NIGEL CATTLIN/VISUALS UNLIMITED/CORBIS

the European Grid Infrastructure Federated Cloud, a network of largely publicly funded cloud services such as the Supercomputing Centre of Galicia in Spain — and through companies, such as Cloudwatt, a provider based in Paris. A pilot platform would start relatively small, with the computing equivalent of 100 million hours of processor time and some 10 petabytes of storage (1 petabyte is 10^{15} bytes). The network would need to expand to 20 times this size to serve the whole of Europe, says Jones.

An advantage of such a system is that all data would be stored, protecting them if a provider were to stop operating, says Jones. And the system's standard terms would make it quicker and easier for researchers to sign up to and access, he says. "The most valuable thing for researchers is their data. If we're going to convince researchers to trust cloud services, we really do need this hybrid model." A federated European cloud could also deal with restrictions that require sensitive data to be analysed in its country of origin, says Lück.

In the United States, researchers and funders are also thinking about how to increase access to data stored on clouds variously funded by the US National Science Foundation, individual institutions and companies, says David Lifka, director of the Cornell University Center for Advanced Computing in Ithaca, New York, which runs a service called Red Cloud. "Sharing cloud capacity is the next logical step," he says. But creating a system that is fair and does not constrain users is not easy, he adds.

US computer giants Google, Amazon and Microsoft are notably absent from the HNX. Mark Skilton, who studies information systems at the University of Warwick, UK, suggests that the focus on European companies may reflect the commission's desire to boost homegrown providers. "The issue is whether this will suffer for the lack of Amazon and Google scaling," he says. Some researchers see the likes of Amazon and Google as a route to open data. Writing in *Nature* this week, genomics researchers call on funding agencies to expand access to major data sets by paying to place them in popular cloud services (see page 149).

The biggest barrier to cloud computing for small labs is the cost of accessing high-quality cloud resources, says Skilton. If the negotiating power of a European initiative can bring costs down, many could benefit, he says. But it is unclear whether commercial providers will play ball, says Lifka. Although firms often give trial periods for free, "from my experience, their price is their price", he says. Getting everyone — especially commercial partners — to work under the same governance system and according to the same conditions will be an organizational challenge, says Skilton. ■

The bright-line brown eye (*Lacanobia oleracea*) is just one of many potential tomato residents.

BOTANY

Plant dwellers take the limelight

Researchers seek holistic view of botanic ecosystems.

BY HEIDI LEDFORD

A plant may be rooted in place, but it is never lonely. There are bacteria in, on and near it, munching away on their host, on each other, on compounds in the soil. Amoebae dine on bacteria, nematodes feast on roots, insects devour fruit — with consequences for the chemistry of the soil, the taste of a leaf or the productivity of a crop.

From 30 June to 2 July, more than 200 researchers gathered in Washington DC for the first meeting of the Phytobiomes Initiative, an ambitious proposal to catalogue and characterize a plant's most intimate associates and their impact on agriculture. By the end of the year, attendees hope to carve out a project that will apply this knowledge in ways that will appeal to funders in industry and government.

"We want to get more money," says plant pathologist Linda Kinkel at the University of Minnesota in St Paul. "But beyond that, let's just all try to talk the same language and come up with some shared goals."

The effects of microbes and insects on plant health have often been studied in pairs — one microbe and one plant. But advances in genetic sequencing have opened up ways to survey entire microbial communities. Meanwhile, engineers and computational biologists have developed better ways to manage large data sets, merge disparate recordings into cohesive models and rapidly collect information on the physiology of every plant in a field. "Historically, we haven't had the capacity to look at this as a system," says plant pathologist Jan Leach at Colorado State University in Fort Collins. "Now we need to begin to integrate not just the data about the plant and the plant's environment, but all the biological components in that system."

Leach coined the term phytobiome in 2013, at a retreat about food security. She defines ▶

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the phytobiome broadly, to encompass microbes, insects, nematodes and plants as well as the abiotic factors that influence all these.

Since then, she has visited companies, funding agencies and universities to call for a unifying phytobiomes initiative. She has teamed up with Kellye Eversole, a consultant based in Bethesda, Maryland, and the co-owner of a small family farm in Oklahoma, who has experience working on large agricultural genomics projects, including the US National Plant Genome Initiative. That initiative was launched in 1998 and continues to crank out databases and other tools for analysing plant genomes.

Leach hopes that the Phytobiomes Initiative will leave a similar legacy, but she is mindful that federal funding has tightened considerably since 1998. Still, she notes that the project can build on several emerging trends in agriculture. Industry has shown renewed interest in boosting plant growth by manipulating associated microbes (*Nature* **504**, 199; 2013). Companies and farmers are also investing in 'precision agriculture', which uses high-tech monitors to track conditions in a field or even around individual plants, allowing farmers to water and fertilize in exactly the right places.

HIGH-TECH FUTURE

Eversole foresees a day when tractors will carry dipstick-like gauges that provide a snapshot of the microbial community in the soil. Data from the Phytobiomes Initiative would then help farmers to manipulate that community to their advantage, she says.

But first, the initiative needs to standardize protocols and metrics, the meeting's attendees determined. Kinkel says that efforts are likely to focus initially on cataloguing microbes and insects and their interactions with different crops and habitats. "We're where plant biologists were 150 years ago," she says. "We're still trying to inventory things."

Work has already begun along these lines: for example, a group at the International Rice Research Institute in Los Baños in the Philippines is fishing for microbial DNA in data discarded from an effort to sequence the rice genome. The goal is to determine which microbes prefer which strains of the crop.

Kinkel, meanwhile, has begun experimenting with manipulating carbon levels in the soil to alter the microbial population, with the aim of improving plant productivity. "If we can understand better who lives on and within plants, we have the potential to manage them to have healthier, more resilient plants," she says.

Projects such as these would move faster under an organized, cohesive framework, says Sarah Lebeis, a microbiologist at the University of Tennessee in Knoxville who is studying how plants manipulate microbial communities by secreting antibiotics into the soil. "Right now we're working as individuals," she says. "Having an initiative will give us focus and hopefully we'll progress further, faster, better." ■

CHARLIE NEIBERGALL/AP/PA

Dong-Pyou Han (centre) confessed to fabricating and falsifying data on an HIV vaccine.

RESEARCH MISCONDUCT

Uneven response to scientific fraud

The case of jailed US vaccine researcher Dong-Pyou Han shows up inconsistent nature of penalties.

BY SARA REARDON

Rare is the scientist who serves time on charges of research misconduct. But on 1 July, Dong-Pyou Han, a former biomedical scientist at Iowa State University in Ames, was sentenced to 57 months in prison for fabricating and falsifying data in HIV vaccine trials. Han has also been fined US$7.2 million and will be subject to three years of supervised release after he leaves prison.

His case had a higher profile than most, attracting interest from a powerful US senator. Han's harsh sentence raises questions about how alleged research fraud is handled in the United States, from decisions about whether to prosecute to the types of punishment imposed by grant-making agencies.

Han was forced to resign from Iowa State in 2013, after the university concluded that he had falsified the results of several vaccine experiments supported by grants from the US National Institutes of Health (NIH). In some cases, Han spiked rabbit blood samples with human HIV antibodies so that the vaccine seemed to have caused the animals to develop immunity to the virus.

In a confessional letter sent to the university just before its investigation concluded, Han said that he began the subterfuge to cover up a sample mix-up that he had made years before.

The US Office of Research Integrity (ORI), which oversees investigations into alleged misconduct involving NIH funds, barred Han from receiving federal grants for three years — the maximum penalty that it generally imposes on junior investigators. The case probably would have ended there had it not drawn the attention of Senator Charles Grassley (Republican, Iowa), who has a history of investigating misconduct in the biomedical sciences.

This story is the first in an occasional series on research misconduct in the United States.

"This seems like a very light penalty for a doctor who purposely tampered with a research trial and directly caused millions of taxpayer dollars to be wasted on fraudulent studies," Grassley wrote in a February 2014 letter to the ORI. The office can issue lifetime funding bans,

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