Kim told *Nature* that one of the project's ion sources has been delayed by a year, but that this is a minor setback for a large-scale project.

Following the hearings, the government announced in November that it was auditing 4 of the IBS's 30 centres. And a week later, it confirmed the IBS's research budget would be cut by 7%, from 254 billion to 236.3 billion won. The cut, which came into effect this year, left centres with an average budget of a little over 6 billion won, says Doochul Kim.

The organization came under further scrutiny when several South Korean broadcasters reported in June that, according to audit results, at least two centres had misspent research funds. Media reports also called out multiple centres for questionable hiring practices, including the review of candidates by acquaintances. The media coverage was followed by another government audit — this time of 24 of the 30 IBS centres. The investigation was due to finish last month. The science ministry has not yet released its findings.

Doochul Kim told *Nature* that most of the allegations against the IBS reported in the media amount to administrative errors rather than nefarious wrongdoing. He thinks that the audits are politically motivated, and criticizes the way some preliminary results have been leaked to the press.

Since its inception, the IBS has had critics who think the institute swallows up too much of the nation's basic research budget. It's the institute's "original sin", says So Young Kim, a science and technology political scientist at the Korea Advanced Institute of Science and Technology (KAIST) in Daejeon. The IBS is also associated with the country's main conservative party, which founded it. When the Democratic Party came to power in 2017, it was more interested in spreading resources to many researchers, says So Young Kim. "It's a very different philosophy."

GROWING PAINS

Narry Kim, who says that the IBS centre she leads was audited in July, notes that the behaviours that have been criticized in the media might have arisen because of confusion about the rules — rather than anything more nefarious — and that this is an expected "growing pain" for an innovative style of research organization. The IBS was designed to break the mould of other public institutions in South Korea by giving centre directors freedom and larger-scale funding to pursue high-risk, high-reward projects that could win Nobel prizes. South Korea has never won a scientific Nobel, and the IBS is frequently referred to as the nation's 'Nobel prize project'.

But the IBS's flexibility has sometimes led to ambiguity, Narry Kim says. For instance, ten IBS centres, including hers, are administered by host universities and so are subject to both university and IBS regulations, which sometimes conflict or lead to confusion.

Doochul Kim accepts that some features of the IBS need to change to protect centres from being involved in further scandals. He has proposed redefining the institute's core principle of autonomy to ensure that centre heads would no longer have direct authority to hire tenure-track research fellows, thus avoiding accusations of nepotism. IBS directors are allowed to hire directly, but in South Korea the public is quick to anger at any hint of nepotism. Doochul Kim also proposed changes to the IBS's administrative structure. For instance, the institute currently has administrative staff at each research centre, but he wants the five IBS centres at KAIST to share a centralized office that would be more powerful and relieve directors of some of their administrative burdens, such as approving all purchasing decisions, no matter how small.

But the proposals undermine the IBS's original goal of having centre directors make decisions about how they are run, says Yannis Semertzidis, director of the IBS Center for Axion and Precision Physics Research at KAIST. IBS management should strengthen internal auditing to root out actual misconduct, but not interfere with directors' decision-making, he argues.

With Doochul Kim's term almost over, it will be up to his successor to follow through on his proposals. A shortlist of three South Korean physicists was announced last week. The science minister will nominate one person, subject to the approval of South Korean President Moon Jae-in. ■

ANCIENT HUMANS

Iconic finger fossil reconstructed

Virtual restoration of Denisovan finger bone reveals surprisingly human-like digits.

BY EWEN CALLAWAY

A new analysis of a finger bone used to study the Denisovans — a group of ancient humans identified in 2010 — offers clues to a decade-long mystery surrounding one the most important hominin fossils ever found.

The study describes the very tip of a right-hand little finger, which was separated from the rest of the finger bone after it was excavated 11 years ago. A digital reconstruction of the complete finger bone, or phalanx, reveals that the Denisovans' fingers were much more similar to those of modern humans than expected.

"I'm happy that we could get something out," says Eva-Maria Geigl, a palaeogeneticist at the Institute Jacques Monod in Paris, who co-led the study. "So far there was nothing, as if the phalanx was lost."

Her team sequenced DNA from the missing fragment to show that it matched the rest ▶

EDDIE GERALD/ALAMY

The Denisova Cave in Siberia has been a rich source of bones belonging to ancient hominins.

© 2019 Springer Nature Limited. All rights reserved.

of the fingertip bone, and used photographs to reunite the two pieces digitally. The work was published on 4 September in *Science Advances*[1].

The missing fragment's whereabouts are still unclear.

EVA-MARIA GEIGL

DENISOVAN DISCOVERY

The mystery surrounding the lost piece began at the foot of the Altai Mountains in Siberia, where Russian archaeologists excavating the Denisova Cave uncovered a finger bone belonging to a group of ancient humans in 2008. Anatoly Derevianko, an archaeologist at the Russian Academy of Sciences Institute of Archeology and Ethnography in Novosibirsk who was leading the dig, decided to divide the bone and send the pieces to two labs to see whether DNA could be extracted from either half.

One of the fragments went to Svante Pääbo, an evolutionary geneticist at the Max Planck Institute for Evolutionary Anthropology in Leipzig, Germany. His team sequenced its DNA and discovered that the bone belonged to a lineage distinct from those of modern humans and Neanderthals. In January 2010, Pääbo and several of his colleagues flew to Novosibirsk.

That's when Derevianko told Pääbo's team that he had divided the bone in two and sent the other half to Edward Rubin, a geneticist then at Lawrence Berkeley National Laboratory (LBNL) in California, whose team had been competing with Pääbo's to sequence Neanderthal DNA.

Worried about getting scooped, Pääbo and his team raced to report their discovery. They published the fossil's mitochondrial genome — a short stretch of maternally inherited DNA — in March 2010[2], and went on to reveal the first complete nuclear genome of a Denisovan several months later[3]. The studies showed that Denisovans were a group of extinct hominins that were more closely related to Neanderthals than to modern humans, and that they lived in the Siberian cave more than 30,000 years ago.

REVISITING OLD BONES

According to Geigl, Rubin, who left the LBNL in 2016 for industry and could not be reached for comment, sent his half of the fossil to her lab in 2010, but her initial attempts to extract nuclear DNA failed. After Pääbo's team published the Denisovan nuclear genome, Rubin asked Geigl to return the fossil. She returned the fragment in 2011, but was able to sample its DNA and take detailed photographs first.

Geigl sat on the data for years, but in 2016, she decided to publish them, at the suggestion of Pääbo. Her team sequenced the mitochondrial genome and showed that it exactly matched the sequence Pääbo's team had published in 2010. But a digital reconstruction of the complete finger bone held a surprise: the bone was slim, and more like the fingers of modern humans than the stout digits of Neanderthals.

"Given the limited skeletal remains definitively associated with Denisovans, this is an important discovery," says Tracy Kivell, a palaeoanthropologist at the University of Kent in Canterbury, UK, who was not involved in the study. The slender shape of the Denisovan finger suggests that Neanderthals' burlier fingers might have evolved as a result of strenuous use of their hands, she adds.

Although the story of the missing bone fragment has become clearer, the fossil's current whereabouts are still unknown. According to Derevianko, Rubin sent the sample to the ancient-DNA lab of Eske Willerslev at the University of Copenhagen and the Natural History Museum of Denmark in 2011 or 2012. Willerslev did not respond to requests for comment. ■

1. Bennett, E. A. *et al. Sci. Adv.* **5**, eaaw3950 (2019).
2. Krause, J. *et al. Nature* **464**, 894–897 (2010).
3. Reich, D. *et al. Nature* **468**, 1053–1060 (2010).

nature research
EDITING SERVICE

Could you communicate your research more effectively?

Our editors understand what it takes to get published and can offer expert advice to help you optimise your research paper or grant proposal.

Learn more at authorservices.springernature.com/scientific-editing

nature research

A51005

© 2019 Springer Nature Limited. All rights reserved.