that huge hole," says Doug Gurian-Sherman, director of sustainable agriculture at the Center for Food Safety, an environmental-advocacy group in Washington DC. "Whether you think they're over-regulated or under-regulated or just not intelligently regulated, there's nobody who thinks this is appropriate."

And developers eager to market gene-edited varieties want clarity as to how the USDA will view the crops, says Daniel Voytas, chief science officer at Calyxt, a plant biotechnology company in New Brighton, Minnesota. The agency has already determined that it will not regulate several crops that have been developed using two editing tools — zinc-finger nucleases and TALENs — and it is currently considering a non-browning mushroom that was made using another, CRISPR–Cas9.

CASE BY CASE

These crops embody the simplest application of genome modification: deleting a small section of the genome to disrupt a gene. Calyxt, for example, used TALENs to edit a single gene in the parent plant and generate a variety of wheat with improved resistance to powdery mildew. On 11 February, the USDA informed Calyxt that it would not regulate the crop.

But more-sophisticated edits — such as rewriting genes or inserting new ones — are around the corner, Voytas says. "We don't understand how those crop varieties are going to be regulated," he says. "And they're already in the works."

On 5 February, the USDA released four broad regulatory scenarios that are open to public comment until 21 April. The draft proposed a definition of "products of biotechnology" that encompasses organisms in which segments of the genome have been deleted, added or altered. "Sometimes you are using these technologies to introduce genetic variation that already exists in wild relatives," says Custers. "The question is whether or not that differs from traditional plant breeding." Custers therefore advocates a definition that excludes plants carrying genetic changes that are already present in nature.

But including such plants in the definition does not mean that they would be heavily regulated, notes Greg Jaffe, director of biotechnology at the Center for Science in the Public Interest, a consumer advocacy group in Washington DC. "The USDA is capturing them under the rubric, but it sounds like they're also going to exempt many of them from oversight," he says.

Some activists are unlikely to support the idea. Gurian-Sherman notes that gene-editing technology is still relatively new, can be applied in many ways and sometimes makes unintended genetic changes. "We feel very strongly that this technology still needs to be regulated as we learn more about it," he says. "Maybe at some point it wouldn't need to, but this is still a new technology."■

FUNDING

Lab fights grant rejection and wins

Scientist hired lawyer to challenge European Commission.

BY EWEN CALLAWAY

Faced with a rejected grant application, scientists usually experience a range of emotions — shock, sadness, anger — before accepting the verdict and moving on. But when the European Commission rejected a €5-million (US$5.7-million) grant application from computational scientist Peter Coveney, he hired a lawyer and challenged the decision.

The successful appeal, made public on 29 March, highlights an aspect of the research-funding process that scientists rarely act on and almost never succeed at.

"I've been told by colleagues that you don't challenge the commission on anything," says Coveney, of University College London (UCL). "But if your research is in jeopardy as a part of poor decisions, then people should be prepared to challenge them."

Coveney thinks that his rare victory should encourage more researchers to appeal against decisions made by funders. But funding-agency administrators warn that the chances of success are low — and that fruitless appeals can waste time and resources. "If you're going to play the odds here, your chance of getting funded is substantially higher if you submit a revised proposal than if you go down the route of submitting an appeal," says Michael Lauer, director of the Office of Extramural Research at the US National Institutes of Health (NIH), the world's largest biomedical funder.

Appeals are uncommon in both Europe and the United States. Between 2007 and 2013, the European Commission's Framework Programme 7 received more than 106,000 grant applications, but although around 80% were rejected, only 3,683 decisions were appealed. Of these, 101 were re-evaluated and fewer than 10 succeeded in gaining funding. The US National Science Foundation, by comparison, received just 388 appeals between 2001 and 2014, 17 of which led to funding. Appeals at the NIH are similarly rare, says Lauer. Although the agency does not track them centrally, in eight years of overseeing cardiology-research grants, he saw just one successful challenge.

When the European Commission rejected the Coveney team's proposal to create a hub for applying computer modelling to biomedical and clinical data in May 2015, he was surprised. The 3-year project would involve 15 industrial and academic partners across Europe and use a consulting firm as project manager. Those elements fitted with a requirement for professional management, says Coveney, as outlined in the commission's funding call (part of a 7-year €78.6-billion programme called Horizon 2020). But he says that the reviews indicated that the team had brought in unnecessary partners by including the consulting firm, resulting in a poor score on that aspect.

FOLLOW THE RULES

Like some other funders, including the NIH, the commission has a formal 'redress' process that allows spurned scientists to ask for their grant applications to be re-reviewed. UCL advised Coveney that the odds of success were low. But he hired a law firm, Bindmans in London, to mount a challenge; his team incurred around £10,000 (US$14,000) in legal fees. He learned that his grant would be reconsidered in October 2015, and later that it had scored well enough on this subsequent review to be funded in February this year. He got official word of its approval last month. A representative of the commission confirmed that the grant's initial evaluation report contained incorrect information, leading to a new evaluation.

"If your research is in jeopardy as a part of poor decisions, then people should be prepared to challenge them."
Peter Coveney

"It is the only time I've challenged a grant decision so far in my life. I've seen a few dubious things happen in the past, but this one was so black and white," says Coveney. "It should send the message to people that they should think carefully and not just assume it's not worth it."

Not everyone agrees. "Lawyering up to ▶

get money is not something that strikes me as the way I'd do it," says Adrian Liston, an immunologist at the University of Leuven in Belgium. "I'd just take the grant to another agency."

Some researchers see Coveney's victory as an exception that proves the rule — science's version of 'You can't fight city hall'. Liston's own attempt to appeal a funding decision last year was foiled by a Kafkaesque process. When a funder that he declines to name denied a fellowship renewal for a postdoc in his lab, Liston was told that he first needed to request the reviews. They arrived two months later, and were positive. But the funder then told him that appeals had to be filed within a month of a rejection. "It's an appeals process on paper, but they make it so it can't ever be used," he says.

DIFFERING OPINIONS

A lack of expertise on the review panel is one of the few grounds on which the NIH says that it will grant an appeal, in addition to factual errors, bias or conflicts of interest on the part of reviewers. But Lauer says that such complaints often boil down to differences of opinion, which can't be appealed against.

Researchers are personally invested in their grant proposals, making rejection that much harder to handle, says Sally Rockey, Lauer's predecessor at the NIH, who is now executive director of the Foundation for Food and Agriculture Research in Washington DC. "People have a tough time separating their emotions from the actual review itself."

There may now be more motivation than ever to appeal against grant rejections, because the success rates of grant applications are in decline at many funding agencies, notes Björn Brembs, a neurobiologist at the University of Regensburg in Germany who still bemoans the denial in 2003 of a grant extension that he requested in from Germany's major funding agency, the DFG. "At a certain threshold of desperation and lack of alternatives, then an appeal doesn't seem as much of a cost any more," he says.

Appeals could waste the time of overworked agencies already faced with far too many strong applications to fund, warns Douglas Kell, a biologist at the University of Manchester, UK, and former head of the country's Biotechnology and Biological Sciences Research Council. Like the DFG, as well as Britain's other government funders, the biotechnology council does not have a formal appeals process.

"There are lots of things I would say we could do to improve funding procedures," says Kell. "But letting people bitch about the ones that go down isn't one of them." ■ SEE EDITORIAL P.147

SCIENCEATHOME.ORG

Games enable researchers to appeal to the public for help in solving scientific problems.

PHYSICS

Quantum world may be intuitive

A computer game suggests that the human mind is adept at grasping the bizarre laws of quantum mechanics.

BY ELIZABETH GIBNEY

With particles that can exist in two places at once, the quantum world is often considered to be inherently counterintuitive. Now, a group of scientists has created a video game that follows the laws of quantum mechanics, but at which non-physicist human players excel (J. J. W. H. Sørensen *et al. Nature* **532,** 210–213; 2016).

One implication of the team's results is that efforts to use computer games to crowdsource solutions to science problems can now be extended to quantum physics (see page 184). In the past, such gamification projects have been limited to challenging but less mind-bending problems, such as protein folding.

But the work also suggests that the human mind might be more capable of grasping the rules of the bizarre quantum world than previously thought — a revelation that could have implications for how scientists approach quantum physics, says Jacob Sherson, a quantum physicist at Aarhus University, Denmark, who led the study. "Maybe we should allow some of that normal intuition to enter our problem solving," he says. Scientists studying quantum foundations have also long said that finding a more intuitive approach to quantum physics could help to crack outstanding puzzles, although many doubted that this would ever be possible without new theories.

The game, called *Quantum Moves*, is based on a real problem in quantum computing: how fast a laser can move an atom between wells in an egg-box-like structure without changing the energy of the atom, which is in a delicate quantum state. In the quantum world, speed and energy are a trade-off limited by Heisenberg's uncertainty principle, so the trick is to find the sweet spot where the transition from one place to another is as fast as possible without disturbing the quantum state. Endless possible combinations of movement and timing exist, and scientists have designed computer algorithms to try to solve the problem.

In the game, an atom is represented by what looks like a liquid sloshing around in a well, which reflects the wave-like nature of a quantum particle. In one level, players move