RESEARCH FUNDING

# Europe's €100-billion science plan

*Budget proposed for European Union's next big research-funding programme.*

**BY INGA VESPER**

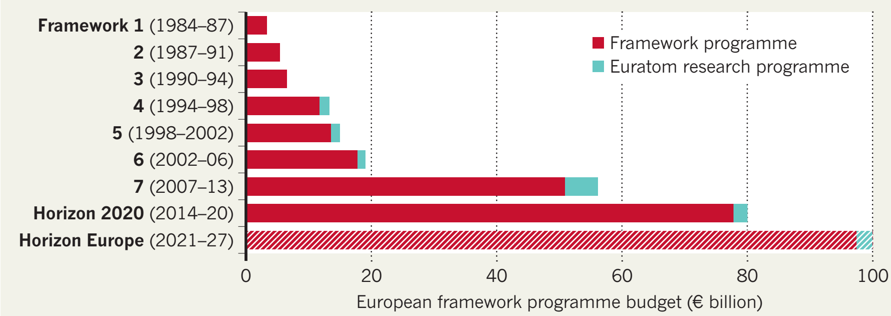
The European Union is planning to spend €100 billion (US$120 billion) on its next major research-funding programme, for 2021 to 2027 — a disappointment to some scientists and policy groups who had been hoping for up to 60% more. The budget does not include a contribution from the United Kingdom, whose departure from the bloc in 2019 is likely to shake up the distribution of funds among the remaining 27 EU countries.

The European Commission issued its opening budget proposal for Framework Programme Nine — newly named Horizon Europe, and the successor to the current programme, Horizon 2020 — on 2 May. The announcement marks the start of tough negotiations between the European Parliament and the Council of the European Union, which comprises government representatives from EU nations.

The proposed €100 billion is an increase on the €77-billion pot for Horizon 2020, which began in 2014 (see 'Europe's science spending'). However, a report by influential academic and industry experts, published last July, had urged a doubling of the budget for the next framework programme.

**EUROPE'S SCIENCE SPENDING**

The European Commission has proposed a €100-billion (US$120-billion) budget for Horizon Europe, the next instalment of its flagship research-funding programme, which will last from 2021 to 2027.




Euratom's budget is included as part of the framework's total funding, but its grants are distributed through a separate programme.

SOURCE: EUROPEAN COMMISSION

And in March, 13 science and higher-education organizations, including the European University Association (EUA), which represents more than 800 institutions, also demanded a €160-billion budget. "The increase is good, but it's not at the level we would consider suitable," says Enora Bennetot Pruvot, deputy director of governance, funding and policy at the EUA in Brussels.

"With the UK leaving the EU, we knew it was going to be difficult to get the €160 billion we would have liked to see," says Laura Keustermans, senior policy officer at the League of European Research Universities in Leuven, Belgium. The full proposal for Horizon Europe is expected in June. The framework is set to include funding for large, multidisciplinary 'missions' to tackle big societal questions; €10 billion has also been earmarked for research into food, agriculture and rural development. ■

BIOMEDICINE

# Anti-cancer viruses take off

*Encouraging study results and a handful of clinical trials spur interest in therapy approach.*

**BY HEIDI LEDFORD**

Pharmaceutical giant Johnson & Johnson announced on 2 May that it would pay up to US$1 billion to acquire a company that makes cancer-killing viruses. The striking show of support for a still-unproven treatment is just the latest sign that industry and academics are warming to the approach.

In February, Merck, headquartered in Kenilworth, New Jersey, agreed to pay US$394 million to snatch up an Australian firm working on cancer-killing, or 'oncolytic', viruses. And in April, 300 people showed up for the oversubscribed International Oncolytic Virus Conference in Oxford, UK. When the conference launched in the early 2000s, there were only about 60 attendees. "They were very small meetings for these crazy people working with viruses," says Jean-Simon Diallo, a molecular biologist at the Ottawa Hospital Research Institute. "We've really seen a shift."

Diallo credits a couple of developments with igniting the field. One was a 2015 US Food and Drug Administration (FDA) decision to approve a modified herpes virus called talimogene laherparepvec (Imlygic) to treat some forms of melanoma. It was the first cancer-fighting virus to win regulatory support in the US market. Another development is emerging evidence — largely from animal studies — that the viruses might work better when administered in concert with therapies called checkpoint inhibitors, which boost immune responses against tumours.

***People with cancer sometimes go into remission after contracting a viral infection.***

"The intersection of these two events has really put some spice in the oncolytic-virus field," says Diallo. The checkpoint inhibitors in particular turned things around, he adds.

Researchers have been trying to develop cancer-fighting viruses for decades, hoping to capitalize on centuries-old observations that people with cancer sometimes go into remission after contracting a viral infection. That has spurred teams to develop a panoply of viruses that have passed through the gauntlet of a clinical trial.

Many of these trials have met with little success. Even Imlygic fell short of showing a statistically significant improvement in patient survival during a clinical trial (R. H. I. Andtbacka *et al. J. Clin. Oncol.* **33**, 2780–2788; 2015). Still, the results were enough to persuade the FDA to approve the therapy for melanomas that had resisted other treatments. That study also sparked hope among researchers by showing that a virus injected directly into one tumour could rein in tumours elsewhere in the body.

### DEATH BY ASSOCIATION

The viruses work by generating an immune response. After the virus infects and kills cancer cells, the immune system eliminates the virus and ends up also getting rid of the dead cancer cells. "The side effect from eliminating the virus is that the systemic immune system recognizes the cancer cells," says Tomoki Todo, a neurosurgeon at the University of Tokyo. "Then it starts to attack even those cancer cells that are not infected by the virus."

Scientists reasoned that bolstering such an immune response — for example, by using a checkpoint inhibitor — could amplify this indirect effect. These inhibitors sometimes send cancer into remission for years, but only for a fraction of people.

Studies in mice suggest that combining checkpoint inhibitors with cancer-killing viruses might boost that percentage. And in a small clinical trial involving 21 people with advanced melanoma, Imlygic, together with a checkpoint inhibitor, significantly shrank tumours in 62% of participants and wiped them out altogether in 33% (A. Ribas *et al. Cell* **170**, 1109–1119; 2017).

When researchers have combined checkpoint inhibitors with other treatments, they have met with mixed success. Some fervently anticipated combinations have failed in clinical trials. "Could the same thing happen with oncolytic viruses? Sure," says Dmitriy Zamarin, an oncologist at the Memorial Sloan Kettering Cancer Center in New York City.

But Zamarin and others are cautiously optimistic. Many checkpoint-inhibitor combinations target a specific protein, Zamarin notes, whereas oncolytic viruses provoke a much broader immune response that can target cancer in a number of different ways. "That gives us some comfort," he says. ■

QUANTUM PHYSICS

# Universe's coolest lab set to open up quantum world

*NASA's Cold Atom Laboratory will allow physicists to play with quantum phenomena like never before.*

BY ELIZABETH GIBNEY

Quantum physicists are about to get their own playground in space. NASA's Cold Atom Laboratory, scheduled to launch to the International Space Station on 20 May, is set to be the coldest place in the known Universe. Researchers will use the lab to probe quantum phenomena that would be impossible to observe on Earth.

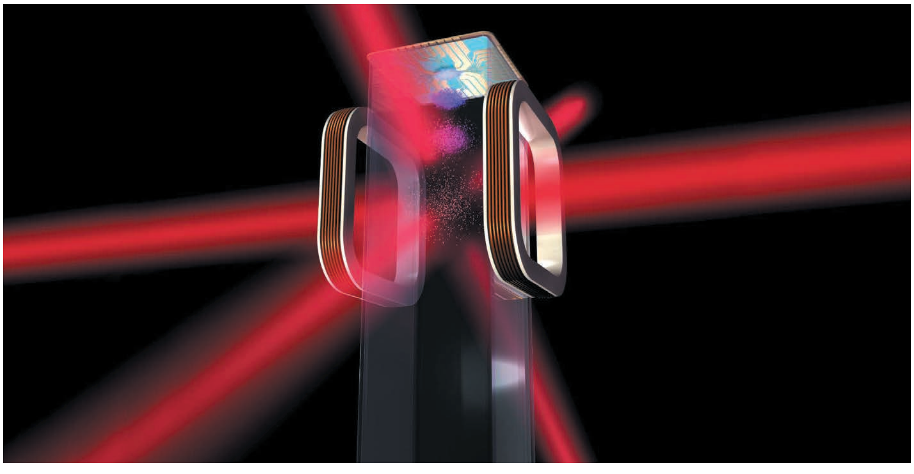
The US$83-million mission will be used to study quantum mechanics on the macroscopic scale by making a state of matter known as a Bose–Einstein condensate (BEC). These are clouds of hundreds of thousands of atoms that, when chilled to just above absolute zero, behave as waves that synchronize into a single quantum object. "Just being able to do these experiments in space I think is a huge accomplishment," says Kamal Oudrhiri, mission manager at the Jet Propulsion Laboratory (JPL) in Pasadena, California.

On Earth, gravitational forces usually disperse these condensates within a few seconds. The closest that BECs have come to being in space-like conditions is during brief stints in a research rocket, or falling from a drop tower over 9 seconds. But, floating on the space station, they should be able to exist for at least 10 seconds. That's long enough for them to be cooled to record-low temperatures — perhaps as little as 20 trillionths of a degree above absolute zero. That would be the coldest known temperature in the Universe, says Oudrhiri. Colder and long-lasting condensates will "push the frontiers of studying fundamental physics", says Gretchen Campbell, an atomic physicist at the US National Institute of Standards and Technology in Gaithersburg, Maryland. "It's something people have hoped for for almost 15 years."

### DOWN-SIZED KIT

Real estate on the space station is at a premium, so engineers had to crunch down atomic-physics equipment that usually fills a large room into a cool-box-sized chest. The equipment will cool rubidium and potassium atoms by scattering laser light off the particles in all directions to slow them to almost a standstill. It will then use magnetic fields to trap the cloud. To create the condensate, other cooling techniques are used to push the cloud even closer to absolute zero — including creaming off the most energetic atoms using a radio-wave 'knife' and widening the trap to let the cloud expand.

Engineers also had to design shielding to protect the delicate condensates from interference from densely packed components and from Earth's varying magnetic field. Although astronauts will unpack and install the equipment, the experiments will run only while the team is asleep to minimize disruption from ▶



NASA/JPL-CALTECH

Instruments on NASA's Cold Atom Laboratory will cool atoms to near absolute zero (artist's concept).