Using monkeys for research is justified – it's giving us treatments that would be otherwise impossible

October 20 2016, by Stuart Baker

One of Newcastle's macaque monkeys. Credit: Newcastle University, Author provided

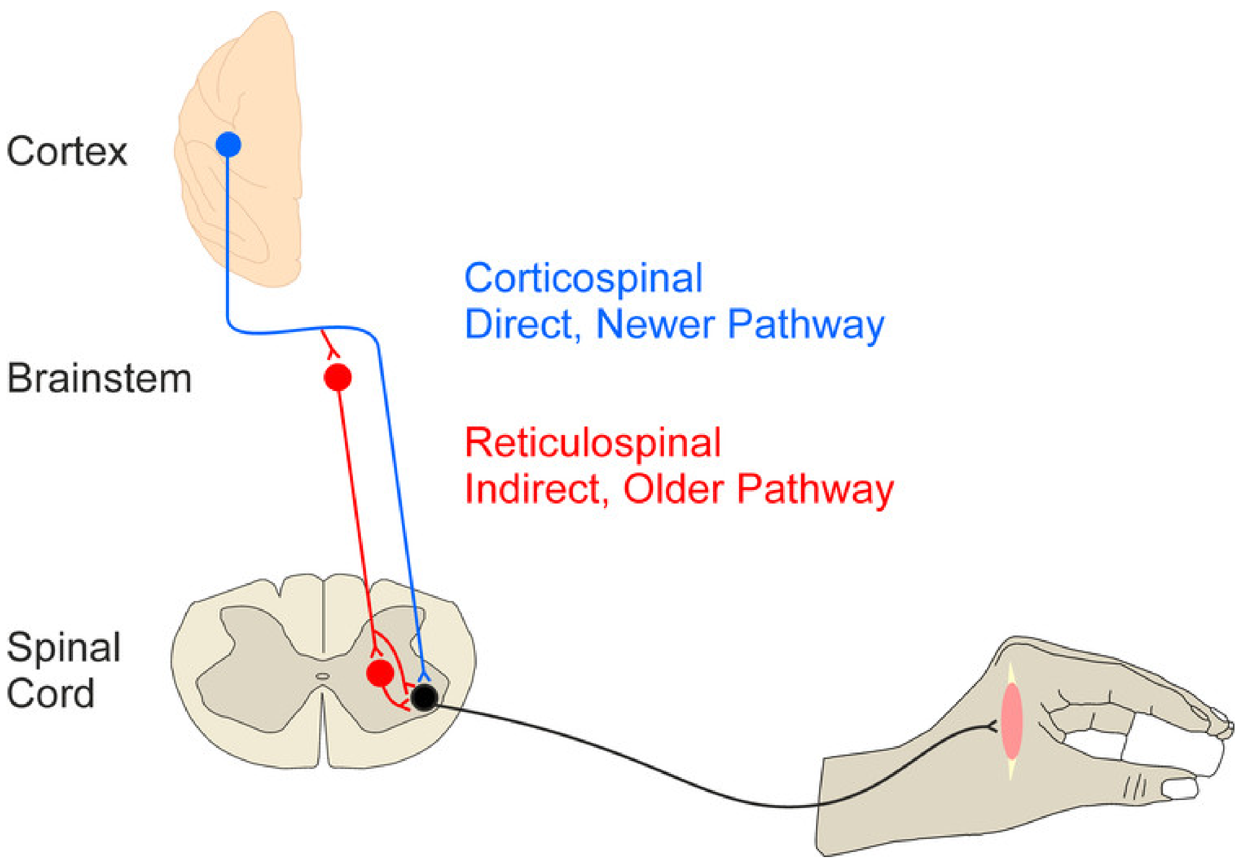
The debate about animal experiments often seems to start from false premises. Unsurprisingly, the conclusions are then often flawed. Opponents claim that animals suffer terrible cruelty. The macaques I use for vital research are well looked after, by a lab full of dedicated people who love working with animals. A huge effort goes into minimising suffering every day. This is not some optional extra, but an integral part of what we do and who we are.

Some claim animal experiments are not necessary. But virtually every medical advance of the last century depended on animals, often to provide the fundamental underpinning of understanding which paved the way to develop successful treatment. My own experience shows that using primates in research still has the potential to help us gain an understanding of how our own bodies work – and how we can repair them – that would be otherwise impossible.

I am a neuroscientist, interested in the fundamental science of how the brain controls movement. We typically take the ability to move in a fluid, coordinated way for granted. Yet any parent will be familiar with the helplessness of a newborn baby. A large part of early childhood is dedicated to learning to move. As an adult, some people suffer damage to the brain's pathways for movement, for example after a stroke. Suddenly, everyday tasks become a tiring, frustrating struggle.

To understand how the brain controls our arms and hands, we need to look inside and measure how brain cells change their activity during movements, how they are connected together, and how they reconfigure after injury. We can make some progress on these issues using non-animal methods now at our disposal. In my own research group, we use magnetic brain stimulators to activate the brain of healthy volunteers, clever instrumented tasks, and recordings of brain waves from the scalp and muscle activity from the skin over contracting muscles.

But these methods all have their limitations. Single cells are individualists. Even cells right next to each other can be carrying totally different messages. When we record from the scalp, we average the signals from many millions of cells. It's a bit like placing a microphone on the ceiling of an airport departure hall, and measuring the sound levels.



Neural pathways.

This can tell you something – what times of day the airport is busy, and when quiet –- but we wouldn't expect to get much insight into the conversations of individual passengers like this. And some aspects of the airport's operations –- those outside on the tarmac -– would be missed.

Equally, some brain centres are so deep beneath the skull that they don't contribute to scalp recordings at all.

In my own work, we use a small number of macaques to gain this fine-grain understanding. Many pathways for movement control are different between primates such as humans and other animals such as rats. Only a primate model can give us information which is relevant to human diseases.

State-of-the-art care

To learn how these pathways are actually used to control movements, in some studies we first teach the macaque to perform complex tasks with their hands or arm. Getting it right is rewarded with a treat (typically fruit or nuts, but chocolate or strawberry yoghurt also sometimes feature). Once they know what to do, we carry out a surgical implant to allow us to record from the brain using fine electrodes, with tips around the same size as single cells.

All surgery is done in a fully equipped operating theatre, with sophisticated anaesthetics and painkilling medication borrowed from state-of-the-art human care. Once the macaque has recovered, we can record from the brain cells while they do the trained task. An animal that is stressed or in pain would not willingly cooperate with the experiments. The animals seem to enjoy the daily interaction with the lab staff and show no distress.

Our studies are right at the crossroads of basic and clinical sciences. We are trying to understand fundamental brain circuits, and how they change in disease and recovery. Over the past ten years, we've shown that a primitive pathway linking brain to spinal cord can carry signals related to hand use. That was a surprise, as until now it was assumed that the primate hand was controlled only by more sophisticated pathways that developed later in evolution.

We have shown that after damage to the newer pathways, such as after stroke, the older pathway is responsible for much of the recovery of hand function which occurs in the following weeks and months. However, this recovery is unbalanced. Connections strengthen more to flexors, which close the hand, than to extensors, which open it. This is why stroke patients often end up with a strong grip, but cannot open the hand to let go.

We have also shown that the older pathway can be powerfully activated by loud clicks. This led us to develop a portable device to deliver clicks to an earpiece, timed precisely relative to weak shocks to a muscle. When healthy subjects wear the device, connections from the primitive pathway can be strengthened or weakened depending on the relative timing of clicks and shocks. We are now testing whether this might help stroke patients strengthen their weak extensor muscles, and so regain better hand function.

Western society is facing a massive challenge of brain diseases, burgeoning because of our ageing population. Many of these brain systems are not the same in humans and rodents, and unless we can find alternatives then we are going to have to expand our use of primates to make progress.

In my opinion, we should not condemn large numbers of people to disability and dependence, but need to use all of the tools of modern science to discover and innovate the solutions. I am confident that the next 50 years will see wonderful progress in treatments for these terrible disorders and primate research will be central to this effort.

Source: The Conversation

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