



AN IMMUNE SYSTEM FOR PLANET EARTH

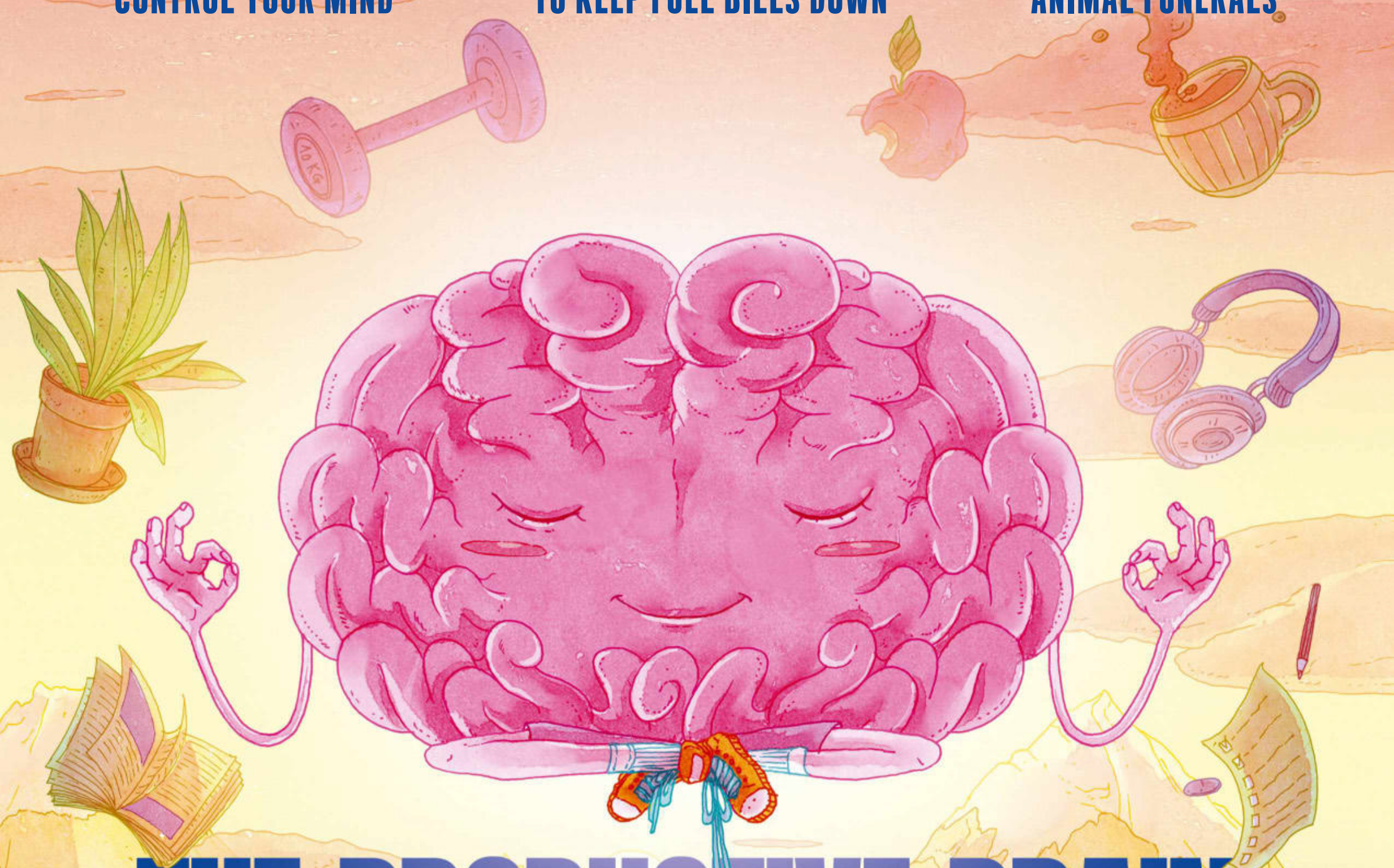
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DISCOVERIES

SPACE

HOW CAN WE SOLVE THE SPACE JUNK PROBLEM?

Recent news of an out-of-control rocket crashing into the Moon sounds dramatic, but it's the millions of pieces of smaller debris that present the real danger, according to a UK expert

In January, Elon Musk's SpaceX once again made headline news: a large section of rocket booster belonging to the spaceflight company was found to be on course to smash into the Moon. The errant chunk of space junk, which has been careering around the Earth for the last seven years, was spotted by American astronomer Bill Gray. He identified it as the upper section of a Falcon 9 rocket, launched from Florida in 2015, which had run out of fuel and become trapped in an 'chaotic orbit'. Many internet pundits and social media users were incensed. Then shortly after Gray's announcement, a group of students

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➤ based at the University of Arizona’s Space Domain Awareness lab eventually identified the offending piece of defunct space hardware as belonging to a Chang’e 5-T1 rocket launched in 2014 by the Chinese space agency.

However, a spokesperson from the Chinese foreign ministry has since told reporters that this cannot be the case as the Chang’e 5-T1 rocket in question safely entered the Earth’s atmosphere and burned up.

At the time of writing, calculations showed that the rocket would crash onto the surface of the Moon on 4 March. But should we be worried about the potential damage it could cause? Not according to Prof Don Pollacco, director of the University of Warwick’s newly formed Centre for Space Domain Awareness.

“It’s no big deal,” he said. “The Moon has actually been a handy dump for things like the Apollo spacecraft. Rather than let them float

ABOVE The rocket that will crash into the Moon could be from the Chinese space agency

around, most of the first and second stages were crashed into the Moon.”

Not only is it no big deal, for those who study objects in Earth orbit it comes as little surprise.

“There are particular orbits that boosters were just dumped in,” said Pollacco. “There are still about 50 objects, maybe more, that are from deep space adventures that are not tracked now. Space is big, but occasionally something like this happens.”

TAKING OUT THE TRASH

The Centre for Space Domain Awareness launched in September 2021 to study the potential threats of space debris to technology, such as satellites, in orbit around Earth. They focus particularly on those in low Earth orbit, which is classed as anything below 2,000km. According to Pollacco, the greater threat is not posed by things like rockets colliding with the Moon, but by much smaller fragments of debris.

According to the most up-to-date statistical estimates carried out by the European Space Agency (ESA) there are currently around 8,000 satellites, functioning or otherwise, in orbit around Earth. Compare this to the 130 million pieces of space debris also occupying the same space and the magnitude of the problem begins to emerge.

What’s more, all but around 36,000 of these fragments are thought to be less than 10cm in

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“Once you start getting below spacecraft size, then we don’t monitor things well enough to continually know what’s there”



LEFT Prof Don Pollacco from the Centre for Space Domain Awareness

diameter. This makes them particularly difficult to track – the errors in measurements of their position are currently in the range of kilometres.

“Most stuff that’s tracked at low Earth orbit is done with radar. And that stems from history, really. It stems from the fact that we have these really big military radar – Fylingdales – that are designed to see missiles,” said Pollacco. They can be used, not in the most efficient way, to look at things a few hundred kilometres up.”

“Once you start getting below spacecraft size, then we don’t monitor things well enough to continually know what’s there. The numbers of small things, even 10 centimetres in size, are just not known, except through models. They’re not observationally verified, so it’s a pretty serious situation,” he said. “There are already some orbits where there is a significant chance of collision. Put it like this – it’s not going to get better.”

As these small pieces of debris are travelling at more than 28,000km/h (17,400mph) – 10 times faster than a rifle bullet – any impact they make with a spacecraft could potentially cause significant damage.

Moreover, unless action is taken to remedy the situation, the risk of triggering a Kessler event becomes more and more of a possibility. This is a catastrophic scenario named after NASA scientist Donald Kessler, who first proposed the theory in the 1970s. It involves a runaway effect in which a satellite that is hit by a lump of space junk breaks into hundreds of tiny pieces, which then hit other satellites and create a domino effect. This could make it extremely dangerous, or even impossible, for rockets to leave the Earth.

“We’re at a situation where it’s not too late. But my worry has always been it’s only when, say, a spaceship carrying people on it is clobbered that we actually take it more seriously. But now we could deal with it before anything really bad happens,” he said. “But we have to be careful because if we don’t do something, then you can be sure that some kind of Kessler event is going to come our way.”

SPACE JUNK IN NUMBERS

9,800 tonnes

Total mass of all space objects in Earth orbit

30,040

Number of debris objects regularly tracked by Space Surveillance Networks

Debris objects estimated by statistical models to be in orbit

36,500

Number of objects greater than 10cm

1 million

Number of objects from 1cm to 10cm

130 million

Number of objects from 1mm to 1cm

Source: sdup.esoc.esa.int/discosweb/statistics/

So what options do we have?

“I think it’s a mixture of being responsible and abiding by the Outer Space Treaty, which means deorbiting things, paying some sort of levy when you launch so that there is a government or a company that goes to remove the old spacecraft that are there,” said Pollacco.

“And then for the rest of the stuff that doesn’t deorbit, we need to know where it is. So instead of having error boxes for each bit of debris that are kilometres in size, you need to have a much more reliable measurement.”