

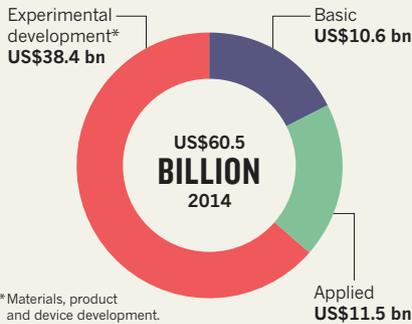
The prospects for increased support for basic science are encouraging, says Doochul Kim. Established in 2011, and modelled after Germany's Max Planck Institute and Japan's RIKEN, the IBS is South Korea's flagship effort in basic research.

There are currently 28 research centres within the IBS, but the original plans called for 50. With conservatives now out of favour, the IBS must win bipartisan support to secure its expansion, says So Young Kim.

Whatever the future of scientific research looks like in South Korea, it's clear that scientists are trying to change course. Some have taken matters into their own hands: a crowdfunding project to study health issues affecting transgender people in South

BUDGET BREAKDOWN

Basic research got short shrift in South Korea's 2014 science budget, the most recent for which figures are available.



Korea recently raised nearly 15 million won (US\$13,300), exceeding its target by half. Conventional funding routes have proved difficult for research that is not intended for economic growth, says Tae-Woong Yoon, chair of Engineers and Scientists for Change (ESC), and a systems engineer at Korea University in Seoul.

The ESC promotes research for social progress and sustainability, and led the crowdfunding campaign. The group, founded last year, seeks to establish a funding route that is not controlled by companies or political parties, says Yoon.

He is not waiting for the next administration to create change. "I think it's up to us," Yoon says. "We are dedicated and we really want to improve the situation here." ■

ETHICS

San people issue research code

Heavily studied indigenous communities — known for their click languages — are the first in Africa to draft science-ethics guidelines.

BY EWEN CALLAWAY

The San people of southern Africa are among the most-studied indigenous groups in the world. Legions of researchers have investigated their hunter-gatherer lifestyles, click languages and ancient rock art, and San individuals were some of the first from Africa to have their whole genomes sequenced.

But some San want a greater say in such research. On 2 March, three communities in South Africa issued their own research-ethics code — thought to be the first from any indigenous group in Africa. Although the rules will carry no legal weight, their authors hope that scientists will feel compelled to submit proposals for research in San communities to a review panel of community members. And the San may refuse to collaborate with institutions whose staff do not comply, the rules warn.

The code was developed by traditional leaders of the !Xun, Khwe and !Khomani groups of San, which represent around 8,000 people in South Africa.

"We've been bombarded by researchers over the years," says Hennie Swart, director of the South African San Institute in Kimberley, which helped to develop the code. "It's not a question of not doing the research. It's a question of doing it right."

The impetus for the ethics code was the 2010 publication, in *Nature*¹, of the first human genome sequences from southern Africa: those of Archbishop Desmond Tutu, winner of the 1984 Nobel Peace Prize, and four San men from Namibia. The Namibian government and



A traditional San dance performed at a living museum in Namibia.

ethics committees at the scientists' universities in Australia, South Africa and the United States approved the study. The researchers also filmed the San men giving verbal consent with the help of a translator.

But some San leaders were upset that the team did not consult them, and were concerned about how the researchers obtained informed consent from the San men, according to Roger Chennells, a human-rights lawyer based in Stellenbosch, South Africa, who helped draft the code (see go.nature.com/2nwyj1m). The study was a "massive catalyst", he says.

The paper also used terms, including "Bushman", that some San individuals consider

offensive. "No other recent research has been perceived as being so insulting and arrogant to San leaders," says Chennells.

He anticipates that communities in Namibia and Botswana will formally adopt the code in the future. Until then, researchers working with those communities will be encouraged to take note of the code, adds Chennells.

However, Stephan Schuster, a genome scientist who co-led the study while at Pennsylvania State University in State College, asks whether the views of San leaders in South Africa are representative of other San groups. "Why would a San council in South Africa know what we are doing in northern Namibia?" ▶

► asks Schuster, who is now at the Nanyang Technological University in Singapore. After the genome paper came out, San leaders held workshops with scientists, ethicists and lawyers to draft research guidelines. The TRUST Project, a European effort to promote global research ethics, funded the drive.

The process for endorsing research under the guidelines is still taking shape, says Swart, but researchers will be encouraged to submit proposals to the South African San Council. The council “undertakes not to unduly curb or hinder good research”, adds Chennells.

Both Chennells and Swart hope that the research code will achieve the same influence as guidelines for working with Aboriginal communities in Australia. There, researchers

must typically gain approval from groups that represent local or regional indigenous communities. A 2011 study² reporting the first genome of an Aboriginal Australian (taken from an early-twentieth-century hair sample) was nearly scrapped because the scientists had not initially sought the endorsement of an Aboriginal group. “We are learning from Australians,” says Swart.

“If researchers want to work among the San and that’s the protocol, they should honour it. That’s what social justice is all about,” says Himla Soodyall, a geneticist at the University of the Witwatersrand in Johannesburg, South Africa, who co-authored a 2012 paper³ analysing the genomes of San individuals.

That team sought permission for its research from the South African San Council and

another San organization, the Working Group of Indigenous Minorities in Southern Africa. The researchers communicated their findings to San communities and told individuals what they had learnt about their genetic ancestry.

Emma Kowal, an anthropologist at Deakin University in Melbourne, Australia, who works on indigenous research ethics, thinks the code will encourage scientists to consider the interests of San communities. “Our experience in Australia is that researchers will come to the table and change the way that they practise,” she says. ■

1. Schuster, S. C. *et al. Nature* **463**, 943–947 (2010).
2. Rasmussen, M. *et al. Science* **334**, 94–98 (2011).
3. Schlebusch, C. M. *et al. Science* **338**, 374–379 (2012).

AWARDS

Wavelets scoop maths prize

Yves Meyer wins the Abel Prize for role in theory with multiple applications in data analysis.

BY DAVIDE CASTELVECCHI

French mathematician Yves Meyer has won the 2017 Abel Prize for his “pivotal role” in establishing the theory of wavelets — data-analysis tools used in everything from pinpointing gravitational waves to compressing digital films.

The prize of 6 million Norwegian kroner (US\$710,000) — hailed as mathematics’ Nobel prize — was announced by the Norwegian Academy of Science and Letters on 21 March. Following the Nobel tradition, Meyer learnt that he was the winner only when he received a call on the morning of the announcement.

“There are not many examples of mathematical discovery that have directly influenced society so much,” says Jean-Michel Morel, an applied mathematician and Meyer’s colleague at the École Normale Supérieure Paris–Saclay.

Wavelet-based computer algorithms are among the standard tools used by researchers to process, analyse and store information. They also have applications in medical diagnostics, where they can help to speed up magnetic resonance imaging, for example; and in

entertainment, to encode high-resolution films into files of manageable size.

After groundbreaking work — in the ‘wavelet revolution’ — spearheaded by Meyer in the 1980s, textbooks were rewritten, Morel says.

Wavelets are an extension of the toolkit of Fourier analysis, named after Joseph Fourier, who initiated the field in the 1800s. He discovered that a complex waveform can be broken down into simpler, sine-wave components. That is, a piece of information such as a musical note or a seismic signal can be expressed in a compact way using Fourier techniques.

“There are not many examples of mathematical discovery that have directly influenced society so much.”

But Fourier’s mathematically elegant formulae did not easily apply to many types of real-world data, explains John Rognes, a mathematician at the University of Oslo who chairs the Abel Committee. Fourier’s techniques were helpful for steady signals, such as a continuous note played on a violin. But they were not efficient for sifting a noisy

data set to extract transient signals — such as the ‘chirp’ of two black holes colliding, which the Laser Interferometer Gravitational-wave Observatory (LIGO) picked up in 2015.

In the 1900s, researchers developed algorithms that made Fourier analysis more practical for applications such as seismology. Among these were waveforms invented in 1981 by French geophysicist Jean Morlet at CNRS in Marseilles. These could replace Fourier’s sine waves and were of finite duration, making them more efficient for dealing with transient signals. Morlet called them *ondelettes* — wavelets in English. But until Meyer entered the field, these tools did not have the full power of Fourier’s theory.

Meyer made his serendipitous encounter with Morlet’s wavelets in 1982, while waiting for a photocopier at the École Polytechnique in Paris, where he then worked. A colleague was copying a paper on Morlet’s wavelets, and the two struck up a conversation.

Meyer, a researcher in functional analysis, was so captivated that he took the first train to Marseilles to talk to Morlet and his colleagues. He decided overnight to change fields. “It was


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