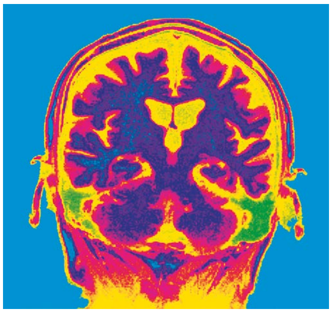
News in brief



BRAIN STIMULATION LEADS TO MEMORY BOOST

Neuroscientists have shown that zapping people's brains with weak electric currents over several days led to long-lasting memory improvements (S. Grover *et al. Nature Neurosci.* https://doi.org/gqpjp7; 2022).

Using transcranial alternating current stimulation (tACS), which delivers electric currents through electrodes on the scalp, the team conducted a series of experiments on 150 people aged 65 or over. Participants were asked to recall lists of 20 words that were read aloud. They underwent tACS for the duration of the task.

Previous studies have suggested that long-term and 'working' memory are controlled by distinct parts of the brain. Drawing on this research, the team showed that stimulating the dorsolateral prefrontal cortex – a region near the front of the brain – with high-frequency currents improved long-term memory, measured by participants' ability to remember words from the beginning of the lists. Stimulating the inferior parietal lobe, which is further back in the brain, with low-frequency currents boosted working memory, enhancing participants' recall of items later in the lists. Memory performance improved over the four days – and the gains persisted even a month later.

DARK-MATTER SIGNAL COULD BE DUE TO ANALYSIS ERROR

Physicists have shown that an underground experiment in South Korea can 'see' dark matter streaming through Earth – or not, depending on how its data are sliced (G. Adhikari *et al.* Preprint at https://arxiv.org/abs/2208.05158; 2022). The results cast further doubt on a decades-old claim that another experiment has been detecting the mysterious substance.

For more than two decades, the DAMA/LIBRA experiment at the Gran Sasso National Laboratory near L'Aquila, Italy, has been reporting yearly fluctuations in flashes registered by the sodium iodide crystals of its detector. These events peak in June and bottom out in December, as physicists would expect if dark-matter particles are suffusing the Milky Way.

But none of the many other dark-matter experiments has so far seen signals compatible with DAMA/LIBRA's. Now one of these – the COSINE-100 detector (pictured) – has shown that, by using a certain type of analysis on its own data, it can produce similar seasonal fluctuations.

That the data analysis created a spurious result "strikes me as a potentially good – and maybe even likely – explanation" for the DAMA/LIBRA claims, says Dan Hooper, a dark-matter theorist at the University of Chicago in Illinois.

CHEAP METHOD BREAKS DOWN 'FOREVER CHEMICALS'

Researchers have developed a way to break down long-lasting chemicals that they say is easier and cheaper than the harsh methods currently used.

Per- and polyfluoroalkyl substances, or PFASs, are widely used in products such as firefighting foams (pictured), waterproof clothes and nonstick cookware. Dubbed 'forever chemicals' because they don't break down under typical environmental conditions, PFASs accumulate in soil and water and can persist in the human body once ingested.

"The chemicals were originally designed by companies to be stable – that was a feature, but once they get into the environment, it's a flaw," says Shira Joudan, an environmental chemist at York University in Toronto, Canada.

PFASs can be removed from water, but disposing of them is challenging. When buried in landfill, PFASs leach into the environment. Methods for disposing of them typically rely on expensive and harsh treatments, some of which require high pressures and temperatures above 1,000 °C.

A team led Brittany Trang, an environmental chemist at Northwestern University in Evanston, Illinois, developed an approach that broke down one of the largest groups of PFASs using inexpensive reagents and temperatures of about 100 °C (B. Trang *et al. Science* **377**, 839–845; 2022).

PFASs owe their durability to a series of carbon–fluorine links, which are among nature's strongest chemical bonds. Instead of trying to break these, Trang and her colleagues targeted a chemical group containing oxygen atoms at one end of PFAS molecules called perfluoroalkyl carboxylic acids, or PFCAs. By heating the compounds in the solvent dimethyl sulfoxide, with a common reagent used in the manufacture of cleaners, the researchers knocked off the oxygen-containing group. This triggered a cascade of reactions that broke the compounds down into harmless products.

Using this approach, the team degraded ten PFASs, including perfluorooctanoic acid (PFOA) – a chemical banned in most countries – and one of its common replacements.

"This is the first time I've seen a degradation mechanism where I thought, 'This could actually make a difference,'" says Joudan.

L TO R: BSIP/UIG/GETTY; COSINE-100 COLLABORATION; FORGET PATRICK/ALAMY