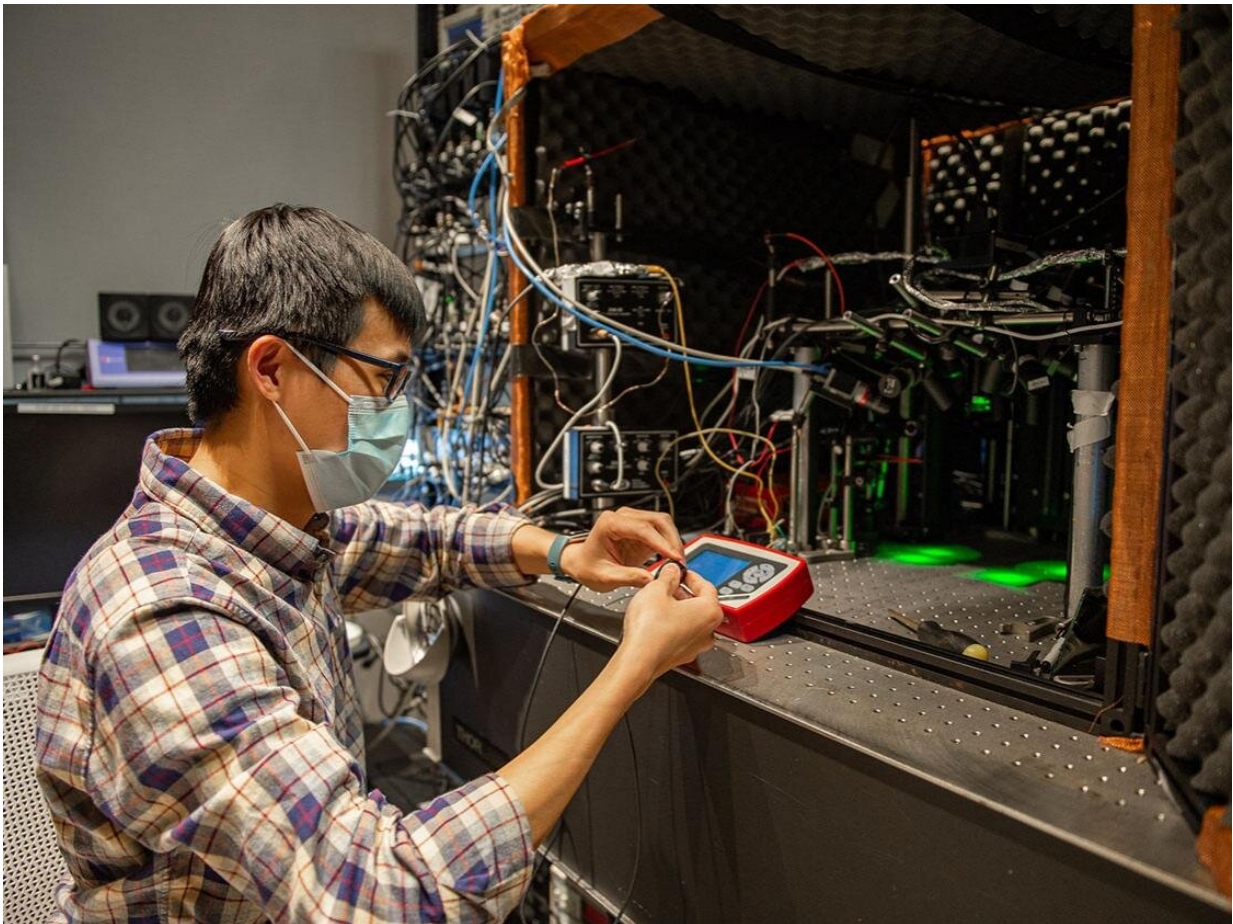


Researchers publish how-to guide for monitoring and analyzing brain activity

March 4 2022, by Sarah Small



Qingguang Zhang, assistant research professor in engineering science and mechanics, is one of the Penn State researchers who developed a set of tools and methods for monitoring and analyzing brain activity, which they then published as a how-to guide Credit: Kelby Hochreither/Penn State

Penn State researchers have developed a set of tools and methods to better monitor and analyze sleep-related signals and fidgeting in rodent brain studies. Considered the bedrock of biomedical research, rodent studies often provide the first advanced understanding of brain activity and are the foundation on which human studies are eventually built, according to Patrick Drew, Huck Distinguished Associate Professor of Neural Engineering and Neurosurgery and associate professor of engineering science and mechanics.

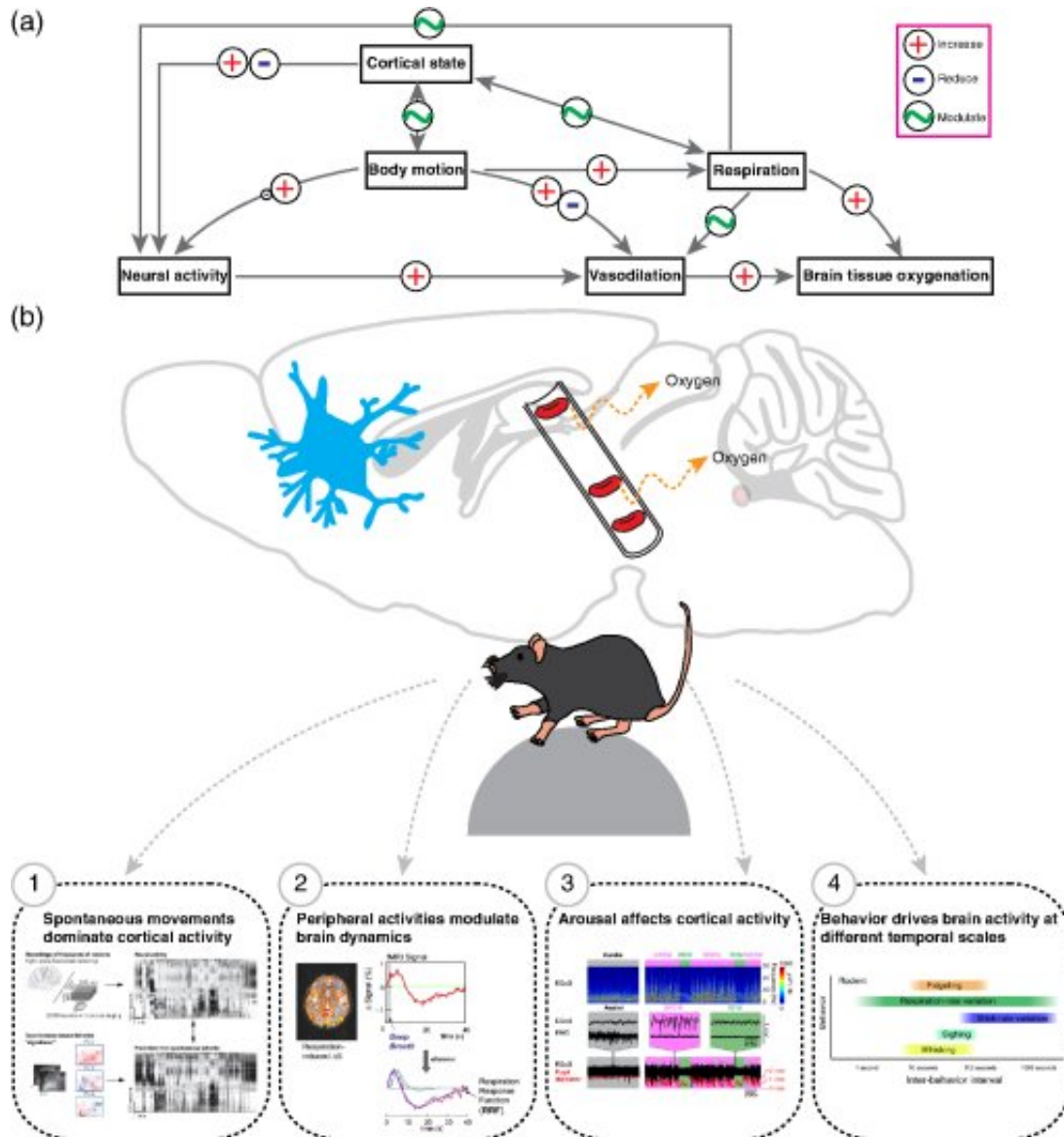
The toolkit allows researchers to monitor behavioral variables such as the rodent's heart rate, pupil diameter and whisker motion during [observational studies](#), as well as a set of codes to measure and analyze the data. They published a how-to guide complete with their tools, code and images of the lab setup in *Neurophotonics*, a journal published by SPIE, or the international society for optics and photonics.

According to Drew, the variables can trigger oscillations in [brain activity](#) that in the past may have been interpreted as noise but that now are known to be behavior-driven changes. Charting and analyzing these brain activities is critical to better understanding the brain, but having a person monitor experiments and analyze the movements and awake-sleep states manually is very time intensive and subject to [human error](#).

To remedy this, the researchers' multiprong approach tracks the rodent's specific arousal state at the moment of fidgeting without the uncertainty introduced by human interpretation.

"What people have always done in both animal and human models is say, "I presented a stimulus and this happened,"" Drew said. "And what turns out to be very important is the arousal state of the animal—whether they are alert or dozing off—as well as their fidgeting behaviors. These behaviors drive brain-wide activity. If a rodent moves its whiskers and twitches, it doesn't just show up in the motor areas of the brain; it shows

up everywhere, including the visual cortex, for example. As someone studying the brain, you can't forget that it is connected to the body, and the body and brain impinge on each other in ways that we don't quite yet understand. The detailed instructions we published will make it easier for people to study and understand all of this."



Overview of the relationship between movement, arousal, and neurovascular signals in rodents. (a) Schematic showing how the movement-related signals modulate the relationship between neural activity and brain hemodynamics.

(b) Selected studies showing the obligation to monitor movement related signals.
Credit: *Neurophotonics* (2022). DOI: 10.1117/1.NPh.9.2.021905

According to the researchers, the tools and methodology they shared should be especially useful in sleep studies but may also apply to other aspects of neuroscience. For example, Drew explained that researchers could better parse changes in the brain's blood flow, which neurons control to maintain [brain](#) health and scientists use as signal markers in imaging studies.

"Our lab is applying engineering methods to solve life science problems, so we're bridging different research areas," said Qingguang Zhang, assistant research professor in engineering science and mechanics at Penn State and first author on the paper. "As members of the Center for Neural Engineering and the Huck Institute for Life Sciences, we span this group of people and can understand the problem from both sides. We developed the tools that will help neuroscientists to better analyze the data and find their next step."

More information: Qingguang Zhang et al, Behavioral and physiological monitoring for awake neurovascular coupling experiments: a how-to guide, *Neurophotonics* (2022). [DOI: 10.1117/1.NPh.9.2.021905](https://doi.org/10.1117/1.NPh.9.2.021905)

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