

Japan

Editorial Simon Baker, Benjamin Plackett, Rebecca Dargie, David Payne **Analysis** Bo Wu, Catherine Cheung **Art & design** Tanner Maxwell, Madeline Hutchinson, Anthea Lewis, Sou Nakamura, Wojtek Urbanek **Production** Ian Pope, Nick Bruni, Kay Lewis, Bob Edenbach, Paul Glaeser **Sales and Partner content** Yuki Fujiwara, Eri Shimoyama, Yosuke Sato, Keitaro Matsukawa, Amanda Rider, Natsumi Penberthy, Simon Pleasants, Anne Leitch, Chika Takeda, Rebecca Pan, Yoshiko Sugita, Takeaki Ishihama, Shoko Hasegawa, John Pickrell **Marketing & PR** Kimberly Petit, Aiko Shuzui, Ritsuko Miki **Publishing** Rebecca Jones, Richard Hughes, David Swinbanks.

Nature Index 2023 Japan, a supplement to *Nature*, is produced by Nature Portfolio, the flagship science portfolio of Springer Nature. This publication is based on data from the Nature Index, a Nature Portfolio database, with a website maintained and made freely available at natureindex.com.

Nature editorial offices
The Campus, 4 Crinan Street,
London N1 9XW, UK
Tel: +44 (0)20 7833 4000
Fax: +44 (0)20 7843 4596/7

Customer services
To advertise with the Nature Index, please visit natureindex.com or email clientservicesfeedback@nature.com.

© 2023 Springer Nature Limited.
All rights reserved.

Nature Index supplements on Japan over the past decade have documented the country's ongoing struggles to compete globally in high-quality research. The latest data are no exception: the nation's adjusted Share in the Nature Index fell to 3,185 in 2021, a level that represented just 12.6% of Asia Pacific output, down from 21.4% in 2015. There are rumblings, however, of a potential rebound. The data suggest there is light at the end of the tunnel as Japanese scientists show a stronger performance in life sciences, where adjusted Share remained higher in 2021 than in 2019.

Successes in creating spin-off companies from research, and a focus on tailoring support for young researchers are paying dividends (see page S48). We shine a light on individual successes among that emerging generation of scientists (see pages S62–S81). The government is also rolling out a new endowment scheme worth ¥10 trillion (US\$75 billion), inspired by the funding models that sustain the Ivy League universities in the United States, that could further boost recovery. There are concerns, however, about what this could mean for academic independence and whether enough universities in Japan will reap the benefit (see page S84).

There remain challenges that demand more complex solutions than cash injections. Robotics research, for example, was an area in which Japan enjoyed an edge as an enthusiastic and early adopter. But although the country's engineers continue to excel in robotics hardware, Japanese science is lagging behind other major global players in the emerging field of artificial intelligence (AI). Without finding a way to incorporate this AI revolution, it could be difficult for Japan to stay relevant in the field (see page S92). This is indicative of where Japanese science finds itself today more generally. It is still making impressive gains, but these achievements are fragile and need continual nurturing if they are to endure.

Benjamin Plackett

Locum senior editor, Nature Index

**Nature Index's signature metric Share, used in this supplement, is a fractional count for an article allocated to an institution, city or country/region, that accounts for the proportion of authors on the article whose institutional affiliation is with that institution or location. Adjusted Share accounts for the small annual variation in the total number of articles in the Nature Index journals. We point out that the Nature Index provides just one indicator of research performance, and many other factors must be taken into account when assessing the quality of research or institutions.*



On the cover: Mariko Kimura,
Credit: Irwin Wong for *Nature*

Contents

- S48 A concerted effort to reassert research strength**
Japan has seen promising results, but continuing success is not guaranteed.
- S56 Joint effort**
A look at cooperation between scientists in Japan and abroad.
- S57 Let's free up PhD potential**
A lack of prospects means Japan isn't making the most of valuable talent.
- S62 Expecting the unexpected**
Mariko Kimura delves into the mysteries of distant galaxies.
- S66 Lightning watcher**
Yuuki Wada uses data from storms to study high-energy particles.
- S72 Seismic sleuth**
How submarine sensors help Tatsuya Kubota to understand earthquakes.
- S76 Taste chaser**
Yasuka Toda's research reveals the evolution of taste receptors.
- S80 Heavy hitter**
Ken-ichi Otake uses novel materials to isolate 'heavy water'.
- S84 Will Japan's ¥10-trillion fund lift research performance?**
Endowment must be accompanied by other reforms, say critics.
- S86 Shoring up Japan's research performance**
Takahiro Ueyama explains the Japanese government's plan to reinvigorate universities.
- S87 Disciplinary focus**
Physical sciences and chemistry still dominate Japan's research output.
- S92 A robotic romance on the rocks**
Japan's universities are lagging in automation breakthroughs.
- S98 The tables**
How Japan's leaders stack up.