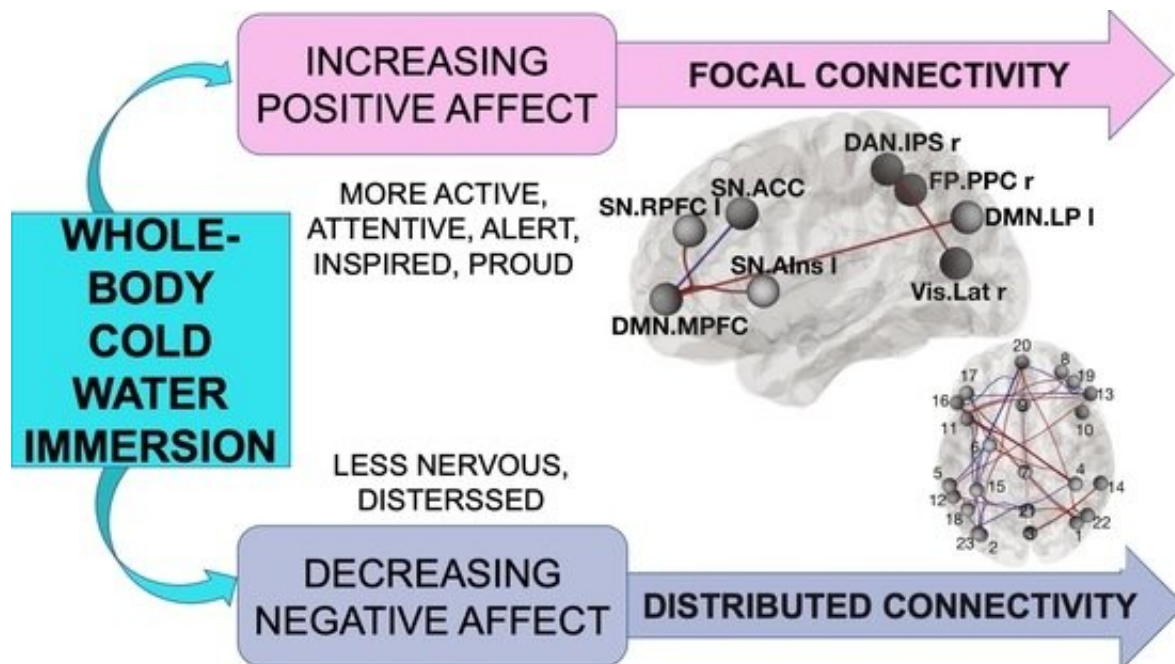


MRI scans reveal changes in brains wiring after cold water shock

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Credit: *Biology* (2023). DOI: 10.3390/biology12020211

For the first time, a team of researchers has observed changes in how different parts of the brain interact with each other after a person's body is immersed in cold water. The findings explain why people often feel more upbeat and alert after swimming outside or taking cold baths.

During a research trial, the results of which are published in the journal *Biology*, healthy volunteers were given a functional MRI (fMRI) scan

immediately after bathing in cold water. These scans revealed changes in the connectivity between the parts of the [brain](#) that process emotions.

The research team from the University of Portsmouth, Bournemouth University and University Hospitals Dorset (UHD) recruited 33 volunteers for the trial.

The team included imaging experts from Bournemouth University and UHD, and extreme environments researcher Dr. Heather Massey from the University of Portsmouth.

Dr. Massey, from the School of Sport, Health and Exercise Science, said, "It has been a really pleasing experience to work with this interdisciplinary team to develop a method and publish this piece of research that could only be completed by a group with such a diverse skill set.

"With the growing popularity of outdoor swimming and cold water immersion, which many now use to support improved mood, it is long overdue that we study how it may affect us. We know so much about the impact cold water immersion can have on the body, but the brain has had little focus, primarily as it has been more challenging to study. It is only now that technology is developing, can we start to get some insight."

Dr. Ala Yankouskaya, Senior Lecturer in Psychology at Bournemouth University, led the study. She said, "The benefits of cold-water immersion are widely known from previous studies where participants were questioned on how they feel afterwards, but we wanted to see how the shock of going into the cold water actually affects the brain."

Each participant came to Bournemouth University's Institute of Medical Imaging and Visualisation where they were given an initial fMRI scan. They were then immersed in a pool of water at 20 degrees Celsius for

five minutes while an ECG and respiratory equipment measured their bodies' physiological responses. After being quickly dried, they were given a second fMRI scan so the team could look for any changes in their brains' activity.

"All tiny parts of the brain are connected to each other in a certain pattern when we carry out activities in our day-to-day lives, so the brain works as a whole." said Dr. Yankouskaya. "After our participants went in the cold water, we saw the physiological effects—such as shivering and heavy breathing. The MRI scans then showed us how the brain rewires its connectivity to help the person cope with the shock."

Comparing the scans showed that changes had occurred in the connectivity between specific parts of the brain, in particular, the [medial prefrontal cortex](#) and the parietal cortex.

"These are the parts of the brain that control our emotions, and help us stay attentive and make decisions," Dr. Yankouskaya said. "So when the participants told us that they felt more alert, excited and generally better after their cold bath, we expected to see changes to the connectivity between those parts. And that is exactly what we found."

The team members are now planning to use their findings to understand more about the wiring and interactions between parts of the brain for people with mental health conditions.

"The medial prefrontal cortex and [parietal cortex](#) have different wiring when people have conditions such as depression and anxiety," Dr. Yankouskaya explained.

"Learning how [cold water](#) can rewire these parts of the brain could help us understand why the connectivity is so different for people with these conditions, and hopefully, in the long-term, lead to alternative

treatments," she concluded.

More information: Ala Yankouskaya et al, Short-Term Head-Out Whole-Body Cold-Water Immersion Facilitates Positive Affect and Increases Interaction between Large-Scale Brain Networks, *Biology* (2023). [DOI: 10.3390/biology12020211](https://doi.org/10.3390/biology12020211)

Provided by University of Portsmouth

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