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Brain and body are more intertwined than we knew

A host of disorders once thought to be nothing to do with the brain are, in fact, tightly coupled to nervous-system activity.

For decades, scientists thought of the brain as the body's most valuable – and consequently most closely guarded – asset. Locked safely behind a biological barrier, away from the hurly-burly of the rest of the body, it was broadly free of the ravages of invading germs, the battles waged by the immune system and the constant churn of cells.

Then, 20-odd years ago, some researchers began to ask a heretical question: is the brain really so isolated? The answer, according to a growing body of evidence, is no – and has important implications for both science and health care.

The list of brain conditions that have been associated with changes elsewhere in the body is long and growing. Changes in the make-up of the microorganisms resident in the gut, for example, have been linked to disorders such as Parkinson's disease and motor neuron disease. Some researchers think that certain infections could provoke the onset of Alzheimer's disease; there is also a theory that infection during pregnancy could lead to autism spectrum disorder in babies.

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The effect is two-way. There is a lengthening list of symptoms not typically viewed as disorders of the nervous system in which the brain and the neural processes that connect it to the body play a large part. For example, the development of a fever is influenced by a population of neurons that control body temperature and appetite. The effect of brain on body is underlined by the finding that stimulating a particular brain region in mice can ‘remind’ the body of previous bouts of inflammation – and reproduce them¹.

The list goes on. Evidence is mounting that cancers use nerves to grow and spread. In this week's *Nature*, Michelle Monje and her colleagues² show how some brain cancers consolidate connections with neurons that enhance their progression (see page 366). Meanwhile, Jonathan Lovelace and his colleagues³ explore the neural pathway that can cause a drop in blood pressure and fainting (see page 387). This comprises a group of nerves that project from the heart to the brainstem.

These findings and others mark a radical shift in our view of the nervous system, and neuroscientists are still only beginning to explore its impacts. To really get to grips with how the brain and the body are entangled, researchers in a range of fields will need to work together more closely. Ultimately, the goal should be to study the interplay between the brain and body in humans. This will require methods for accessing brain function, such as functional magnetic resonance imaging, as Emily Finn and her colleagues⁴ describe in a Perspective article (see page 263).

The interconnectedness of brain and body has tantalizing implications for our ability to both understand and treat illness. If some brain conditions start outside the brain, then perhaps therapies for them could also reach in from outside. Treatments that take effect through the digestive system, heart or other organs, for instance, would

be much easier and less invasive to administer than those that must cross the blood–brain barrier, the brain’s first line of defence against pathogens and other insults from the body.

In the reverse direction, the effects of our emotions or mood on our capacity to recover from illness could also be exploited. There is, for instance, preliminary work under way testing whether stimulating certain areas of the brain that respond to reward and produce feelings of positivity could enhance recovery from conditions such as heart attacks. Perhaps even more exciting is the possibility that making changes to our behaviour – to reduce stress, say – could have similar benefits.

For neuroscientists, it’s time to look beyond the brain. And clinicians treating the body mustn’t assume the brain is above getting involved – its activity could be influencing a wide range of conditions, from mild infections to chronic obesity.

1. Koren, T. et al. *Cell* **184**, 5902–5915 (2021).
2. Taylor, K. R. et al. *Nature* **623**, 366–374 (2023).
3. Lovelace, J. W. et al. *Nature* **623**, 387–396 (2023).
4. Finn, E. S., Poldrack, R. A. & Shine, J. M. *Nature* **623**, 263–273 (2023).

Argentina’s economy won’t be fixed by cutting science funding

The nation must consider the wider benefits of research as it chooses its next president.

At the end of last month, people in Argentina voted in the first round of presidential elections. Sergio Massa, the current economy minister for the ruling centre-left party, took a narrow lead over economist and television personality Javier Milei of the far-right Libertarian party. Neither candidate secured the required majority, so there will now be a second round of voting on 19 November.

If elected, Milei plans a radical reshaping of funding for science, the environment, health and education. His aim is to shrink spending by Argentina’s heavily indebted government by 15% of gross domestic product (GDP).

Milei’s plan would see the closure of Argentina’s main public science-funding agency, the National Scientific and Technical Research Council (CONICET), which provides funding for 12,000 researchers at 300 institutions at an annual cost of US\$400 million. Furthermore, he says he would axe three ministries – environment, health and the Ministry of Women, Genders and Diversity. Milei wants



Sergio Massa (right) and Javier Milei are battling for Argentina’s presidency.

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private companies to run primary, secondary and university education, with parents and students given vouchers to spend in educational institutions of their choice. He also intends to cut what he sees as barriers to trade, which could include health and environmental regulations.

Many in Argentina’s science community are alarmed. Victor Ramos, president of Argentina’s National Academy of Exact, Physical and Natural Sciences in Buenos Aires, wrote in *Nature* that he has “never heard a politician propose such extreme ideas” in his country in the nearly 60 years since he graduated from the University of Buenos Aires in 1965.

There’s no doubting that Argentina’s leaders have let their people down. Around 40% of the population lives in poverty, caused in part by inflation running at more than 100%. The country is the International Monetary Fund’s (IMF’s) largest debtor, and owes around \$46 billion. In June, the IMF threw Argentina a lifeline, which allowed the nation to continue borrowing to keep up with its loan repayments to the fund and other creditors.

Yet it is worth pausing to take in Milei’s proposal, and whether it will kick-start Argentina’s stuttering economy. The world economy as a whole is experiencing a period of low growth. But the solution is not to cut back on research and development (R&D), let alone abolish an entire science-funding agency. The opposite needs to happen, on the basis of much evidence that investment in R&D – including basic science – boosts economic growth (see, for example, A. J. Salter and B. R. Martin *Res. Policy* **30**, 509–532; 2001).

Argentina currently spends just 0.5% of its GDP on R&D, which is low even by the standards of some middle-income countries, notably Brazil (which spends around 1.2%). The average for high-income nations was around 2.7% in 2020. That is what Argentina should aspire to. The change won’t happen overnight, and needs stable economic management. Instead of abolishing its funding agency and key ministries, the nation’s leaders need to work closely with scientists and tap into their knowledge and skills. Researchers are ready to play their part. They just need an opportunity to contribute.