

## News in focus

has a personality that isn't representing us well', they have that right. But they did it in the context of this moment. I think that's the issue."

### History of conflict

Randy Schekman, a Nobel-prizewinning cell biologist at the University of California, Berkeley, who was *eLife's* editor-in-chief before Eisen, suspects that the decision stems from ongoing problems between Eisen and the board, with the post on X being the last straw. "He's extraordinarily controversial," Schekman says. "He has a history of inflammatory and often profane statements on his Twitter account."

"I have been involved in controversies," Eisen told *Nature* – including a strange one nicknamed 'Wormgate', in which a crude tweet Eisen posted about worms devolved into a debate about oppression. The board "told me to stop tweeting about *eLife* from my personal account, which I stopped doing a long time ago", Eisen says. "They didn't like that I swore."

His changes to the journal's publication strategy have also proved divisive. Eisen, who became editor-in-chief of *eLife* in 2019, pioneered a policy in which the journal works only with articles that have already been posted on a preprint server. If the journal decides to send an article out for peer review, it then guarantees it will publish it, and posts reviewer comments and a short editorial assessment of the work's significance alongside the paper. *eLife* charges authors US\$2,000 per review.

Several *eLife* editors resigned in protest over the policy, citing issues with Eisen's willingness to listen to feedback and concerns about the journal's reputation. Some in the community called for Eisen to be fired. "I have certainly not always responded in an ideal manner" to criticisms, Eisen admits.

"I'm not afraid of pissing people off," he adds. The board "clearly view this as me having done one too many somethings. Somehow, I'm a powder keg for them that they don't like."

The journal's statement says that the "board remains committed to *eLife's* 'Publish – Review – Curate' model".

Eduardo Franco, a senior editor at *eLife* and a cancer epidemiologist at McGill University in Montreal, Canada, told *Nature* that Eisen's "passion for making *eLife* a force in the preprint-review model was admirable. Occasionally, his behaviour would deviate from the usual gravitas expected from an editor-in-chief." The informality of social media combined with the tension of current geopolitical events creates "the conditions for a perfect storm", Franco says.

### Extramural activities

It is not unprecedented for academics to be fired over 'extramural speech' – comments made outside work. These cases usually hinge

on extremely inflammatory statements, says Sophia McClennen, founding director of Pennsylvania State University's Center for Global Studies in University Park.

In one prominent case in 2014, Steven Salaita, a scholar of Jordanian and Palestinian descent, had a job offer at the University of Illinois revoked because of a series of tweets violently critical of Israel's bombardment of Gaza in 2014. Salaita sued the university for breach of contract and violation of his free speech;

**The board "clearly view this as me having done one too many somethings. Somehow, I'm a powder keg."**

in 2015, the university agreed to an \$875,000 settlement while admitting no wrongdoing.

The protest letter in support of Eisen expresses the view that there are some circumstances that would warrant removing a leader from their role because of problematic public statements, including statements that express views "antithetical to the value or mission of the organization", that suggest ignorance on matters key to the job, that are explicitly disrespectful to colleagues or that are hate speech. The letter says that Eisen's posts on X do not fall into such categories.

Following up on X on 14 October, after he promoted the *Onion* article, Eisen posted: "Every sane person on Earth is horrified and traumatized by what Hamas did and wants it to never happen again. All the more so as a Jew with Israeli family. But I am also horrified by the collective punishment already being meted out on Gazans, and the worse that is about to come." On 7 October, Hamas, an Islamist organization that governs Gaza and has been designated a terrorist group by some countries, launched attacks in Israel in which it killed more than 1,400 people and kidnapped at least 200, according to Israeli officials. Israel declared war soon after and has been bombarding Gaza. As *Nature* went to press, more than 8,000 Palestinians had been killed, according to the health ministry in Gaza.

Some responders on X expressed surprise that anyone would find Eisen's statements controversial, whereas others were deeply offended on behalf of Israelis who have suffered in the violence. Ehud Cohen, a molecular biologist at the Hebrew University of Jerusalem, posted on X: "I will not review and will not publish in *eLife* as long as you are the EIC."

McClennen says it can sometimes be hard to evaluate whether there are legitimate reputational costs for an organization caused by an employee's extramural speech. "That can be a grey area," she says. But, if Eisen's firing was based on the posts on X earlier this week, then she thinks it was "inappropriate".

## JAPANESE RESEARCH IS NO LONGER WORLD CLASS — HERE'S WHY

Despite a strong workforce, Japan's research continues to slide down the indicators of quality.

By Anna Ikarashi

**J**apan's contribution to world-class research continues to decline, despite the country having one of the world's largest research communities, according to a report by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT; see [go.nature.com/3shaqjd](https://go.nature.com/3shaqjd)).

Masatsura Igami, director of the Center for S&T Foresight and Indicators at the National Institute of Science and Technology Policy (NISTEP) in Tokyo, and one of the authors of the 2023 edition of the Japanese Science and Technology Indicators report, says that the findings highlight several areas that Japan could explore to improve its global standing.

"Japan's current research environment is far from ideal and is unsustainable. The research environment must shape up," he says.

The report shows that Japan ranks third globally in the total number of researchers, after China and the United States. However, this workforce is not producing as much high-impact research as it was two decades ago. Japan's global share of research papers in the top 10% of most-cited articles has slipped from 6% to 2%, intensifying concerns in the nation (see 'Slipping down').

Igami says that Japan has been overtaken in terms of quality output. "Japanese researchers haven't become less productive. But the research environment in other countries has improved so much over the past few decades,"

he says (see 'Steady but slipping').

Some of the decline might be attributable to funding, Igami says. The 2023 report shows that research spending in the university sector has grown by roughly 80% in the United States and Germany, and by 40% in France; quadrupled in South Korea; and increased tenfold in China over the past two decades. By contrast, Japan's spending has increased by 10%.

However, even if Japan's researchers receive more funding, producing high-impact work might still be challenging, because they are spending less time on actual research, Igami says. According to a 2020 analysis by MEXT, the proportion of time that university researchers dedicated to science decreased from 47% to 33% between 2002 and 2018.

"University researchers are increasingly expected to take on diverse roles in teaching, industry collaborations and community engagement. In medicine, junior researchers are dedicating more time to clinical duties to maintain hospital revenue," says Igami. "While there are benefits to universities contributing to the wider society in diverse ways, it limits the time available for research."

The report's findings confirm those of a previous survey of early-career researchers, which pointed to a lack of time for research as a notable factor in job dissatisfaction (see [go.nature.com/4ojrvuj](https://go.nature.com/4ojrvuj)). Haruka Ono, a civil engineer at the Toyohashi University of Technology in Japan, who was part of the group that conducted the survey, says that respondents found administration too onerous.

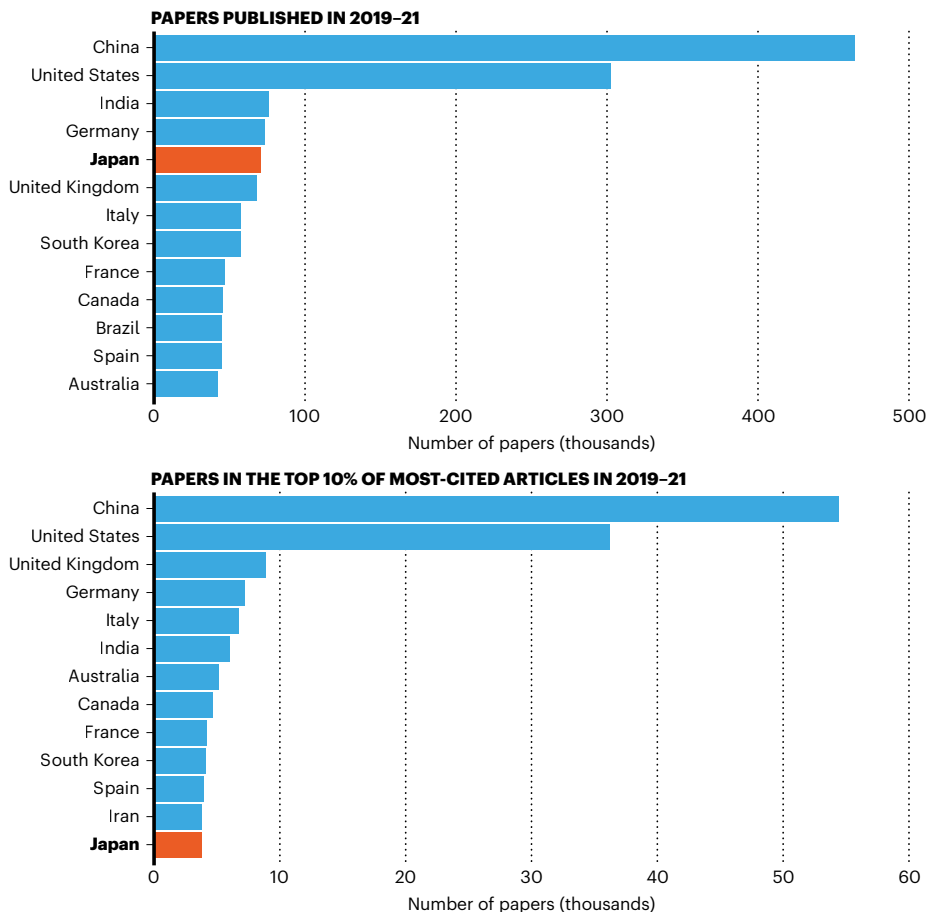
"Anything from visa paperwork for foreign lab members, to taking calls from landlords claiming that your students aren't paying rent on time – that's your responsibility if you are a principal investigator," she says.

To secure more research time, Wataru Iwasaki, a computational biologist at the University of Tokyo, who represents early-career researchers at the Science Council of Japan, would like to see more support staff, including administrative personnel and laboratory technicians as well as those with business expertise to facilitate collaborations with the private sector. Currently, Japanese universities have one technician per 20 researchers, markedly fewer than other countries included in the 2023 report.

Having more support staff would also increase the trend of moving away from the hierarchical laboratory models prevalent in Japan, adds Ono. Conventional lab structures give senior faculty members control over research direction and resources, with junior faculty members often playing an assisting part. For example, Tohoku University, which has been selected as the recipient of Japan's new university endowment fund, has pledged to appoint more junior researchers as principal investigators. But without more support staff, the sudden autonomy could end up being counterproductive for junior researchers. Ono

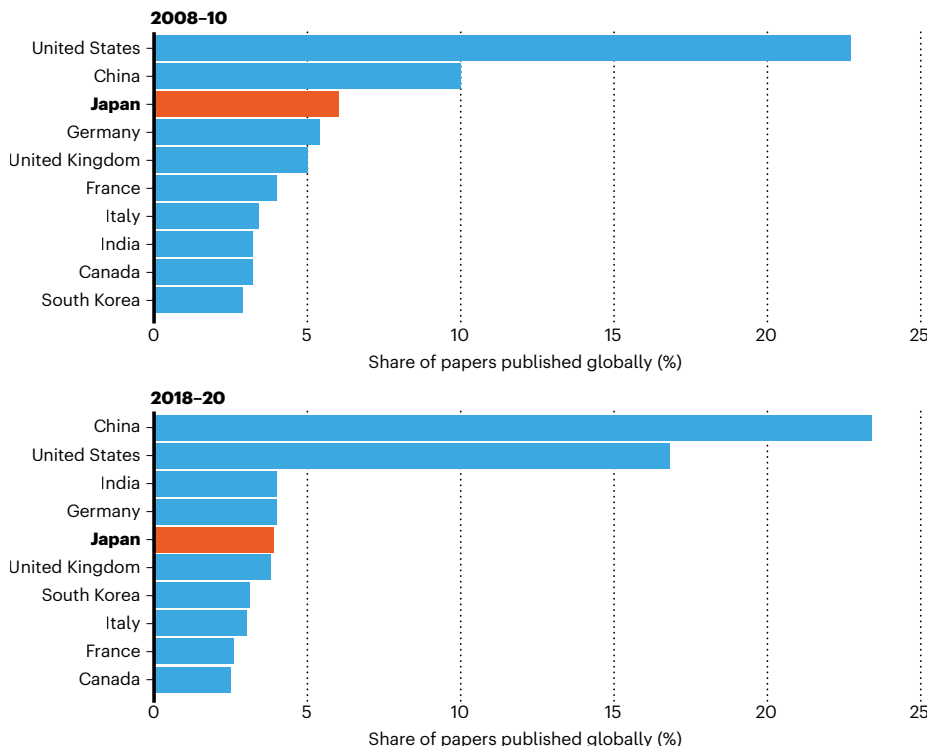
## SLIPPING DOWN

Although Japan was ranked fifth globally in terms of output of scientific papers in 2019–21, it ranked 13th on measures of quality output.



## STEADY BUT SLIPPING

Japan's output of scientific papers has stayed steady over time, hovering at around 65,000 papers published in 2008–10 and in 2018–20. But its overall share of papers published globally has slipped from 6% to below 4%.



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says when she was made a principal investigator, she went from having no experience in running a lab, to having students depend on her for direction while also needing to meet her own research goals, without any professional support – an experience she describes as “overwhelming”. “The anxiety that came with it was not constructive for attempting long-term, high-impact research,” she says.

Igami says that seeing lab members struggle with increased seniority might be putting off younger scientists from pursuing a career

in research. He says that the number of PhD students has dropped by 21% in the past two decades. Attracting more PhD students to the lab, who have more research experience than undergraduates and master’s students, will be crucial for facilitating higher-impact research for Japan, he says.

“Japan’s research environment hasn’t progressed from the past, and career prospects in academia are only getting worse, as universities increasingly offer temporary positions for researchers,” he says.

# AI HAS HUMAN-LIKE ABILITY TO GENERALIZE LANGUAGE

## A neural network outperforms ChatGPT in a key aspect of human intelligence.

By Max Kozlov & Celeste Biever

Scientists have created a neural network with the human-like ability to make generalizations about language. The artificial intelligence (AI) system performs about as well as humans at folding newly learnt words into an existing vocabulary and using them in fresh contexts, which is a key aspect of human cognition known as systematic generalization.

The researchers gave the same task to the AI model that underlies the chatbot ChatGPT, and found that it performed much worse than did either the new neural net or people, despite the chatbot’s uncanny ability to converse in a human-like manner (B. M. Lake and M. Baroni *Nature* <https://doi.org/k23d>; 2023).

The work, published on 25 October in *Nature*, could lead to machines that interact with people more naturally than even the best AI systems do today. Although systems based on large language models, such as ChatGPT, are adept at conversation in many contexts, they display glaring gaps and inconsistencies in others.

The neural network’s human-like performance suggests there has been a “breakthrough in the ability to train networks to be systematic”, says Paul Smolensky, a cognitive scientist who specializes in language at Johns Hopkins University in Baltimore, Maryland.

Systematic generalization is demonstrated by people’s ability to effortlessly use newly acquired words in fresh settings. For example, once someone grasps the meaning of the

word ‘photobomb’, they can use it in a variety of situations, such as ‘photobomb twice’ or ‘photobomb during a Zoom call’. Similarly, someone who understands the sentence ‘the cat chases the dog’ will also understand ‘the dog chases the cat’ without much extra thought.

### Language lessons

But this ability does not come innately to neural networks, which emulate human cognition and have dominated artificial-intelligence research, says Brenden Lake, a cognitive computational scientist at New York University and co-author of the study. Unlike people, neural nets struggle to use a new word until they have been trained on many sample texts that use that word. AI researchers have sparred for nearly 40 years over whether neural networks could ever be a plausible model of human cognition if they cannot demonstrate this type of systematicity.

To attempt to settle this debate, the authors first tested 25 people on how well they use newly learnt words in different situations. The researchers ensured that the participants would be encountering these words for the first time by testing them on a pseudo-language consisting of two categories of nonsense words. ‘Primitive’ words such as ‘dax’ and ‘lug’ represented basic, concrete actions such as ‘skip’ and ‘jump’. More abstract ‘function’ words such as ‘kiki’ and ‘fep’ specified rules for using and combining the primitives, resulting in sequences such as ‘jump three times’ or ‘skip backwards’.

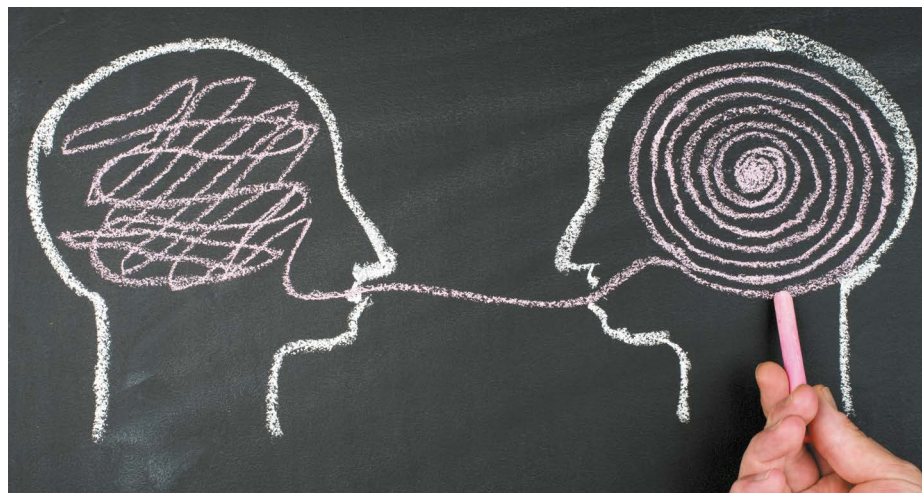
Participants were trained to link each primitive word with a circle of a particular colour, with a red circle representing ‘dax’, and a blue circle representing ‘lug’. The researchers then showed the participants combinations of primitive and function words alongside the patterns of circles that would result when the functions were applied to the primitives. For example, the phrase ‘dax fep’ was shown with three red circles, and ‘lug fep’ with three blue circles, indicating that fep denotes an abstract rule to repeat a primitive three times.

Finally, the researchers tested participants’ ability to apply these abstract rules by giving them complex combinations of primitives and functions. The volunteers then had to select the correct colour and number of circles and put them in the appropriate order.

### Cognitive benchmark

As predicted, people excelled at this task; they chose the correct combination of coloured circles about 80% of the time, on average. When they did make errors, the researchers noticed that these followed a pattern that reflected known human biases.

Next, the researchers trained a neural network to do a task similar to the one presented to participants, by programming it to learn from its mistakes. This approach allowed the AI



A neural net has achieved a version of humans’ flexibility at using new vocabulary.