north to Europe tens of thousands of years later. A handful of African genomics projects are now beginning to address this imbalance.

In 2009, Tishkoff and her colleagues published a study[3] assessing small sections of the genome from people belonging to about 100 of the more than 2,000 ethnic groups in Africa today. The results suggested that the San and the Baka might have descended from a single lineage of hunter-gatherers.

But Tishkoff needed whole genomes from them and other ethnic groups to test this idea. Her team spent years getting approvals for the project from government and institutional ethical review boards in countries in eastern, southern and western Africa. Tishkoff and her colleagues partnered with local researchers and spoke about genetics with the communities that they hoped to enrol in the project, explaining what the scientists and the groups could learn about their early ancestry. Many of the communities live in remote regions — such as the Sabue people of southwestern Ethiopia — and geneticists know little about them.

> *"There is nothing in Africa that is not possible since we have no idea what humans were doing on the continent 5,000 years ago."*

Genomics research in Africa can be contentious, and many scientists engage in such outreach to involve the communities they work with in their research. The Human Heredity and Health in Africa (H3Africa) Initiative — an African-led consortium that supports genomics research — has called for a greater role for Africa-based scientists in such projects. And last year, an Indigenous group in South Africa introduced research-ethics guidelines for scientists looking to work with them.

Tishkoff and her colleagues make sure to follow up with the communities that participate in their studies. For example, some of the Fulani, a traditionally nomadic group, are interested in what their genetics can reveal about their migration history, says Alfred Njamnshi, a neurologist at the University of Yaoundé in Cameroon.

ANCESTRAL LINKS

Nearly one-fifth of the genetic variation that the team uncovered has never before been reported. Statistical models of the data indicate that the Hadza and the Sandawe people of Tanzania shared an ancestor in the past 30,000 years. The findings also suggest that there was intermingling during that period between the Hadza, the San in southern Africa and the Baka in central Africa, all of whom were traditionally hunter-gatherers. "I think we are seeing an ancient common ancestry between the major hunter-gatherer groups in Africa," Tishkoff says.

Some of the findings align with signals of mixed Hadza and San ancestry in DNA extracted from human remains[1] dated to between 2,500 and 8,100 years old, says Pontus Skoglund, a palaeogeneticist at the Francis Crick Institute in London.

Other researchers want to see further statistical analyses of the data before they accept the idea that the Hadza, San and Baka overlapped geographically. Earlier studies have given little indication that people from these groups mixed with each other, says Deepti Gurdasani, a genetic epidemiologist at the Wellcome Sanger Institute in Hinxton, UK. But it's plausible, she adds. "There is literally nothing in Africa that is not possible since we have no idea what humans were doing on the continent 5,000 years ago."

This knowledge gap might dissipate in the coming years as more teams working on African genome projects publish their results. Gurdasani presented findings from an analysis of whole genomes from 2,000 Ugandans at the ASHG meeting. And H3Africa has sequenced more than 400 genomes from African individuals, says Charles Rotimi, a Nigerian genetic epidemiologist at the National Human Genome Research Institute in Bethesda, Maryland, who founded the initiative.

After conducting further analyses, Tishkoff plans to publish the results and share the anonymized genomes publicly, so that scientists can pool their data.

This last bit is essential, says Shaohua Fan, a molecular biologist at Fudan University in Shanghai, China. As of 2016, about 80% of people in genetic studies were of European descent. "We know humans originate in Africa," says Fan, "but we don't know what we did before we left — we don't know our own history." ■

1. Skoglund, P. *et al. Cell* **171**, 59–71 (2017).
2. Schlebusch, C. M. *et al. Science* **358**, 652–655 (2017).
3. Tishkoff, S. A. *et al. Science* **324**, 1035–1044 (2009).

PHYSICS

Quantum projects get cash

European Commission has announced the first-round winners of its new flagship.

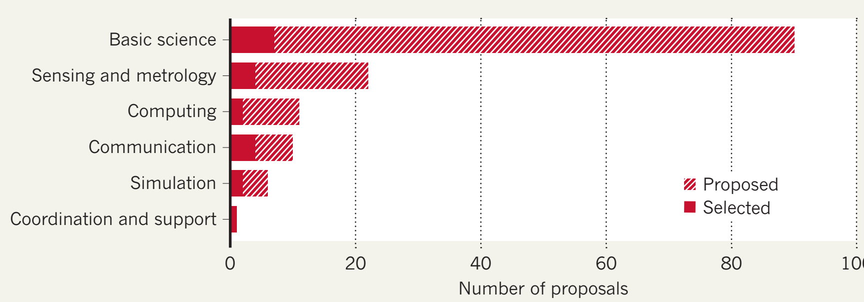
BY DAVIDE CASTELVECCHI

Plans to build two working quantum computers are among the first winners to be announced in a €1-billion (US$1.1 billion) funding initiative of the European Commission. On 29 October, the commission announced the first batch of fund recipients of its Quantum Flagship. The 20 international consortia, including public research institutions and industry, will receive a total of €132 million over 3 years for technology-demonstration projects (see 'Quantum windfall').

The efforts add to a global rush to turn early-stage laboratory experiments into applications such as practical quantum computers, which promise to improve certain tasks — for example, predicting chemical reactions exponentially faster than classical computers do. Most recently, in August, Germany's federal government quietly announced a quantum initiative worth €650 million. The US Congress is considering a proposal to set aside more than $1.2 billion for quantum computing, and China, which has already made major investments in

QUANTUM WINDFALL

Europe's Quantum Flagship programme will spend €132 million (US$150 million) overall on 20 projects spanning 6 themes for its first 3 years.



SOURCE: QUANTUM FLAGSHIP

AVALON

the field, is rumoured to be planning a quantum-research centre in Hefei worth billions of US dollars.

The European Union initiative is the commission's third flagship scheme, after the Human Brain and Graphene flagships started in 2013. It was announced in 2016 in response to a 'Quantum Manifesto' written by a group of experts. The two previous flagships have been criticized, in part about how they awarded the grants. The organizers of the Quantum Flagship have been mindful of those controversies, says Tommaso Calarco, who was an author of the original Quantum Manifesto and is a theoretical physicist at the Helmholtz Centre in Jülich, Germany. "Grants are decided with open calls, evaluated by external collaborators," he says.

Other grants announced this week included those for a range of projects. Some of the proposed technologies are relatively close to having market applications, including ultra-precise, portable, atomic clocks, and chip-sized devices that produce random numbers for use in secure networks. For most labs involved, the flagship funds will not make a substantial difference to buying machinery or hiring researchers: the money is distributed over ten years and dozens of laboratories. (The EU provides half of the €1 billion; member countries must provide the remaining half.)

Lieven Vandersypen, a physicist at the Delft University of Technology in the Netherlands, says that the flagship is a missed opportunity to provide a 'Moonshot' on a single focused goal, such as building a large quantum computer. Instead, "only €20 million goes to computing" in this round of funding, says Vandersypen, who is leading an effort to build a quantum computer on a silicon chip, in collaboration with US semiconductor giant Intel. "I don't see the Moon."

But others say that the main advantage of the flagship is that it has forced groups to pool their efforts and knowledge — in particular, those in academia and industry. "It is a strong incentive to make sure that we collaborate on a European scale," says Thomas Monz, a physicist at the University of Innsbruck in Austria.

Major public funding will be necessary merely to keep a pipeline of experts, says Rodney Van Meter, an engineer at Keio University in Tokyo. "You need to build quantum programmes inside universities simply to train the people that Google and Intel are going to need." Public funders worldwide, from Canada to Japan, and major corporations are betting that quantum technologies will grow into multi-billion-dollar markets. The "decisive stimulus" for the European Commission to select quantum physics as its third flagship project, says Calarco, was a dramatic increase in investment in the field from US technology giants such as Google and IBM. ■

A project to protect bananas from disease is among those affected by a European court decision.

RESEARCH

EU gene-editing rule squeezes science

Researchers protest about impacts of stricter legislation.

BY ANDREW J. WIGHT

Three months after the European Union's top court gave gene-edited crops the same stringent legal status as genetically modified (GM) organisms, researchers across the world are starting to feel the pinch. And some are becoming increasingly vocal in their opposition to the ruling.

The ruling by the European Court of Justice (ECJ) imposes extensive risk evaluations before gene-edited organisms can be planted or sold as crops.

Much basic research on gene editing in plants isn't affected because these evaluations apply only to organisms released into the environment, and so pose hurdles at the field-trial or commercialization stage. But some applied-research projects are feeling the strain.

"A maize field trial we've been conducting in Belgium for over a year and a half was suddenly considered a GM field," says Dirk Inzé, science director at the VIB–UGent Center for Plant Systems Biology in Ghent, Belgium.

As a result of the ruling, he says, local authorities have insisted on extra precautionary measures, such as placing a fence around the researchers' plot and completing extensive documentation.

Meanwhile, a Belgian start-up that planned to use CRISPR technology to help Africa's banana industry says it lost its financing. And a company in Brazil says it has put millions of dollars' worth of gene-editing projects focused on soya beans on hold because its major market is in Europe.

A 2001 EU Directive required GM organisms to be identified, tracked and monitored for their effects on the environment and consumers. The new ruling imposes those restrictions on gene-edited crops, even though gene editing mostly involves small, precise changes to DNA — and not inserting foreign genes, as in the case of GM organisms.

"We see a chilling effect on plans for performing research with CRISPR-edited plants in the field," says René Custers, manager of regulatory and responsible research at the VIB life-sciences research institute in ▶