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Neurology

Amnesia may be worse with milder brain damage

Jason Arunn Murugesu

MEMORY problems related to a type of amnesia paradoxically seem to be worse in people with less severe brain damage compared with those with more damage.

Developmental amnesia most often occurs as a result of a baby receiving too little oxygen while being born. This affects a person's episodic memory, which involves recollecting an experience.

To better understand this, Faraneh Vargha-Khadem at University College London and her colleagues asked 23 people who had been diagnosed with developmental amnesia and 32 people without the condition to complete a series of tests to assess their various cognitive abilities.

The participants with developmental amnesia had worse memory recall than those without the condition. A statistical analysis suggests this wasn't a chance finding.

But among the participants with amnesia, those with more extensive damage to their hippocampus – a brain region that plays a key role in memory – had better recall than those with less extensive damage, as assessed via MRI scans (bioRxiv, doi.org/jvvg).

The brains of people with more extensive damage to their hippocampus may undergo reorganisation so that other parts of the brain take over some of its function, says Vargha-Khadem.

The findings point to the brain's plasticity and its limits, as the participants with developmental amnesia still had worse recall than those without the condition, says Vargha-Khadem.

"I believe these findings are incredibly exciting, as they begin to shed much-needed light on the full potential of brain plasticity while outlining its unavoidable limitations," says Antonina Pereira at the University of Chichester, UK.

Astronomy

Sunquakes may be caused by high-energy electron beams

Leah Crane

WE MAY finally know what causes sunquakes. The source of these strange rumbles within the sun has divided solar physicists for decades, but researchers have now found that they may come from beams of high-energy electrons burrowing through the outer layers of the sun.

Sunquakes are waves in the sun's photosphere – the surface from which its light shines – that ripple across the star like the waves from a pebble tossed in a lake. They are usually associated with strong solar flares, which are powerful eruptions of energy that sometimes fling plasma from the sun into huge tendrils and loops in the solar corona, its tenuous outermost layer.

Despite this apparent connection, it has long been debated whether flares could actually cause sunquakes. "The origin of sunquakes is located deep in the photosphere, while solar flares usually occur in the corona," says Mingde Ding at Nanjing University in China.

It makes sense that it would be extremely hard for an energy release in the corona to cause a disturbance in the photosphere because the photosphere is about 1 trillion times denser than the corona, says Ding. "Just as a tail cannot wag a dog."

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Solar flares that coincided with sunquakes from 2008 to 2019

Ding and his colleagues examined data from the Reuven Ramaty High Energy Solar Spectroscopic Imager (RHESSI) space observatory on 20 flares that occurred during the most recent solar cycle, between 2008 and 2019. The researchers focused their analysis on 12 that occurred at the same time as sunquakes.

They found that 11 of the 12 flares also coincided with blasts of X-rays that hinted at the presence of high-energy electrons, far more of them than accompany solar flares without sunquakes. This supports the idea that the magnetic activity thought to cause solar flares also creates beams of electrons that plunge into the sun's photosphere (*The Astrophysical Journal Letters*, doi.org/jvm9).

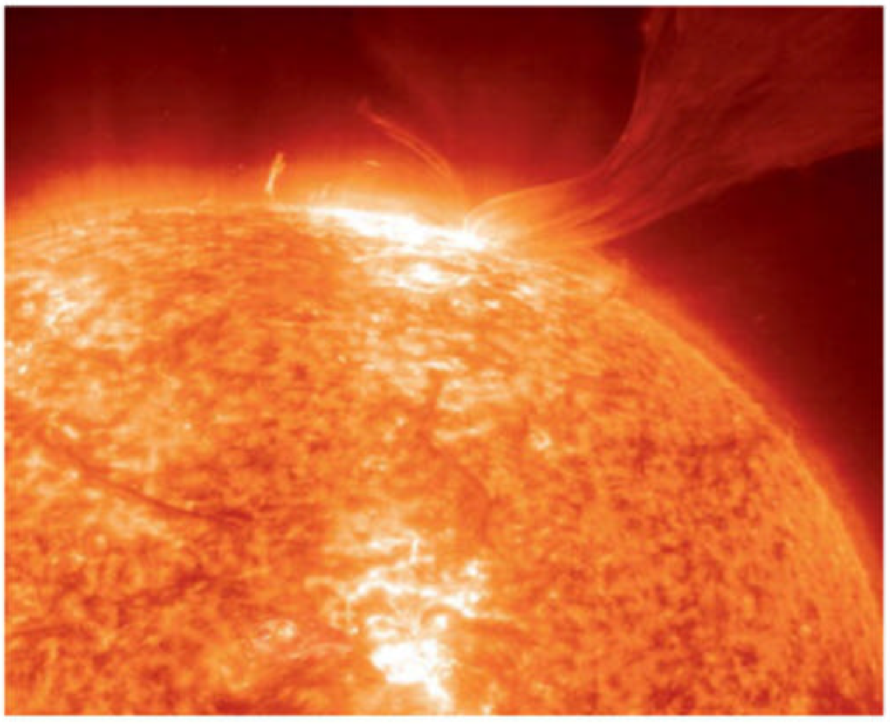
Understanding sunquakes is important because we could use them to probe the areas through which they propagate. "When there are earthquakes we can study the interior of the earth, and when there are sunquakes we can measure the interior of the sun," says Alexander Kosovichev at the New Jersey Institute of Technology.

But it isn't all wrapped up yet: researchers still struggle to explain how the electrons transfer their energy into the sun's plasma to cause a ripple. We also don't know whether any of these mechanisms apply to the quakes observed without strong X-rays.

There are probably multiple mechanisms behind these quakes, the researchers say – the electrons might need some help penetrating the photosphere, and some tremors don't seem to coincide with high-energy electrons at all. "Our work did not provide a full explanation for all kinds of sunquakes, but only a possible scenario in triggering sunquakes," says Hao Wu, also at Nanjing University. "The mystery requires more accurate observation for further validation."

It also requires detailed modelling of how the sun's plasma, magnetic fields and electrons interact with one another. There are several spacecraft observing the sun now, so the data they provide should help researchers finish unravelling the mystery.

Solar flares fling plasma into huge loops in the corona



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