NEWS

# Resting-state maps bridge mouse models, humans

BY **SARAH DEWEERDT**

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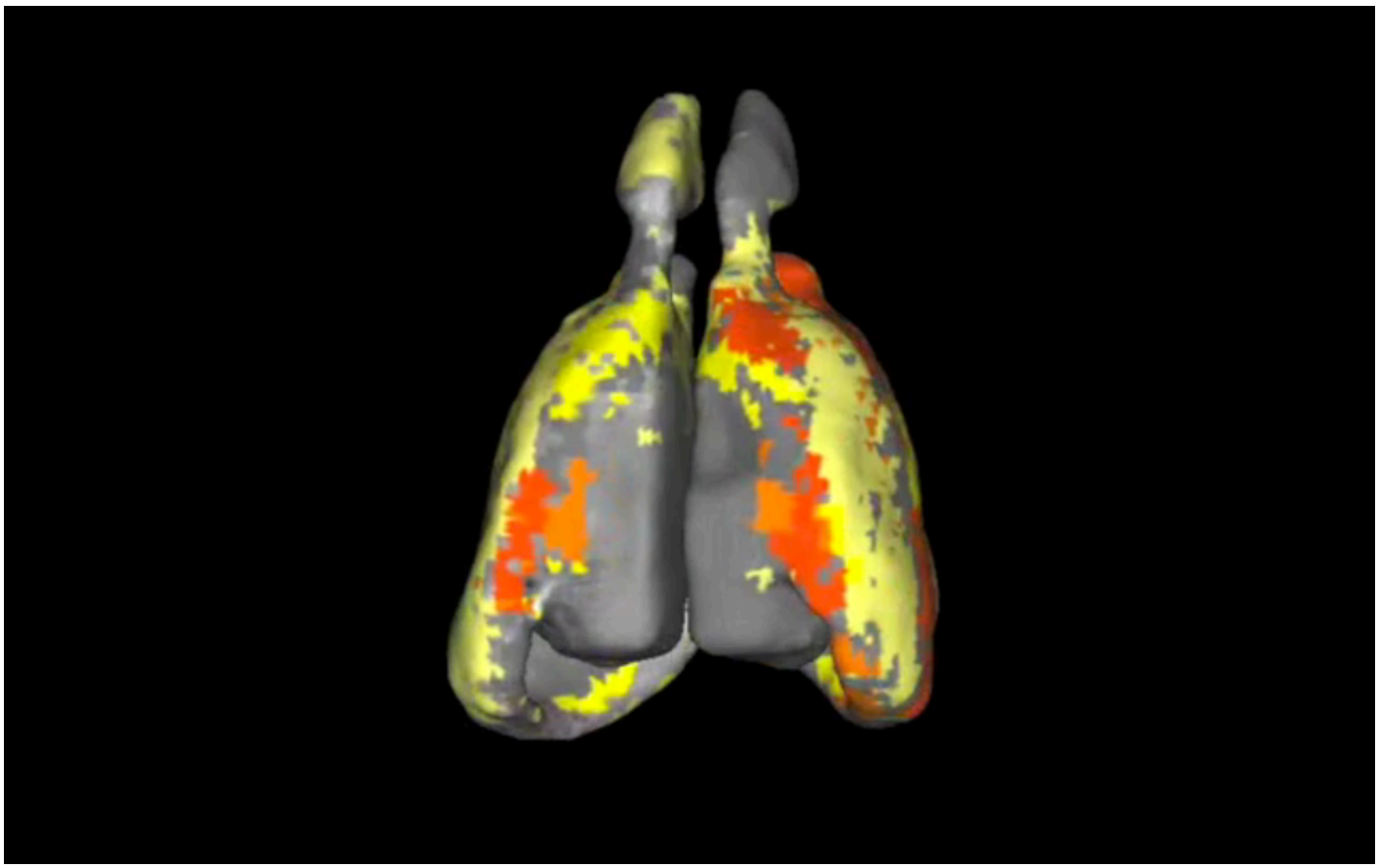

A tube the size of a soda can, a magnet the size of a walk-in closet and a year and a half of hard work: These are the key ingredients that have enabled researchers to produce images of resting-state activation in the brains of mice. Some of the first images generated by this approach were presented Monday at the **2013 Society for Neuroscience annual meeting** in San Diego.

The technique enables researchers to make more direct comparisons between mouse and human brain function, and could help ensure that animal models are truly relevant to the neuropsychiatric disorders, such as autism, that they purport to represent.

“It’s often very difficult to choose an animal model,” says **Damien Fair**, assistant professor of behavioral neuroscience and psychiatry at Oregon Health and Science University in Portland. “We have few measurements that can be made in an animal model that can also be measured in humans.”

Measurements of resting-state activation, or brain activity that occurs while individuals are resting quietly in a scanner, are good candidates for enabling comparisons between species, says Fair, who led the effort. The method produces maps of ‘functional connectivity,’ meaning parts of the brain that tend to activate and deactivate together during this procedure.

“People have been trying to do this for a while, but it’s been difficult,” Fair says.

First, the technique requires a specialized magnetic resonance imaging (MRI) scanner that can accommodate mice. “The bore is really tiny,” Fair says — that’s the soda can. “The magnet is huge” — the walk-in closet.

Scanning a mouse brain takes a much more powerful magnet than scanning a human brain. That’s because the bigger the magnet, the smaller the spatial resolution of the resulting images. “You need that for the mice because their brains are the size of a raisin,” Fair says.

Unfortunately, the bigger the magnet, the noisier the data, a relationship that has prevented researchers from imaging mice in the past.

But in the past year or so, Fair says, improvements in imaging protocols and software for processing MRI data have enabled researchers to capture clear images of tiny brains.

The first images to come out of the scanner were promising. Fair says, “We saw what we expect to see” — for example, connectivity between the motor regions in the two hemispheres of the brain.

To validate the imaging technique, Fair’s team collaborated with scientists from the Allen Brain Institute in Seattle, who have created a detailed map of structural connections within the mouse brain.

The functional and structural connectivity maps “look very similar, which is very good for us,” Fair says.

But comparing those maps with human data is not straightforward, because mouse and human brains have some important structural differences. For example, the piriform cortex, which is devoted to processing information about smell, is large in mice and small in humans.

Looking at **hubs of connectivity in the brain** might provide a bridge between species, Fair says. In humans, certain parcels of the brain, or nodes, are connected to many other nodes.

“These are probably really important regions for processing information,” says Benjamin Jarrett, a research associate in Fair’s lab who presented the work on Monday.

The researchers analyzed patterns of connectivity in the mouse brain and found that such information-processing hubs can be identified in rodents as well. “We were pretty excited about that,” Fair says.

Data from Fair’s lab presented in a poster session on Sunday applies this analysis to a potential mouse model of autism: male mice exposed *in utero* to domoic acid, a neurotoxin that is sometimes found in shellfish. As young adults, the mice have social deficits, showing less interest in interacting with littermates than controls do.

“There are some changes in network connections that are similar to what’s seen in autism,” Fair says. “That was the first test case of using the methodology we developed in an animal model of autism — any animal model.”

*For more reports from the 2013 Society for Neuroscience annual meeting, please **click here**.*