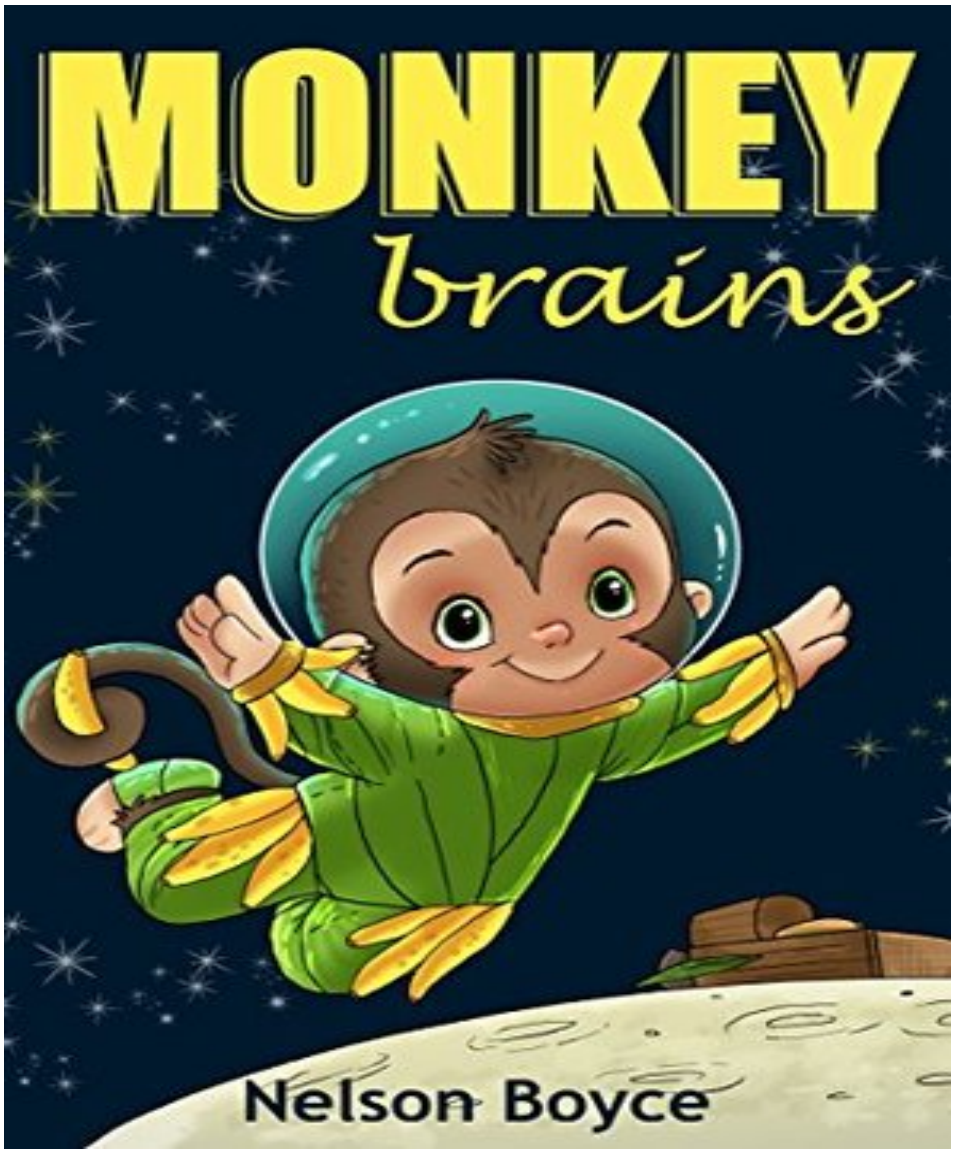

As much as we may wish it so, it's not likely that a room full of monkeys will ever be able to reproduce the works of Shakespeare no matter how long they sit there typing. But what if you connected their brains? Could they achieve great things—or at least reach a higher level of thinking power?

The idea intrigued Miguel Nicolelis, director of the Center for Neuroengineering at Duke University. Nicolelis has a lot of experience in wiring animal brains and seeing what they're capable of. As far back as 1999, he and his team at Duke connected a rat's brain to a robot arm. Ever since, they've been pushing the limits of what's known as brain-machine interfaces.

That led Nicolelis to wonder what was possible if, instead, you connected brains to brains. Could animals learn to literally think together?

Monkeys get down to business

So he set out to see if several diferent animal brains could work together to perform a task. The goal was to create a kind of “organic computer.”

For the study, published earlier this month in Scientifc eports, Nicolelis’ team frst placed electrodes into the brains of three rhesus monkeys, targeting areas associated with movement, and these were connected to a computer that controlled an image of a robotic arm. Although their brains weren’t wired together, the monkeys, although in diferent rooms, eventually learned to synchronize their thinking so they could move the screen arm and grab a ball. That earned them a reward of juice.

Then the researchers made things harder. They created a situation where the avatar arm could move in three-dimensional space. But each of three monkeys could control only one or two types of movement—say up or down, or right or left—so no one monkey by himself could move the arm efectively enough to win juice.

Over time, their separate neurons began working together, and, through the computer, were able to move the arm and reach the virtual ball. Without being aware that they were collaborating, the monkeys had created a monkey superbrain, said Nicolelis, or as he dubbed it, a “brainet.”

More mind melds

But Nicolelis and the Duke researchers didn’t stop there. They went a step further with a group of four adult rats. Instead of connecting their brains to one another through a computer, this time the brains of the animals were connected directly.

They connected two sets of electrodes into each of the rat’s brains, targeting the region associated with movement. One electrode stimulated a particular part of the brain, while the other recorded its activity. When one rate responded to touch, it was able to pass the knowledge of that reaction to the other rats.

Through trial and error, that rats learned how to synchronize their brains—for which they were rewarded. In one experiment, the animals were able to produce diferent brain responses to diferent signals, a single electric pulse or four of them. When that happened, those four brains had become a simple computer, processing a response as a group.

This clearly came into play in the second half of the rat experiment. This time the animals received patterns of electrical stimulation that were designed to

represent increasing or decreasing temperatures and increasing or decreasing air pressure. Based on how the brains interpreted and responded to those patterns, the rats could “predict” if it was going to rain.

Turns out that the rats were consistently more accurate in their predictions when their brains worked together than when individual rats attempted to make these predictions on their own. As Nicolelis explained, “The rats could divide tasks across animals, so their individual workload was smaller. We didn’t expect that at the beginning.”

Brain gain?

Fascinating stuf, but what does it mean for us humans? Does Nicolelis believe that one day human brains will actually be connected to help solve bafing problems? And what kind of dark box is opened once another person has direct access to what’s happening inside our brain?

For his part, Nicolelis sees potential value of a human “brainet” in treating people with a neurological injury or disability. For instance, he thinks a person who has sufered a stroke could accelerate their rehabilitation if they could relearn their language and motor skills in conjunction with a healthy brain. He also has said that he could imagine a team of surgeons joining brains to complete a difcult surgery or mathematicians sharing brain power to solve a complex problem.

Of course, it’s going to be a while before people are plugging into each other’s brains. Obviously, the process would have to become a lot less invasive than was done with the monkeys and rats where electrodes were implanted in their brains. And, when the Duke experiments were tracking the collaboration among the rats’ brains, they were monitoring only 3,000 neurons. The human brain is way more complex—it has just under 100 billion neurons—so the technology would probably need to record and transmit information from hundreds of thousands of neurons.

That challenge, though, seems far less daunting than the ethical ones that brain-sharing raises. If people become part of a brainet and their brain signals are recorded, do they lose the right to keep them private? And, let’s say they would have the right to keep their secrets secret. Could whatever group or company or person that oversees a brain network be able to guarantee that the data from deep inside your brain could never be stolen?

That’s a quandary for another day, one that scientists like Miguel Nicolelis hope that they have the opportunity to confront.