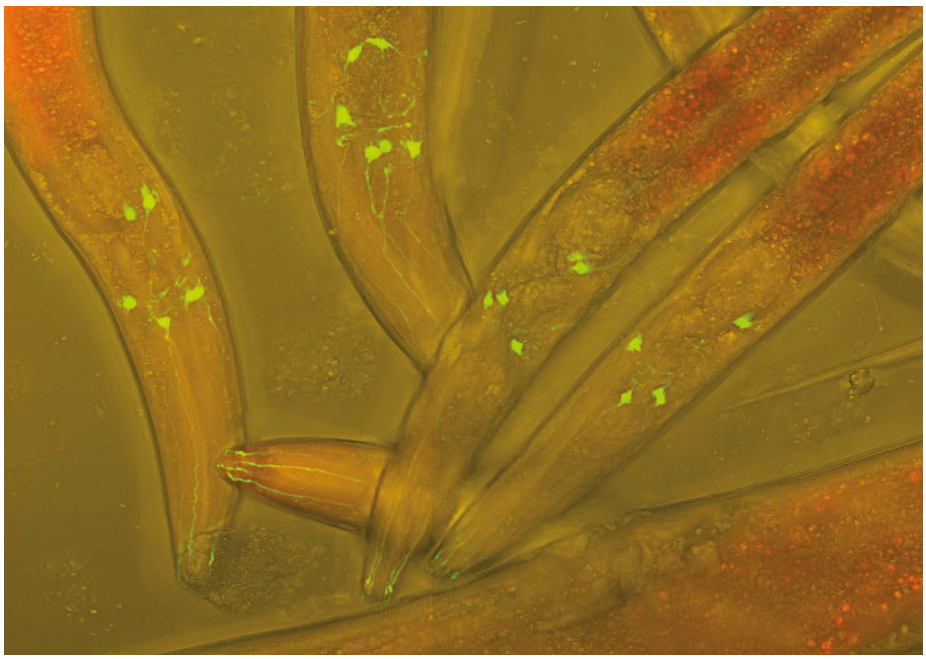


HEITI PAVES/SPL

The worm *Caenorhabditis elegans* has 302 neurons (green).

network. The team enlisted optogenetics, a technique that uses light and light-sensitive proteins to trigger nerve cells so that they send electrical 'messages'. The researchers activated each of *C. elegans*' 302 neurons one by one and then imaged how signals propagated from one neuron to the next.

The map of activity they created did not follow what they would have predicted for *C. elegans* on the basis of the worm's standard connectome alone — and they suspected that neuropeptide communication was the missing piece. So they produced a genetically engineered worm that lacked a protein crucial for this type of signalling, and saw that when they tried to activate the worm's cells with optogenetics, many of them stayed silent. This suggests that wireless communication in the worm directly activates neurons.

When the researchers developed a model to describe neuronal activity in *C. elegans*, they found that one incorporating both wired, synaptic connections and wireless signalling better predicted how signals travelled in the worm than did the synaptic connections alone. The team published its results in *Nature*[1] earlier this month and presented them at the Society for Neuroscience meeting in Washington DC on 14 November.

A whole new view

"It was surprising to see how much [neuropeptide] communication can actually lead to direct activation of neurons," says Francesco Randi, first author of the *Nature* paper, who carried out the work while at Princeton.

"The neuropeptide network was thought of as a helper for synaptic signalling," says Isabel Beets, a neuroscientist at the Catholic University of Leuven in Belgium and an author of the *Neuron* study. "But the extensive scale of this signalling map really shows that it's equally important, complex and maybe even more diverse than the synaptic signalling network."

Drugs such as the popular weight-loss treatment semaglutide (Wegovy) can activate neuropeptide receptors in the body, so understanding this wireless network is important, Schafer says. The next steps for Schafer and his colleagues will be to undertake similar studies in other organisms — aiming to understand how the neuropeptide network, in combination with the 'wired' synaptic network, contributes to an organism's behaviour. Because neuropeptides are conserved across species, some researchers suspect that this network could look similar to those in other organisms, including humans.

"The two papers are beautiful examples of taking advantage of one simple, well-studied organism with lots of molecular and genetic tools to start learning lessons that I am 100% positive are going to apply to all animals," says Stephen Smith, a neuroscientist at the Allen Institute in Seattle, Washington.

Researchers hope the findings will spur others to think differently about how neural dynamics arise. "I think we have to move away from the synapse-only view of the nervous system," Jékely says. "That's just not going to work."

1. Randi, F., Sharma, A. K., Dvali, S. & Leifer, A. M. *Nature* **623**, 406–414 (2023).
2. Ripoll-Sánchez, L. *et al. Neuron* **111**, 3570–3589 (2023).

CHATGPT GENERATES FAKE DATA SET TO SUPPORT HYPOTHESIS

Fabricated database is convincing at a glance, but a close examination shows it doesn't pass as authentic.

By Miryam Naddaf

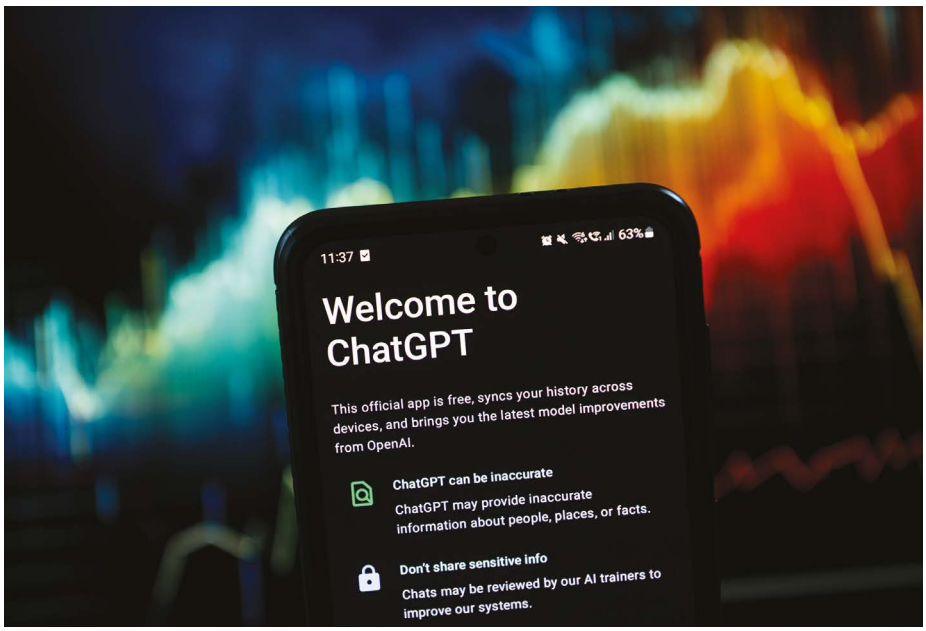
Researchers have used the technology behind the artificial intelligence (AI) chatbot ChatGPT to create a fake clinical-trial data set to support an unverified scientific claim.

In a paper published in *JAMA Ophthalmology* this month, the authors used GPT-4 — the latest version of the large language model on which ChatGPT runs — paired with Advanced Data Analysis (ADA), a model that incorporates the programming language Python and can perform statistical analysis and create data visualizations. The AI-generated data compared the outcomes of two surgical procedures and indicated — wrongly — that one treatment is better than the other (A. Taloni *et al. JAMA Ophthalmol.* https://doi.org/k58f; 2023).

"Our aim was to highlight that, in a few minutes, you can create a data set that is not supported by real original data, and it is also opposite or in the other direction compared to the evidence that are available," says study co-author Giuseppe Giannaccare, an eye surgeon at the University of Cagliari in Italy.

The ability of AI to fabricate convincing data adds to concern among researchers and journal editors about research integrity. "It was one thing that generative AI could be used to generate texts that would not be detectable using plagiarism software, but the capacity to create fake but realistic data sets is a next level of worry," says Elisabeth Bik, a microbiologist and independent research-integrity consultant in San Francisco, California. "It will make it very easy for any researcher or group of researchers to create fake measurements on non-existent patients, fake answers to questionnaires or to generate a large data set on animal experiments."

The authors describe the results as a



The artificial-intelligence model that powers ChatGPT can create superficially plausible data.

MATEUSZ SLODKOWSKI/SOPA IMAGES/LIGHTROCKET VIA GETTY

"seemingly authentic database". But when examined by specialists, the data failed authenticity checks, and contained telltale signs of having been fabricated.

Surgery comparison

The authors asked GPT-4 ADA to create a data set concerning people with an eye condition called keratoconus, which causes thinning of the cornea and can lead to impaired focus and poor vision. For 15–20% of people with the disease, treatment involves a corneal transplant, performed using one of two procedures.

The first method, penetrating keratoplasty (PK), involves surgically removing all the damaged layers of the cornea and replacing them with healthy tissue from a donor. The second procedure, deep anterior lamellar keratoplasty (DALK), replaces only the front layer of the cornea, leaving the innermost layer intact.

The authors instructed the large language model to fabricate data to support the conclusion that DALK results in better outcomes than PK. To do that, they asked it to show a statistical difference in an imaging test that assesses the cornea's shape and detects irregularities, as well as a difference in how well the trial participants could see before and after the procedures.

The AI-generated data included 160 male and 140 female participants and indicated that those who underwent DALK scored better in both vision and imaging tests than did those who had PK, a finding that is at odds with what genuine clinical trials show. In a 2010 report of a trial with 77 participants, the outcomes of DALK were similar to those of PK for up to 2 years after the surgery (M. A. Javadi *et al. Cornea* **29**, 365–371; 2010).

"It seems like it's quite easy to create data sets that are at least superficially plausible. So, to an untrained eye, this certainly looks like a real data set," says Jack Wilkinson, a biostatistician at the University of Manchester, UK.

Wilkinson, who has an interest in methods to detect inauthentic data, has examined data sets generated by earlier versions of the large language model, which he says lacked convincing elements, because they struggled to capture realistic relationships between variables.

At the request of *Nature*'s news team, Wilkinson and his colleague Zewen Lu assessed the fake data set using a screening protocol designed to check for authenticity.

This revealed a mismatch in many 'participants' between designated sex and the sex that would typically be expected from their name. Furthermore, no correlation was found between preoperative and postoperative measures of vision capacity and the eye-imaging test. Wilkinson and Lu also inspected the distribution of numbers in some of the columns in the data set to check for non-random patterns. The eye-imaging values passed this test, but some of the participants' age values clustered in a way that would be extremely unusual in a genuine data set: there was a disproportionate number of participants whose age values ended with 7 or 8.

The study authors acknowledge that their data set has flaws that could be detected with close scrutiny. But nevertheless, says Giannaccare, "if you look very quickly at the data set, it's difficult to recognize the non-human origin of the data source".

Bernd Pulverer, chief editor of *EMBO Reports*, agrees that this is a cause for concern. "Peer review in reality often stops short of a full data re-analysis and is unlikely to pick up on well-crafted integrity breaches using AI," he says, adding that journals will need to update quality checks to identify AI-generated synthetic data.

RECORD-BREAKING HEAT EXPECTED FOR SOUTHERN HEMISPHERE'S SUMMER

The Northern Hemisphere experienced a sweltering summer. Scientists say the south will not escape.

By Bianca Nogrady

The Southern Hemisphere is facing a summer of extremes, say scientists, as climate change amplifies the effects of natural climate variability. This comes in the wake of a summer in the Northern Hemisphere that saw extreme heatwaves across Europe, China and North America, setting records for both daytime and nighttime temperatures in some areas (see 'Heating planet').

Andrew King, a climate scientist at the University of Melbourne, Australia, says that there is "a high chance of seeing record high temperatures, at least on a global average, and seeing some particularly extreme events in some parts of the world".

As 2023 draws to a close, meteorologists and climate scientists are predicting weather patterns that will lead to record high land and sea surface temperatures. These include a strong El Niño in the Pacific Ocean, and a positive Indian Ocean Dipole.

"Those kinds of big drivers can have a big influence on drought and extremes across the Southern Hemisphere," says Ailie Gallant, a climate scientist at Monash University in Melbourne, Australia, and chief investigator for the Australian Research Council Centre of Excellence for Climate Extremes. In Australia, both of those phenomena tend to "cause significant drought conditions, particularly across the east of the country".