

that will stay on his record for three years, and which is 'category 1', the least serious sanction on the four-tier scale used in the civil service.

The finding contrasts with the 2015 CNRS investigation, which found Voinnet guilty of research misconduct and suspended him from the agency for 2 years — a category 3 sanction. At the time, the agency found no evidence of data fabrication, but said the intentional manipulation of figures breached ethical standards.

The CNRS has also now said that, in its joint report with ETH Zurich, the institutes concluded that another former researcher at the laboratory, Patrice Dunoyer, committed misconduct in the form of figure manipulations — and in corrections to the manipulated papers — including data fabrication. The CNRS said that Dunoyer would receive the category 2 sanction of a demotion, a more severe punishment than Voinnet's but still relatively low.

In 2015, Dunoyer had received a 12-month exclusion from the CNRS, without pay, for scientific misconduct, with 11 of those months served as a suspended sentence. Alain Schuhl, deputy director-general in charge of scientific affairs at the CNRS, told *Nature* that this suspended sentence will now kick into effect.

The latest version of the CNRS's official bulletin, published on 10 October, confirms the charges and sanctions against Dunoyer, and the reprimand on Voinnet. Yet the first version

of the bulletin, published on 9 October, made no mention of the minor sanction the CNRS gave to Voinnet, which a CNRS spokesperson attributes to a "computing bug".

Dunoyer, who the CNRS statement says is on temporary assignment at the secretariat general of South Province of New Caledonia, his place of birth, has not replied to *Nature*'s requests for comment. Loic Dusseau, Dunoyer's lawyer, told *Nature* that Dunoyer asked him to consider whether to appeal the CNRS ruling, and says that Dunoyer feels the ruling is unfair and questionable.

**"A reprimand is what I only should have got in 2015 — and not a two-year suspension."**

#### DRIVING FORCE

The latest probe was instigated at the initiative of Voinnet, according to ETH Zurich, after he raised the possibility of more-serious misconduct than had been found in 2015.

Voinnet says that the "CNRS's reprimand is perfectly in line with the conclusions of ETH Zurich last month exonerating me". But he takes issue with the agency's 2015 ruling: "A reprimand is what I only should have got in 2015 — and not a two-year suspension."

Schuhl declined to comment on the seeming reversal of responsibilities in the CNRS's latest

conclusions compared with 2015. He said that the matter of its 2015 investigation is closed.

Questions about papers co-authored by Voinnet were first raised in January 2015 on the PubPeer website, which allows anonymous commenting about research articles. The CNRS announced in April 2015 that it had set up a commission to investigate the affair — and in July that year, it announced the original sanctions against Voinnet. At the time, its official bulletin referred only to an inquiry commissioned in early 2015, and to an 8 June 2015 meeting of CNRS's disciplinary committee. *Nature* has obtained a copy of the confidential report of the inquiry, which comprised three CNRS scientists and two from other French research organizations who, between 29 January and 2 February 2015, inspected the relevant articles and interviewed several people, including Voinnet and Dunoyer. The report makes no mention of lab notebooks or raw data, unlike the latest investigation, and runs to four pages.

Voinnet hopes that the recent investigation will lift "the cloud of suspicion that has hung over many other members of the lab". But he told *Nature* that he now intends to take administrative legal action against the CNRS to challenge the grounds for his 2015 sanction. In response, the CNRS spokesperson said that the latest investigation has no bearing on the sanctions pronounced in 2015. ■

#### CLIMATE IMPACTS

# Trouble brewing for beer prices

*Extreme weather will cut barley yields and drive up drink costs, say researchers — but the increase could encourage more people to pay attention to climate change.*

BY MATTHEW WARREN

**E**xtrême weather caused by climate change can have devastating effects — and it turns out that not even beer is safe.

More-frequent droughts and heat waves in the twenty-first century will reduce global production of barley, finds a study published on 15 October (W. Xie *et al. Nature Plants* <http://doi.org/cvtm>; 2018). In turn, it shows, this will decrease the supply of beer, drive up prices and cut consumption, even under best-case climate-change scenarios.

Studies have previously explored how climate change will affect staple foods and luxury goods. But nobody has considered how beer will fare, says Dabo Guan, a climate-change economist at the University of East Anglia in Norwich, UK. It might seem trivial to consider beer production, but Guan hopes that helping people to understand how climate change could affect their daily lives will motivate them to take action. "What I'm trying to emphasize

#### CLIMATE'S TOLL ON BEER

Models show that during years of drought and heat waves driven by climate change, the global supply of barley — and therefore beer — will decrease and prices will rise.

##### High-emissions scenario



here is that climate change will impact people's lifestyle," he says. If people "want to drink beer when we watch football, then we have to do something", he says.

The team began by examining the chances of major droughts and heat waves occurring in barley-growing regions on all six inhabited continents between 2010 and 2099. They considered four futures, based on different emissions scenarios, from low to high emissions throughout the century.

In each case, extreme weather was likely to become more frequent in barley-growing regions compared with the number of similar events recorded in the late twentieth and early twenty-first centuries. In the best-case scenario, the chance of extreme weather increased by a modest 4%, but the worst case saw a rise of 31%. The researchers then simulated the effect of these droughts and heat waves on barley production by using software to model crop growth and yield on the basis of weather and other variables. They found that, globally, ►

► extreme weather would reduce barley yield by between 3% and 17%. Some countries fared better than others: tropical areas such as Central and South America were hit badly, but crop yields increased in some temperate areas, including northern China and the United States. But this was not enough to offset the global decrease.

Finally, Guan and his colleagues fed these changes in barley yield into an existing economic model to look at how reduced barley production would affect pricing and

consumption of beer. In the worst-case scenario, the reduced barley supply would result in doubling of prices and a 16% decrease in beer consumption in the years of extreme-weather events (see ‘Climate’s toll on beer’).

Klaus Hubacek, an ecological economist at the University of Maryland in College Park, says that the study does a good job of combining climate, agriculture and economics models. He wonders how other alcohol crops might be affected, and whether beer drinkers might switch to cider or other alcoholic drinks.

But worries about beer pale in comparison to projections of how climate change could harm food security generally, says David Reay, a climate-change scientist at the University of Edinburgh, UK. “The effect on beer is going to be the least of our worries,” he says, especially in the worst-case climate scenarios. Reay worries this message could be diluted in studies such as Guan’s, which concentrate on luxury items.

“I think in that kind of future, I probably will need a beer, because it will be pretty bad,” Reay says. ■

## SPACE

# Mercury probes ready to begin seven-year journey

*BepiColombo, a joint Europe–Japan mission, is only second ever mission to the planet.*

BY DAVIDE CASTELVECCHI

A European rocket is ready to launch the most ambitious mission ever to Mercury, Earth’s once-neglected sibling in the Solar System. The €1.6-billion (US\$1.85-billion) expedition, carrying 2 robotic orbiters, ranks among the most expensive missions undertaken by the European Space Agency (ESA), and includes Japan’s largest contribution yet to an international collaboration in space.

If all goes according to schedule, BepiColombo will lift off in the late hours of 19 October from the Kourou spaceport in French Guiana, atop an Ariane 5 heavy-launch vehicle, to embark on a seven-year journey to Mercury. When it gets there, it will release two probes into the planet’s orbit: the Mercury Planetary Orbiter (MPO), built by the European Space Agency (ESA), and the Mercury Magnetospheric Orbiter, nicknamed MIO and built by the Japan Aerospace Exploration Agency (JAXA).

The orbiters will investigate the mysteries of the innermost, smallest planet of the Solar System (see ‘Journey to Mercury’). Mercury was once thought to be a static, boring place. But in recent years, it has revealed many surprises, from its unusual magnetic field to water-ice deposits in some of its craters.

BepiColombo was first conceived in the 1990s and has had a long, complicated gestation, says Johannes Benkhoff, overall project scientist and a planetary physicist at ESA in Noordwijk, the Netherlands. “It’s a great moment,” says Benkhoff, who has worked on BepiColombo for nearly 15 years. “Now it’s becoming real.”

Mercury is deep in the Sun’s gravitational well, which makes reaching it a challenge. To get there, a spacecraft has to lose much of

## JOURNEY TO MERCURY

The BepiColombo mission, which should reach Mercury in 2025, carries two orbiters armed with a host of instruments that will probe the mysterious planet’s chemistry, geology and magnetosphere. Here’s a selection of the Mercurian features they will investigate.

