



Mindful molecules – science is decoding the health benefits of meditation

EU-funded researchers are investigating the link between mindfulness and health, offering potential new options for the treatment and early detection of cancer.

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Meditation and mindfulness are not just a pastime for Maria Goreti Sales, a professor in the Department of Chemical Engineering at the University of Coimbra in Portugal. She is convinced they hold the key to understanding how and why the body gets sick.

Sales coordinates the Coimbra University's BioMark Sensor Research group that develops advanced sensor technologies for applications in health, the environment and food safety.

Meditation is widely recognised for its physical and mental benefits, from reducing stress to improving cardiovascular health. However, the biochemical mechanisms underlying this mind-body connection have still not been clearly identified. For Sales, this represented an intriguing challenge.

Cellular communication

From 2015 to 2018, Sales organised meditation sessions for her team and was impressed by the outcome. "Everyone was more focused on their work and on getting results instead of being distracted by small troubles," she said.

Around the same time, she was immersed in the scientific literature on something called extracellular vesicles (EVs) – tiny messenger particles that carry information between cells in the body. She was fascinated by their ability to cross the blood-brain barrier, a membrane that protects our brains.

"Could extracellular vesicles provide the missing link?" she wondered.

The question led her to put together a multinational team of experts to investigate further as part of a five-year research project called MindGAP, which ran from 2019 to 2024. Made possible thanks to funding from the EU, it brought together researchers from Coimbra University, Linnaeus University in Sweden, the University of

Oulu in Finland, the Portuguese Institute of Oncology and the VTT Technical Research Centre of Finland.

Their goal was to investigate the biochemical links between the brain and the body, looking in particular at the role of EVs, and to create new tools for monitoring health.

The MindGAP team set out to achieve two major objectives. Firstly, by analysing EVs from cancer survivors who practised meditation, they aimed to identify any influencing factors specifically linked to meditation.

Secondly, they planned to develop a device able to rapidly monitor these EVs for potential health biomarkers – measurable indicators – that would make it possible to predict the onset of a disease process in the body.

Meditation impact

The researchers set up a large trial to study blood plasma from cancer survivors, comparing those with a regular meditation practice and those without.

Thanks to this trial, they were able to identify seven microRNAs within EVs that could be linked to meditation practices. MicroRNAs are tiny pieces of genetic material that affect the expression of genes in cells.

These findings are significant as they suggest a path through which meditation may influence cellular communication in ways that promote overall health.

Recent studies support this concept, showing that mindfulness practices can reduce inflammation and stimulate cell repair, both of which are key to maintaining long-term health.

Unfortunately, the COVID-19 pandemic disrupted the clinical trial, forcing meditation sessions to shift online. Further trials are therefore needed to establish the clinical relevance of the biomarkers identified.

Breakthrough device

The research team did, however, achieve a remarkable breakthrough in developing a device able to detect EV messages in the blood. Using plastic antibodies, the researchers came up with single-use cartridges, roughly the size of a credit card, capable of isolating and analysing EVs from blood samples.

Plastic antibodies are synthetic, polymer-based materials designed to mimic the function and characteristics of natural antibodies. These artificial antibodies are created using a technique called molecular imprinting, which involves forming polymers with specific cavities that match the size, shape and chemical properties of the target molecule (antigen).

“This technology allows us to perform several steps on a single device and quantify microRNA in a low-cost and practical manner,” said Professor Caglar Elbuken, who leads the Elbuken Lab: Microfluidics and Biosensor Research Group at the University of Oulu.

MindGAP’s device could have far-reaching applications as microRNAs are a growing focus in the medical field.

The 2024 Nobel Prize in Physiology or Medicine recognised the discovery of microRNA and its gene-regulating function, which has a pivotal role in helping scientists understand disease mechanisms.

“Rapid and cost-effective microRNA quantification is an important technology that can help diagnose cancer, cardiovascular diseases, Alzheimer’s disease or other neurodegenerative conditions,” said Elbuken.

Prevention first

Sales sees an even broader impact. She dreams of a future where such technology could anticipate diseases long before symptoms emerge, enabling proactive health management.

“If we identify biomarkers that could anticipate health issues, it could let people know early when their body requires attention and care,” she said.

This approach could fundamentally reshape how we think about health and disease, by shifting the focus from reactive treatments to prevention, and ultimately reduce the burden on healthcare systems.

Now that we know that meditation practices can reduce disease-related messengers in the body, the next step will be to understand whether we could one day harness our minds to alleviate cancer, prevent its progression or improve recovery.

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- [MindGAP project website](#)
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