



Vagus thinking: Meditate your way to better health

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Wishful thinking (Image: Kelly Dyson)

The vagus nerve underpins everything from your health and well-being to friendships and happiness, and you can think it into working better

EVERY day, Nancy Havill tries to think kind thoughts about other people. Sometimes, she does this while sitting on a cushion in front of a candle and a bowl of smooth pebbles. "But I also like the informal practice, when I am walking around my neighbourhood, or from the bus stop, and I send random kind thoughts to the people I encounter," she says.

It all sounds rather New Age. But Havill is no credulous crystal-wielding hippy. She is a research associate at the University of North Carolina at Chapel Hill, where psychologist Barbara Fredrickson has uncovered a surprising link between meditating on kind thoughts and a whole range of indicators of physical health and mental well-being. It might boost your immune system, protect you from cardiovascular disease, reduce vulnerability to stress, improve thinking and emotional control, and even raise levels of empathy, sociability and self-esteem.

Too good to be true? Perhaps, but in recent years, evidence linking physical health and psychological well-being has been steadily accumulating. "We all know these two are intricately connected, and in fact are integrated parts of one system," says [Elissa Epel](#) at the University of California, San Francisco. So ideas that a decade ago might have been dismissed out of hand are now gaining wider acceptance.

In this case, the object of attention is the **vagus nerve**, also known as the 10th cranial nerve, which connects your brain to internal organs including the lungs, digestive tract and, most notably, the heart. That much has been apparent since the second century when the Roman anatomist Galen of Pergamon explored the human nervous system. We now know that the vagus is a key component of the parasympathetic nervous system – the branch of the nervous system that works subconsciously to calm you down after a stressful event. When you are threatened or insulted, you experience the "fight or flight" response; your body goes on full alert and your heart races, priming you to act. When danger passes, or action is not required, it is the vagal nerve that soothes you, returning your body to a relaxed state in which it can engage in other important pastimes such as digestion and sexual arousal. The stronger the activity of your vagus, the more readily you assume this "feed and breed" state rather than being stressed out. The strength of that vagal activity is known as vagal tone.

There are several ways to measure vagal tone, but all involve tracking your heart rate in conjunction with your breathing rate (see "[Is there an app for that?](#)"). "Your heart rate speeds up a bit when you inhale and slows down a bit when you exhale," says Fredrickson, allowing freshly oxygenated blood to circulate more rapidly when you breath in and putting a brake on the heart's tendency to race

when you breathe out. This subtle, healthy arrhythmia is controlled by the vagus nerve and varies considerably between individuals.

Vagal tone is at its peak in childhood, decreases during adolescence, and by adulthood "it is about as variable as height", says Bethany Kok, a social neuroscientist at the Max Planck Institute for Human Cognitive and Brain Sciences in Leipzig, Germany, and former colleague of Fredrickson. Genes seem to account for perhaps 65 per cent of this variance, but people who are overweight and do little exercise tend to have low vagal tone. Some researchers think childhood experiences, such as being in stressful or protective environments, may also have a lifelong effect, but this isn't yet clear. Either way, once we reach adulthood, vagal tone tends to be stable.

For people lucky enough to have high tone, the rewards are great, or so a battery of studies seems to indicate. First, there are physical health benefits. The vagus nerve plays a role in stimulating insulin production, and people with low tone are not as good as those with high tone at regulating their blood glucose levels. They also have more difficulty suppressing inflammation. Both these factors are associated with [heart failure, stroke and diabetes](#). And [the link between low vagal tone and dying from cardiovascular disease appears to be quite strong](#).

Spark and smile

Then there are mental benefits. People with higher vagal tone tend to be intellectually sparkier, with a [better working memory and ability to focus their attention](#). Some work even suggests that the [low vagal tone commonly seen in people with chronic fatigue syndrome may account for the cognitive slowness](#) that can accompany the condition.

Intriguingly, newborns with the strongest vagal tone can be highly reactive and irritable for the first five or six months of their lives. Thereafter, however, [people with high tone tend to be more emotionally stable, less stressed and happier than the average](#). Stephen Porges at RTI International, a research institute in North Carolina, believes this is because the experience and regulation of emotion is dependent on the state of the nervous system. Someone with an under-performing parasympathetic nervous system, he argues, could struggle to stay calm in the face of provocation and take longer to recover from a stressful experience. Indeed, low vagal tone is a risk factor for depression, and vagal nerve stimulation is used to help people with treatment-resistant depression.

High tone has also been linked with sociability. It seems to help people form stronger relationships and derive more pleasure from social interactions. The precise mechanisms that underpin this are still pretty murky, but Porges suggests that it is because the vagus nerve is connected to other nerves involved in [making eye contact, facial expressivity and the ability to tune in to the frequency of the human voice](#), all of which are crucial for effective social interactions. A recent study also linked high vagal tone to increased empathy in adolescents. All of which may help to explain the finding that such people are [highly valued as friends](#).

This is an enviable range of physical, mental, emotional and social advantages, but until recently it seemed to be the preserve of people lucky enough to have naturally high vagal tone. Then some researchers started questioning the orthodoxy. A decade ago, there were hints that [exercise might improve vagal tone](#) and it has since been claimed that [this is one reason why exercise is so good for you](#). What Fredrickson is now suggesting, takes things to a new level: you can simply think your way to better vagal tone, and so to increased health and happiness.

A pioneer in the field of [positive psychology](#), Fredrickson was intrigued by studies linking vagal tone with emotional and social well-being, and so decided to take a look for herself. Working with Kok, she measured the vagal tone of 73 adults, then asked them to report all their positive emotions

every day for nine weeks, and to rate the degree to which they felt socially connected. Sure enough, those whose vagal tone was highest at the start of the study reported greater positive emotion.

But there was something else. All the volunteers also showed an increase in positive emotions and feelings of social connectedness – and the more pronounced this effect, the more their vagal tone had increased over the nine weeks (*Biological Psychology*, vol 85, p 432).

Encouraged by these findings, Fredrickson decided to see whether she could boost vagal tone still further. In previous research, she had found that loving kindness meditation – the type of meditation that Havill practises – increases feelings of social connectedness. Her original study suggested that such feelings are associated with increases in vagal tone, so this time the volunteers first learned to meditate (see "[Now close your eyes](#)"). Fredrickson, Kok and colleagues then asked them to keep a daily record of the amount of time they spent meditating and the most powerful of 20 different emotions (both positive and negative) they felt that day. The volunteers also rated their daily social interactions, indicating to what extent they felt "in tune" with the people with whom they had spent most time. After nine weeks, vagal tone had increased significantly in meditators but not in people who neglected their practice. Those who started with the highest scores had the greatest increases in positive emotions and social connectedness (*Psychological Science*, [doi.org/m3x](https://doi.org/10.1177/0956797613503333)).

"Learning loving kindness meditation improves vagal tone," says Fredrickson. And good vagal tone improves emotional and social well-being. So an "upward spiral" exists, in which higher vagal tone promotes greater social connectedness and positive emotions, which then promotes even higher vagal tone. She calls [social connectedness a potent "wellness behaviour"](#), noting that social isolation is associated with an increased risk of death comparable to smoking, drinking too much alcohol, obesity or physical inactivity. If she is correct, vagal tone is an important player in the mind-body connection, and loving kindness meditation is a key to improving our mental and physical well-being, deepening our personal experience, and lengthening our lives.

Persuaded? Others think that Fredrickson is on to something, though it is still early days. Gary Berntson at Ohio State University in Columbus, who researches brain mechanisms underlying behaviour and emotions, says the work is very interesting. "It's clearly speculative but she does have some neat data that support the speculations." He would like to see more research on the causal pathways and mechanisms. Epel, who studies the effect of stress on biological ageing, also thinks there could be something in it. **"The vagus nerve is such an important connection between the brain and the heart, and also related to the immune system, and responsive to what we are doing and feeling."** However, she points out that we have a lot to learn about the dynamics of the vagus. She is also curious about the effects of different sorts of meditation. [For example, mindfulness meditation – which involves the monitoring of moment-by-moment experience – has been more widely studied](#) and found to have positive health effects including improved immune function.

Meanwhile, if you are tempted to think well of others, there is one thing you should know: improving vagal tone is hardest for people who have low tone to begin with. But whatever your level, there is hope – and regular meditation may not even be necessary. Exercise also boosts vagal tone, although there still isn't enough research to quantify its impacts. [Repeated exposure to "excitatory" music may do too.](#) Andy Martens at the University of Canterbury in Christchurch, New Zealand, has found that hearing positive feedback about yourself can increase vagal tone, suggesting that anything that enhances your self-esteem might help. And Kok has unpublished work showing that just reflecting on positive social experiences during the day boosts vagal tone.

Havill, meanwhile, is quietly positive about the effects of her meditation. "I have noticed an improved calmness and clarity of mind," she says. But she tries not to expect too much. "One of the things the teachers instruct is not to be too goal-oriented." It sounds like a win-win strategy.

This article appeared in print under the headline "Wishful thinking"

Is there an app for that?

Your vagus nerve is the branch of your nervous system responsible at a subconscious level for helping you to relax, rest and digest. If it is working well, you are said to have high vagal tone, which brings a range of physical and mental benefits. Once thought fixed in adulthood, it now appears that vagal tone can be increased. So how is it measured?

The nerve's interplay with heart rate as you breathe can be used to infer vagal tone. Inhaling temporarily suppresses vagal nerve activity, increasing heart rate and helping oxygenated blood circulate. When you breathe out, your heart rate slows. **The bigger the difference between your heart rate when breathing in compared with breathing out, the higher your vagal tone.** There are dozens of ways to quantify this difference, but **the most common way measures the amount the heart rate varies between typical breathing cycles. The difference can range from near zero to a few hundred milliseconds.**

Doctors use an electrocardiogram to take this measurement. But there are now various gizmos on the market that promise to help you monitor and improve your vagal tone. For example, earlier this year, **HeartMath Inc**, a company based in Boulder Creek, California, launched the **Inner Balance Sensor**. This connects to a user's earlobe to measure heart rate variability and plugs into an iPhone or iPad for use with an app developed to help you improve your breathing and adopt other techniques to calm down. The organisation claims that the device could be used to reduce stress and to improve vagal tone.

Editor's note: New Scientist has not tested this app and does not endorse it.

Now close your eyes

There is evidence that meditation can increase your vagal tone (see main story) and so improve your mental and physical health. Assuming you were willing to engage in a bit of loving kindness meditation to boost your well-being, how would you go about it?

First, find a quiet place and adopt a position that makes you feel relaxed yet alert. With your eyes closed, try to envisage your heartbeat, and then consciously concentrate on your breathing. Now, visualise someone – it can be yourself, a loved one or someone you barely know – and think of their good qualities. Once you are feeling positive towards them, repeat these traditional phrases of loving kindness meditation: May X feel safe; May X feel happy; May X feel healthy; May X live at ease. After a few minutes, let go of X's image and start thinking nice thoughts about someone else.

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