



AN IMMUNE SYSTEM FOR PLANET EARTH

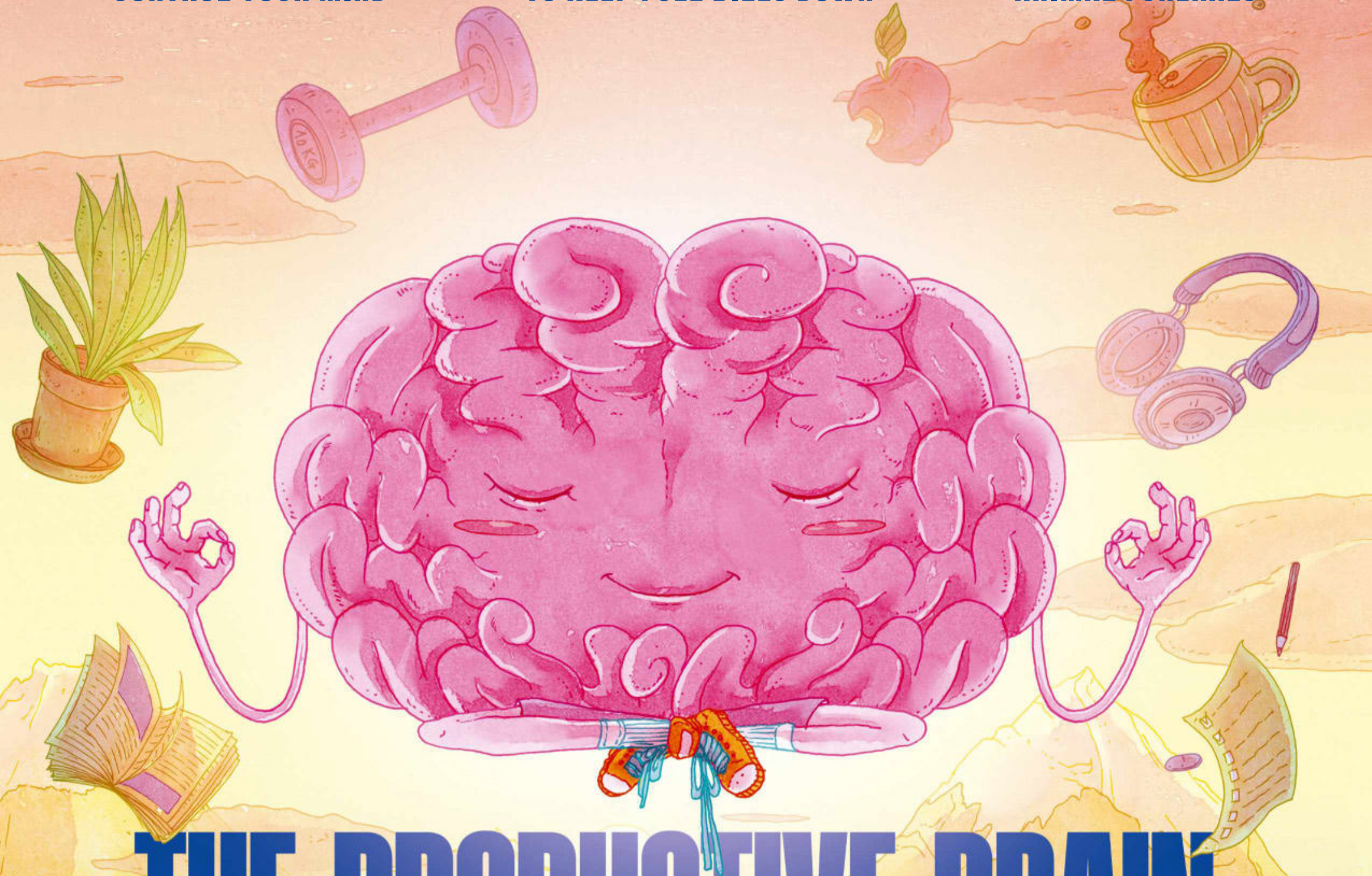
Can we build a network to detect and treat a new disease before it causes a pandemic?

Science Focus

How magnets could
CONTROL YOUR MIND

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TO KEEP FUEL BILLS DOWN

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ANIMAL FUNERALS



THE PRODUCTIVE BRAIN

A neuroscientist explains how to get your mind working at its best



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REVIEW

THE INTERNATIONAL SPACE STATION: WHY IS IT BEING RETIRED AND WHAT WILL HAPPEN TO IT?

The last decade of the ageing space station's life will feature private occupants, movies and an eventual watery grave

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“There are some adults who can now say that there has been someone in space for every single day of their lives”

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BBC

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It is one of the most iconic pieces of space hardware in history, but the days of the International Space Station are now officially numbered. NASA has announced that the curtain will finally fall on the ISS in 2031. The football-pitch-sized orbit outpost will be decommissioned and brought crashing back to Earth before splashing down in the Pacific Ocean.

HOW LONG HAS THE ISS BEEN UP THERE?

The ISS has a rich history. The first segment was launched in 1998 and it has been continuously inhabited since November 2000, with crews of astronauts swapping in and out for typical six-month stays. There are some adults who can now say that there has been someone in space for every single day of their lives.

It was designed as a home from home. A tentative first toe into the celestial waters. A place to test out how to live in space for months at a time, while relatively close to the safety of the Earth. The lessons we've learned about living in microgravity have set us up with the confidence to return to the Moon later this decade and then to venture out to Mars after that.

WHY IS IT BEING DECOMMISSIONED?

As with everything in life, nothing can last forever. In September last year, Russia warned that at least 80 per cent of its section has in-flight systems that are past their expiry date. Cracks have started to appear in the Zarya cargo module. There have also been air leaks in the crew's living quarters.

This structural fatigue is part of the reason the ISS will be vacated in 2030 and de-orbited the following year. NASA made this plan official in January when it released an updated International Space Station Transition Report.

WHAT'S NEXT FOR THE ISS?

With eight years left before the last crew leaves, there will now be a shift in emphasis. The last few years have seen a growing collaboration between publicly

funded space agencies like NASA and privately owned businesses like Elon Musk's SpaceX.

The rest of the 2020s will see the increasing commercialisation of the ISS, with habitable modules available for private space travellers to stay in. December 2024 should see the launch of a six-metre-wide film studio called Space Entertainment Enterprise-1 (SEE-1). It will be a place to make Hollywood blockbusters in a weightless environment, with Tom Cruise widely reported to be shooting a film there.

Then comes the tricky part: what to do with it. Leaving it in space would pose a significant danger. The ISS is the biggest thing orbiting the Earth after the Moon. If it was hit by a piece of space junk it would create a shower of debris that would threaten all of our satellite infrastructure in low-Earth orbit.

So the ISS will join a host of other retired space hardware in a watery grave in the Pacific Ocean. It will be brought down in place known as Point Nemo, or the Oceanic Pole of Inaccessibility. Situated between New Zealand and South America, it is 2,688 kilometres (1,670 miles) from the nearest land, so the falling debris poses little danger to humans.

WHAT WILL THE ENVIRONMENTAL IMPACT BE?

“There are potential impacts to the marine environment,” says Dr Vito de Lucia, from the ➤

The ISS has allowed us to carry out important research, but has also helped us prepare for exploration of the Moon and beyond





The main portion of the ISS's Zarya cargo module, which is now starting to show cracks

➤ Norwegian Centre for the Law of the Sea, and co-author of a report into protecting the marine environment in the so-called spacecraft cemetery. “But those seem to have been generally neglected by space agencies.”

One key issue is that toxic or radioactive materials may survive atmospheric re-entry.

“Once the debris enters the ocean, it would be expected to settle to the ocean floor and some would become encrusted and incorporated into the sediments,” a NASA spokesperson says. “Although unlikely, some leakage could occur from previously sealed containers that remained intact through re-entry and impact. However, no substantial long-term impacts would be expected.”

That may not be the end of the matter, however. de Lucia says that a new international treaty is currently being negotiated to tackle the issue of marine biodiversity conservation in areas which are in international waters, like Point Nemo.

“This new treaty may be adopted and perhaps even enter into force within a time frame relevant to the re-entry of the ISS,” he says.

Whatever its ultimate fate, the ISS has paved the way for the future of human space exploration. NASA is planning to build a similar station – called Gateway – in orbit around the Moon. Astronauts will live and work there, using it as a staging post for trips to the lunar surface. That wouldn't be possible without the valuable lessons we've learned from the ISS.

by COLIN STUART (@skyponderer)
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ANALYSIS

LONDON TUBE: DOES ITS AIR HARM YOUR HEALTH?

The Mayor of London hopes that 80 per cent of trips in the city will be made on foot, bike or public transport by 2041. But how polluted is the Underground's air?

On any given weekday, the London Underground can see up to five million passengers hopping on and off. Its 11 lines serve 272 stations, and at peak times there can be more than 500 trains hurtling around beneath the streets of London. As it's been in constant use since the 19th Century, the London Underground has remained largely the same, and hasn't been updated or researched as much as other forms of transport.

The pandemic did provide Transport for London (TfL), which manages the London Underground, the opportunity to make some improvements. Ventilation