

Scientists map the pulse pressure and elasticity of arteries in the brain

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Researchers at the Beckman Institute at the University of Illinois at Urbana-Champaign have developed a new technique that can noninvasively image the pulse pressure and elasticity of the arteries of the brain, revealing correlations between arterial health and aging.

Brain artery support, which makes up the cerebrovascular system, is crucial for healthy [brain](#) aging and preventing diseases like Alzheimer's and other forms of dementia.

The researchers, led by Monica Fabiani and Gabriele Gratton, psychology professors at the Beckman Institute, routinely record optical imaging data by shining near-infrared light into the brain to measure neural activity. Their idea to measure pulse pressure through optical imaging came from observing in previous studies that the arterial pulse produced strong signals in the optical data, which they normally do not use to study brain function. Realizing the value in this overlooked data, they launched a new study that focused on data from 53 participants aged 55-87 years.

"When we image the brain using our optical methods, we usually remove the pulse as an artifact—we take it out in order to get to other signals from the brain," said Fabiani. "But we are interested in aging and how the brain changes with other bodily systems, like the cardiovascular system. When thinking about this, we realized it would be useful to measure the cerebrovascular system as we worry about cognition and brain physiology."

The initial results using this new technique find that arterial stiffness is directly correlated with cardiorespiratory fitness: the more fit people are, the more elastic their arteries. Because arterial stiffening is a cause of reduced [brain blood flow](#), stiff arteries can lead to a faster rate of cognitive decline and an increased chance of stroke, especially in older adults.

Using this method, the researchers were able to collect additional, region-specific data.

"In particular, noninvasive optical methods can provide estimates of arterial elasticity and brain [pulse pressure](#) in different regions of the brain, which can give us clues about the how different regions of the brain contribute to our overall health," said Gratton. "For example, if we found that a particular artery was stiff and causing decreased blood flow to and loss of brain cells in a specific area, we might find that the damage to this area is also associated with an increased likelihood of certain psychological and cognitive issues."

The researchers are investigating ways to use this technique to measure arterial stiffness across different age groups and specific cardiovascular or stress levels. High levels of stress, especially over a long amount of time, may affect arterial health, according to the researchers.

"This is just the beginning of what we're able to explore with this technique. We're looking at other age groups, and in the future we intend to study people with varying levels of long-term stress," said Fabiani.

"When people are stressed for long periods of time, like if they're caring for a sick parent, stress might generate vasoconstriction and higher blood pressure, with significant consequences for arterial function in the brain. We are interested in knowing whether this may be an important factor leading to arterial stiffness."

The researchers are also able to gather information about pulse transit time, or how long it takes the blood to flow through the brain's arteries, and visualize large arteries running along the brain surface.

"Our goal is to find more information about what causes arterial stiffness, and how regional [arterial stiffness](#) can lead to specific health problems. Our findings continue to bolster the idea that an important key to aging well is having good cerebrovascular health," said Fabiani.

More information: The technique and findings are detailed in an article published in the journal *Psychophysiology*.

[onlinelibrary.wiley.com/doi/10 ... /psyp.12288/abstract](https://onlinelibrary.wiley.com/doi/10.1111/psyp.12288/abstract)

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