produced at the right levels, helps the brain grow new connections, like a brain fertiliser. The way we breathe, in other words, directly affects the chemistry of our brains in a way that can enhance our attention and improve our brain health.

The study, carried out by researchers at Trinity College Institute of Neuroscience and the Global Brain Health Institute at Trinity, found that participants who focused well while undertaking a task that demanded a lot of attention had greater synchronisation between their breathing patterns and their attention, than those who had poor focus. The authors believe that it may be possible to use breath-control practices to stabilise attention and boost brain health.

Michael Melnychuk, PhD candidate at the Trinity College Institute of Neuroscience, Trinity, and lead author of the study, explained: “Practitioners of yoga have claimed for some 2,500 years, that respiration influences the mind. In our study we looked for a neurophysiological link that could help explain these claims by measuring breathing, reaction time, and brain activity in a small area in the brainstem called the locus coeruleus, where noradrenaline is made. Noradrenaline is an all-purpose action system in the brain. When we are stressed we produce too much noradrenaline and we can’t focus. When we feel sluggish, we produce too little and again, we can't focus. There is a sweet spot of noradrenaline in which our emotions, thinking and memory are much clearer.”

“This study has shown that as you breathe in locus coeruleus activity is increasing slightly, and as you breathe out it decreases. Put simply this means that our attention is influenced by our breath and that it rises and falls with the cycle of respiration. It is possible that by focusing on and regulating your breathing you can optimise your attention level and likewise, by focusing on your attention level, your breathing becomes more synchronised.”

The research provides deeper scientific understanding of the neurophysiological mechanisms which underlie ancient meditation practices. The findings were recently published in a paper entitled 'Coupling of respiration and attention via the locus coeruleus: Effects of meditation and pranayama' in the journal *Psychophysiology*. Further research could help with the development of non-pharmacological therapies for people with attention compromised conditions such as ADHD and traumatic brain injury and in supporting cognition in older people.

There are traditionally two types of breath-focused practices — those that emphasise focus on breathing (mindfulness), and those that require breathing to be controlled (deep breathing practices such as pranayama). In cases when a person's attention is compromised, practices which emphasise concentration and focus, such as mindfulness, where the individual focuses on feeling the sensations of respiration but make no effort to control them, could possibly be most beneficial. In cases where a person's level of arousal is the cause of poor attention, for example drowsiness while driving, a pounding heart during an exam, or during a panic attack, it should be possible to alter the level of arousal in the body by controlling breathing. Both of these techniques have been shown to be effective in both the short and the long term.

Ian Robertson, Co-Director of the Global Brain Health Institute at Trinity and Principal Investigator of the study added: "Yogis and Buddhist practitioners have long considered the breath an especially suitable object for meditation. It is believed that by observing the breath, and regulating it in precise ways—a practice known as pranayama—changes in arousal, attention, and emotional control that can be of great benefit to the meditator are realised. Our research finds that there is evidence to support the view that there is a strong connection between breath-centred practices and a steadiness of mind."

"Our findings could have particular implications for research into brain ageing. Brains typically lose mass as they age, but less so in the brains of long term meditators. More 'youthful' brains have a reduced risk of dementia and mindfulness meditation techniques actually strengthen brain networks. Our research offers one possible reason for this - using our breath to control one of the brain's natural chemical messengers, noradrenaline, which in the right 'dose' helps the brain grow new connections between cells. This study provides one more reason for everyone to boost the health of their brain using a whole range of activities ranging from aerobic exercise to mindfulness meditation."

The full paper 'Coupling of respiration and attention via the locus coeruleus: Effects of meditation and pranayama' is available here: <https://onlinelibrary.wiley.com/doi/10.1111/psyp.13091>

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