cells. The target gene encodes a protein called PD-1 that normally acts as a check on the cell's capacity to launch an immune response.

The gene-edited cells will then be multiplied in the lab and re-introduced into the patient's bloodstream, where, the team hopes, they will home in on the cancer. The proposed US trial similarly involves knocking out the gene for PD-1, but also includes knocking out a second gene and inserting a third.

Last year, the FDA approved two antibody-based therapies that block PD-1 for use against lung cancer. Gene editing is expected to inhibit PD-1 with greater certainty, and by multiplying the cells, the scientists can increase the chance of triggering an immune response against tumours.

It is well known that CRISPR–Cas9 can result in edits at the wrong place in the genome, with potentially harmful effects. Chengdu MedGenCell, a biotechnology company in China and a collaborator on the trial, will validate the cells to ensure that the correct genes are knocked out before the cells are re-introduced into the patients, says oncologist Lei Deng of West China Hospital, a member of Lu's team.

Because the technique targets T cells — which are involved in various types of immune response — in a non-specific way, Chan worries that the approach might induce an autoimmune response in which T cells circulating in the blood might start to attack the gut, adrenaline glands or other normal tissue.

He suggests, instead, that the team take T cells from the site of the tumour because they would already be specialized for attacking cancer. But Deng says that the lung-cancer tumours targeted by their trial are not easily accessible. He also says that the team is reassured by the FDA-approved antibody therapies, which did not show a high rate of autoimmune response.

SAFETY FIRST

The phase I trial is designed foremost to test whether the approach is safe. It will examine the effects of three different dosage regimens on ten people, and, Deng says, the team plans to proceed slowly by increasing the dosage gradually and starting with just one patient, who will be monitored closely for side effects. But the researchers will also closely watch markers in the blood that would indicate that the treatment is working.

China has had a reputation for moving fast — sometimes too fast — with CRISPR, says Tetsuya Ishii, a bioethicist at Hokkaido University in Sapporo, Japan.

Lu says that his team was able to progress so rapidly because they are experienced with clinical trials of cancer treatments. The review process, which took half a year, included close communication with the hospital's internal review board (IRB). "There was a lot of back and forth," he says. The NIH's approval of the other CRISPR trial "strengthened our and our IRB's confidence in this study", he adds.

June is not surprised that a Chinese group has jumped out in front, he says, because "China places a high priority on biomedical research". Ishii notes that the clinical trial would be the latest in a series of firsts for China in the field of CRISPR — including the first CRISPR-edited human embryos and monkeys. "When it comes to gene editing, China goes first," he says.

Lu remains cautious. "I hope we are the first," he says. "And more importantly, I hope we can get positive data from the trial." ■

EUROPEAN UNION

Major funder tracks impact

European Research Council embarks on an unusual evaluation that could inspire others.

BY ALISON ABBOTT

Last month, neuroscientist Ileana Hanganu-Opatz began a risky project with a risqué name: Psychocell. With a grant of €2 million (US$2.2 million), she is studying whether a single type of neuron causes a miswiring in the developing brain that has been linked to psychiatric disease. But it may turn out that no 'psychocell' exists, or that her mouse models are unsuitable.

Supporting such blue-skies research is the mission of her funder, the prestigious European Research Council (ERC), which launched in 2007 to raise the quality of European science. "No one but the ERC would have funded such a high-risk project," says Hanganu-Opatz, from the University of Hamburg, Germany.

Now, the council, which sits within the European Union's Framework funding programmes and has a €1.7-billion budget this year, has embarked on an unusual exercise: to retrospectively evaluate the success of the projects it funds. By contrast, most funding agencies assume that the evaluation to select which projects they fund is sufficient.

"Virtually no basic research funding agency tries retrospectively to analyse its own performance and impacts," says Erik Arnold, chair of Technopolis, a European research and innovation consultancy headquartered in Brighton, UK. "It would be nice if the ERC effort would inspire others to do so."

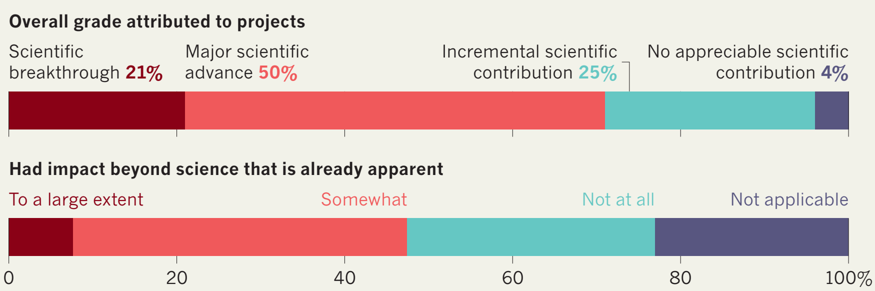
On 26 July, at the European Science Open Forum in Manchester, UK, ERC president Jean-Pierre Bourguignon announced the results of a pilot investigation of 199 completed projects, almost three-quarters of which were deemed to have resulted in a scientific breakthrough or major advance (see 'To science and beyond').

"We push both scientists and grant-application reviewers to take a certain risk, so it is important to know that they are actually taking risks — and that we are selecting the right projects," says Bourguignon.

The ERC now plans to evaluate a selection of completed projects each year and to keep refining its methodology. Bourguignon hopes that this will help the council during discussions ▶

TO SCIENCE AND BEYOND

Scientific experts evaluated 199 completed projects funded by the European Research Council — including their contribution to science and to wider society.



SOURCE: ERC

with politicians. "We want evidence-based arguments to show that bottom-up, curiosity-driven research is valuable to society," he says. The council will have to lobby to keep its generous funding in the next Framework programme, due to begin in 2021.

The pilot evaluation rated projects that were among the first to be funded by the council, mostly in 2007 and 2008. It assigned eight projects each to 25 three-person expert groups.

The ERC gave the experts a bibliometric analysis of the publications from each project, but asked them to use their professional judgement to form an overall view of each one.

They found that 43 had led to a scientific breakthrough, 99 had generated a major advance — and only 7 had had no appreciable scientific output. That indicates an appropriate level of risk and ambition, says Bourguignon.

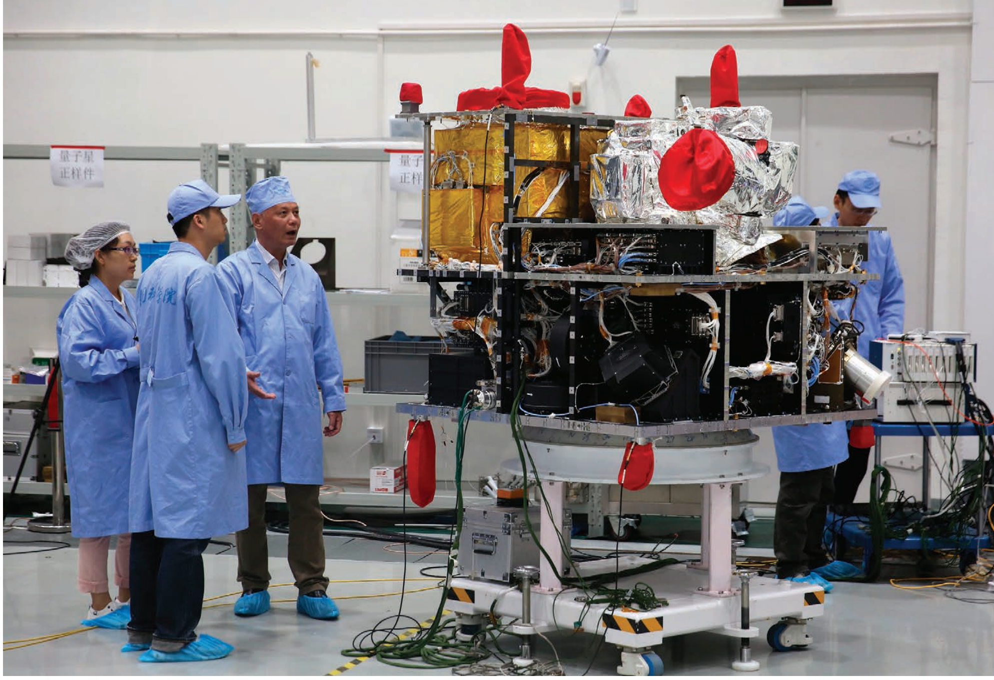
The evaluators also judged that almost 10% of projects had already had a large impact on the economy, policymaking or other aspects of society, and that around one-quarter were likely to do so in the future.

"It's a delight to see a qualitative approach," says science-policy specialist Ben Martin at the University of Sussex in Brighton. "Bibliometrics are misleading in isolation — but too often used this way." Bourguignon says that many of the evaluators, who remain anonymous, struggled with the unfamiliar task of subjectively declaring research a "scientific advance".

The study has limitations. Two experts in each group had served on ERC grant-awarding panels. None of the projects that they judged was included in the analysis, but the process could seem unobjective, says Arnold. Martin says the terms used to categorize the projects may be interpreted differently across disciplines. "As a social scientist, I can tell you that we don't describe our work in terms of 'breakthroughs'."

Bourguignon agrees that the small study was not optimally designed. But the ERC has since solicited independent comments on the methodology, and an ongoing evaluation of a further 250 projects has been fine-tuned to let evaluators across disciplines report consistently.

In the pilot review, evaluators also stressed the ERC's impact on an individual's career, something that Hanganu-Opatz experienced at first hand. Her university gave her tenure on 18 July, and three other universities made her offers. "The visibility you get when you win an ERC grant is embarrassing," she says. ■ SEE EDITORIAL P.465



China's 600-kilogram quantum satellite contains a crystal that produces entangled photons.

CAI YANG/XINHUA VIA ZUMA WIRE

COMMUNICATIONS

One giant step for quantum internet

Chinese satellite is first in a wave of planned craft that could form network secured by quantum cryptography.

BY ELIZABETH GIBNEY

China is poised to launch the world's first satellite designed to do quantum experiments. A fleet of quantum-enabled craft is likely to follow.

First up could be more Chinese satellites, which will together create a super-secure communications network, potentially linking people anywhere in the world. But groups from Canada, Japan, Italy and Singapore also have plans for quantum space experiments.

"Definitely, I think there will be a race," says Chaoyang Lu, a physicist at the University of Science and Technology of China in Hefei, who works with the team behind the Chinese satellite. The 600-kilogram craft, the latest in a string of Chinese space-science satellites, will launch from Jiuquan Satellite Launch Center in August. The Chinese Academy of Sciences and the Austrian Academy of Sciences are collaborators on the US$100-million mission.

Quantum communications are secure because any tinkering with them is detectable. Two parties can communicate secretly — by sharing a encryption key encoded in the polarization of a string of photons, say — safe in the knowledge that any eavesdropping would leave its mark.

So far, scientists have managed to demonstrate quantum communication up to about 300 kilometres. Photons travelling through optical fibres and the air get scattered or absorbed, and amplifying a signal while preserving a photon's fragile quantum state is

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