food production on the Moon, as well as an instrument to measure radiation levels. The latter is Taiwan's first effort to fly a payload into deep space, "and so is a very significant development" in Taiwan's space capacity, says Loren Chang, a space scientist at National Central University in Taoyuan City, Taiwan, who leads the project. The instrument is expected to power up soon after launch, and to gather radiation data as the lander flies to the Moon. The information it collects could help to protect the health of future astronauts.

Moondust and dirt

Meanwhile, the Firefly lander, called Ghost Riders in the Sky, is heading for the lunar plain known as Mare Crisium, or Sea of Crises, closer to the equator than ispace's target. It will take around 45 days to arrive. The landing site was chosen to avoid magnetic anomalies on the lunar surface that could interfere with observations, says Ryan Watkins, a programme scientist at NASA headquarters in Washington DC.

NASA paid Firefly US$101 million to fly ten payloads to the lunar surface. Among them is a 'PlanetVac' designed to hoover up lunar soil using bursts of compressed air, and a drill to measure heat flow in the upper few metres of soil. Three experiments will study how lunar dust adheres to various materials, which could inform future attempts to build a Moon base. There is also a computer that will test strategies for coping with glitches created by space radiation, and an experiment that will be one of the first attempts on the Moon to lock on to satellite-navigation signals.

Also on board is an X-ray instrument that aims to capture some of the first wide-field images of the magnetic shield that protects Earth from charged particles flowing from the Sun. The instrument will use the Moon as a platform for looking back at the planet, to see how its magnetic shield interacts with the rest of the space environment. "It's really exciting stuff," says Ramiz Qudsi, a space physicist at Boston University in Massachusetts who works on the project.

When night falls

If the missions make it, both will operate for up to 14 days on the surface, or until lunar night falls. The cold and dark will then render them both inoperable – although the Firefly lander aims to keep gathering data for a few hours into the night until it fails.

Planners of future Moon missions should consider using radioisotope power systems to provide heat and electricity, says Hannah Sargeant, a planetary scientist at the University of Leicester, UK, who is working with ispace on mission concepts. That would allow probes to operate through the lunar night, enabling more science and more exploration, she says.

Current diagnosis methods for obesity lack nuance, say researchers.

NEW OBESITY DEFINITION SIDELINES BMI TO FOCUS ON HEALTH

Fresh approach to diagnosing the condition looks at how excess fat affects the body.

By Giorgia Guglielmi

Amid the rising buzz around Ozempic and similar weight-loss drugs, a group of 58 researchers is challenging the way obesity is defined and diagnosed, arguing that current methods fail to capture the complexity of the condition. They offer a more nuanced approach.

The group's revised definition, published in *The Lancet Diabetes & Endocrinology*[1] on 14 January, focuses on how excess body fat, a measure called adiposity, affects the body, rather than relying only on body mass index (BMI), which links a person's weight to their height. They propose two categories: preclinical obesity, when a person has extra body fat but their organs work normally, and clinical obesity, when excess fat harms the body's organs and tissues.

This shift could improve clinical care, public-health policies and societal attitudes toward obesity, says Elisabeth van Rossum, an endocrinologist at the Erasmus University Medical Center Rotterdam in the Netherlands.

"Now the idea is, eat less, move more, and you'll lose weight," says van Rossum, who wasn't involved in the work. Although a healthy lifestyle is important, she adds, "if it would be

so simple, we wouldn't have an epidemic, and this paper is an excellent contribution to the discussion about the complexity of obesity".

Global problem

More than 1 billion people worldwide live with obesity, and the condition is linked to about 5 million deaths every year[2] from disorders such as diabetes and cardiovascular disease.

Because it is easy to measure and compare, BMI has long been used as a tool to diagnose obesity. But it doesn't offer a full picture of a person's health, because it doesn't account for differences in body composition, such as muscle versus fat.

For people of European descent, obesity is typically defined by a BMI of 30 or higher, which correlates with a high level of body fat. However, a muscular athlete might be labelled obese on the basis of BMI, whereas someone with a 'normal' BMI might have excess fat that increases their risk of heart problems or other serious health issues, says Francesco Rubino, a bariatric surgeon at King's College London, who led the group proposing the new approach.

Conventional methods lead to unnecessary treatment for some people while missing others who need help, he says. To address this, Rubino and his colleagues propose a system

for diagnosing obesity that goes beyond BMI, combining it with other methods such as measuring waist circumference, which is a proxy for adiposity, or body scans using low-level X-rays, which can directly measure fat mass.

Although there isn't a fixed threshold for obesity, body fat is typically considered to be in excess when it is above 25% in men and 30–38% in women. Because measuring adiposity directly might be impractical or costly, alternative health markers such as waist size, waist-to-hip ratio or waist-to-height ratio are important, the researchers say. However, they add, it's safe to assume that a person with a BMI above 40 has high body fat.

Diagnosing obesity should also consider the results of standard laboratory tests, medical history and information on daily activities to assess how excess body fat might affect a person's health, says study co-author Robert Eckel, an endocrinologist at the University of Colorado Anschutz Medical Campus in Aurora. "These are objective diagnostic criteria, they're standardized across global health systems," he says.

Personalized assessments that consider age, gender and ethnicity are equally important, because certain groups might face health risks at lower BMI thresholds than others, says study co-author Louise Baur, a paediatrician at the University of Sydney, Australia.

Two categories

Although people with preclinical obesity have tissues that work normally, they are at a higher risk of developing health problems than are people without obesity. They can benefit from counselling and preventive measures such as lifestyle changes to reduce their risk of developing more serious health issues, the group says.

Clinical obesity occurs when excess fat harms organs or it seriously limits daily activities such as walking or getting dressed. People with clinical obesity might require treatments aimed at improving health and preventing complications.

Rubino notes that this approach is especially important with the growing use of weight-loss drugs, because it helps to provide more accurate diagnoses and make treatment effective and cost-efficient.

Stigma challenge

The approach, which has been supported by dozens of scientific and patient-advocacy groups worldwide, reflects increasing evidence of obesity's effects on health, van Rossum says. Another framework, published last year[3], also recognized that the obesity diagnosis should go beyond BMI to include an assessment of its impacts on health.

However, many health-care providers still see obesity as an issue of willpower rather than

a disease driven by excess fat, regardless of its underlying causes — which may include hormonal changes and genetic factors, van Rossum says. In the Netherlands, for example, a study she co-authored found that most people with obesity had experienced stigma in a health-care setting[4]. This stigma often prevents people from seeking care, highlighting the need for better education and communication about the condition.

Although the latest approach aims to give a more accurate picture of obesity, it's unclear

whether it will lead to more or fewer diagnoses, or how it will affect management of the condition in the clinic. "With time, we hope that this sort of assessment will be included in clinical practice guidelines," Baur says.

1. Rubino, F. et al. Lancet Diabetes Endocrinol. https://doi.org/10.1016/S2213-8587(24)00316-4 (2025).
2. GBD 2019 Risk Factors Collaborators. Lancet 396, 1223–1249 (2020).
3. Busetto, L. et al. Nature Med. 30, 2395–2399 (2024).
4. Crompvoets, P. I., Nieboer, A. P., van Rossum, E. F. C. & Cramm, J. M. Health Expect. 27, e13954 (2024).

# HOW SHOULD WE TEST AI FOR HUMAN-LEVEL INTELLIGENCE?

OpenAI's o3 model's record-breaking performance on science and maths tests, wowing researchers.

By Nicola Jones

The technology firm OpenAI made headlines last month when its latest experimental chatbot model, o3, achieved a high score on a test that marks progress towards artificial general intelligence (AGI). OpenAI's o3 scored 87.5%, trouncing the previous best score for an artificial intelligence (AI) system of 55.5%.

This is "a genuine breakthrough", says AI researcher François Chollet, who created the test, called Abstraction and Reasoning Corpus for Artificial General Intelligence (ARC-AGI)[1], in 2019 while working at Google, based in Mountain View, California. A high score on the test doesn't mean that AGI — broadly defined as a computing system that can reason, plan
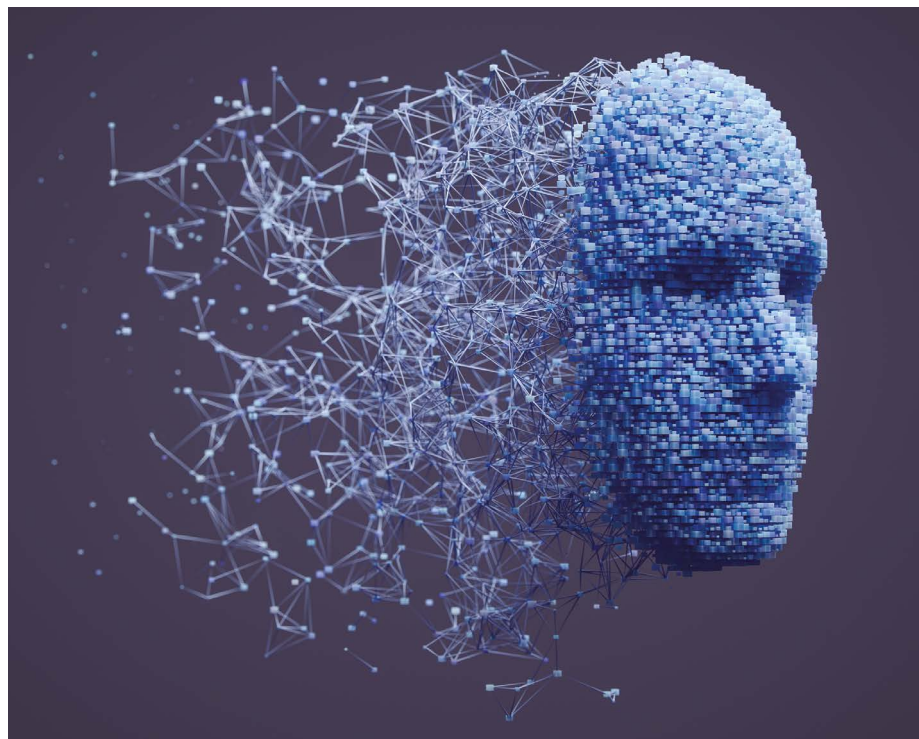
Some researchers think AI systems will reach human-level intelligence soon.