



Bringing home the ancestors

Indigenous groups and geneticists are working together to study DNA from remains that were taken from communities decades ago.

BY NICKY PHILLIPS

Several years ago, Gudju Gudju Fourmile welcomed back several members of his Yidinji community who had been taken from their homes in northern Australia almost a century ago. Like many other Indigenous communities in Australia, the Yidinji have worked for decades to bring the bodies of their ancestors home — which Aboriginal communities describe as returning to Country.

Many of the ancestors are off Country as a result of the dehumanizing practices of the nineteenth and early twentieth centuries, when it was common for white collectors to loot graves and sell the remains of Aboriginal people to museums in Australia, the United Kingdom and other countries. “When our remains are off Country, we try to make sure they come back,” says Fourmile, an elder in the community who lives in Cairns. “They need to be comfortable. That’s a big thing for many tribal groups.” And when his community finally reburied its ancestors in 2014, “everybody was so happy. And the Country felt good again,” Fourmile says.

Before the Yidinji elders laid their ancestors

LISA MAREE WILLIAMS/GETTY

David Edwards, a Mutthi Mutthi elder, welcomes the return of remains that had been taken long ago.



to rest, they received a request from scientists who had been analysing the DNA of living community members: could they sequence the ancestors' genomes, too? With permission granted, a team led by evolutionary geneticist David Lambert at Griffith University in Brisbane extracted DNA from the remains of one individual, and confirmed that the ancient person was closely related to Yidinji people alive today^{1,2}. "When you find something out like that, you jump for joy," says Fourmile. The event also marked a turning point in the mindset of the community, he says, when members started to realize the potential of DNA analysis to help bring their people back home.

In the past 30 years or so, museums have responded to complaints by repatriating thousands of human remains and sacred objects to Indigenous Australian groups such as the Yidinji. But many more — possibly thousands — lack the information necessary to return them to one of the dozens of distinct Indigenous groups in Australia. That is a source of great distress for communities. Lambert's

team published a study in 2018 showing that ten remains, including those of one ancient Yidinji individual, could be linked to specific Indigenous communities through genetics¹.

Now, two teams in Australia, including Lambert's, are partnering with Indigenous communities to create genomic maps that connect ancient and historical remains with present-day groups. Such catalogues could eventually be used to help return remains to the right communities.

Australia is one country where this approach is being trialled. DNA research is confirming that many Indigenous groups have lived on the continent for tens of thousands of years^{2,3}. In some places, it has established that ancient individuals are closely related to present-day groups living in the same region¹. Drawing such links in other regions, such as North America, has proved more difficult, because ancient populations there seem to have moved around more.

One of these projects could eventually be used by Indigenous people who are still suffering from past government actions, particularly a racist Australian policy lasting until 1970 that removed thousands of Aboriginal children from their families. These children became known as the 'Stolen Generations', and many of them are alive today. A DNA database of Indigenous groups could help some individuals to understand their genetic heritage and identify their homeland.

But such efforts raise concerns. As a result of the history of mistreatment, some Indigenous people fear that unscrupulous governments or scientists might misuse their genetic information. And there are tensions over who should control the data and whether scientists can freely share genomic sequences.

Fourmile says that Yidinji people agreed to the study because they had control of the data. "We've done a flip, and now we're wanting them to study us for our own benefit to bring our people home," he says.

GOING BACK TO COUNTRY

The arrival of European colonizers in Australia in the late 1780s marked the beginning of a scientific grave-robbing era there, when white people collected Indigenous human remains for research — including now-discredited 'racial science' theories linking intellect with anatomical differences. By the end of the nineteenth century, most major museums around the world housed Indigenous Australian remains.

The collection of such remains was part of the broader subjugation of Indigenous Australians by Europeans, which has led to generational trauma. Authorities determined where people could live and work, whom they could marry and whether they could keep their children. Tribal groups were also systematically moved off their land and placed on reserves and missions, where their movements were restricted.

"They were trying to get us away from our traditional lands," says Michael Young, a member of the adjoining Paakantyi and Parrintyi tribal groups, which stretch across a large swathe of southwestern New South Wales.

Aboriginal groups began fighting for the return of their ancestors in the 1970s, as part of a wider movement against the ongoing discrimination against them. By the 1980s, the growing pressure prompted some museums to introduce policies to return human remains and sacred objects to their communities.

Tracking down the traditional owners of ancestral remains is important for Aboriginal people because it is part of reclaiming their identities after being forced to assimilate into white Australia, says Young. "Repatriation is healing some of that wrong that has been done to us over the last 230 years," he says.

So far, Indigenous communities have regained custodianship of more than 2,500 sets of ancestral remains from Australian museums, according to the government's repatriation programme (see 'Mapping ancestors'). And in the past 30 years, more than 1,500 sets of ancestral remains have been returned to Australia, mostly from the United Kingdom, but also from the United States, Canada and half a dozen European nations, although some museums still refuse to repatriate remains and cultural objects.

But there are probably several thousand sets of remains in Australian museums whose origin remains unknown, says Deanne Hanchant-Nichols, an anthropologist in Adelaide with experience in trying to identify unprovenanced remains and a member of the Tanganeakald and Barkindji (or Paakantyi) communities. Many of the bodies are simply labelled 'Aboriginal', with no other identifying details, she says.

In 2016, Lambert laid the groundwork for ways to solve this problem, as part of a team that was charting the continent's genetic history². Lambert worked with elders to collect DNA samples and shared the team's findings about the ancestry of some contemporary Indigenous Australians. During these conversations, the elders and Lambert discussed whether DNA could also reveal where ancient remains in museums had come from. Lambert said it was possible, but he was cautious not to predict the result before they did the analysis. "We've got to be careful about this kind of research," he says.

Lambert got permission from the elders of 11 Aboriginal groups, including the Yidinji and the Paakantyi, to test the idea; several members of Indigenous communities, including Fourmile and Young, joined the study as co-authors." His team sequenced DNA from 27 sets of human remains — mostly bones, but also teeth and hair — from individuals who died before British settlers arrived and whose burial location was known¹. Most of these remains have been repatriated.

Despite Australia's sweltering heat, which degrades DNA in remains, the team, co-led by Lambert and evolutionary geneticist Eske

Willerslev at the Natural History Museum of Denmark in Copenhagen, obtained mitochondrial genomes from all 27 remains and full or partial nuclear genomes from 10 of them (see 'Mapping ancestors').

The DNA in mitochondria — cells' power plants — is generally inherited maternally and is present in many more copies in cells than nuclear DNA. But Lambert's team — which included Joanne Wright, then a PhD student at Griffith University — found it was of limited use in linking remains to contemporary groups: 11 of the remains had no conclusive match in a database of more than 100 mitochondrial genomes from Indigenous Australians, and two were linked to the wrong geographic area.

Nuclear DNA proved a much richer source of ancestry information for matching remains to present-day communities. Lambert's team compared the 10 ancient nuclear genomes to those of 100 Indigenous Australians living across the country. In all ten cases, the ancestral remains were most closely related to the Indigenous people in their study who came from the same geographical area.

For instance, one of the ancient individuals is estimated to have lived at least 2,000 years ago, and their remains were excavated from a well-known Aboriginal burial ground in the Willandra Lakes region in far western New South Wales in 1974. The closest relatives of that person are members of the Willandra groups who live in the area today.

Lambert is now negotiating with the Queensland Museum and its board of Indigenous advisers to sequence about 300 unprovenanced remains housed at the museum, to test whether their place of origin can be identified. Young agrees that genetic matching could be a powerful tool for repatriating ancestors to the right community. But he would like to see more proof of its accuracy before the approach is applied to unprovenanced remains. The risk of repatriating remains to the wrong community could be reduced, he adds, by combining genomic analysis with anthropological evidence. Incorporating cultural knowledge from communities and information from museum archives could also help.

Moreover, Young says that such efforts should include more Indigenous scientists, who are aware of the culture and can discuss with communities how the research can help to reinforce their connection to Country. He is working with Lambert and others to set up scholarships for Aboriginal people to study genetics. "I'd love more Aboriginal people to get into that area," he says.

A MAP OF THE PAST

Isabel O'Loughlin has spent the past six years building trust with several Indigenous communities. She is one of two community consultants working on the Aboriginal Heritage Project, another effort to look at DNA from

remains of Indigenous Australians.

The group is sequencing hair samples that were collected mostly by ethnologists Norman Tindale and Joseph Birdsell from 1928 to the 1970s in what are today seen as racially motivated studies.

The Tindale and Birdsell teams drew family trees that name more than 50,000 people, including some who lived before British settlers arrived in 1860. The collection, which is held at the South Australian Museum in Adelaide, also contains photographs, sound recordings, films and drawings. More than 5,000 hair samples are stored in a restricted area in the museum.

When ancient-DNA researcher Alan Cooper at the University of Adelaide first heard about the collection a decade ago, he wondered whether it could be used to determine where Aboriginal Australian communities lived before British settlers arrived and spread throughout the country. Although the hair samples were collected from the 1920s — when Aboriginal people were already being forced from traditional lands — the detailed family trees meant that the team would be able to trace some people's families back to these locations. So, in 2014, Cooper's team started reaching out to Indigenous communities to get permission to analyse the remains.

Lewis O'Brien, an adviser to the Aboriginal Heritage Project, remembers Tindale visiting Point Pearce, the mission where his aunt lived in 1938. Tindale interviewed O'Brien, aged 8, and his brother, and measured their heights and the length of their arms, among other things. Tindale also snipped a lock of O'Brien's hair. "I felt like a guinea pig," says O'Brien, an elder with

“Repatriation is healing some of that wrong that has been done to us over the last 230 years.”

the Kurna people, who is now 89 and lives in nearby Adelaide. O'Brien didn't like how Tindale studied Aboriginal people, but he can see that the collection is a valuable resource for unravelling history for some communities.

The project's data could also be the starting point for creating a service for present-day Indigenous people to compare their DNA against the reference map built from the hair samples. The service could allow some people — including members of the Stolen Generations — to explore whether genetics can reveal anything about where they might have come from, when conventional methods of finding such information fail, says Ray Tobler, a population geneticist at the University of Adelaide. But more work to reduce uncertainties is needed before such a service would

be possible, he says. Hanchant-Nichols thinks a broad discussion among Indigenous people is needed, too. O'Brien supports a genetic-comparison service. He is often approached by Aboriginal people who were removed from their families and are desperate for information about their ancestry. "I want to be able to say, 'we'll get you tested and help you find out where you come from,'" he says.

Cooper and Tobler also visit communities to explain their efforts. Families whose records form part of the Tindale collection then have private meetings with the team to ask questions and raise any concerns. Some worry that their family's genetic results could be misused, for instance, by government agencies to test their status as an Aboriginal person, says Cooper. But he says that status is based on community recognition and cannot be defined genetically. There is currently no DNA test of Aboriginality (despite claims to the contrary by some conservative politicians in Australia). The geographical information accompanying the genetic data is not specific enough to resolve land-title claims — another concern. "To boil someone's identity down to their DNA is unethical and scientifically flawed," adds Tobler.

O'Loughlin says the project has been embraced by the communities largely because Aboriginal people retain control. Of almost 180 families that the team has approached, only two decided not to participate in the project, she says.

After performing the analysis, the team returns with results. The community learns about the history of Australia and the relationships of different Indigenous groups. And individuals get information about their ancestor who provided the hair sample. O'Loughlin and her colleague Amy O'Donoghue also alert families in advance if the results show that biological relationships differ from families' known relationships.

In 2017, Cooper and Tobler's team published its first map of Aboriginal groups, based on mitochondrial DNA from 111 hair samples from three Indigenous communities³. The genetic analysis suggests that the first Australians arrived from Asia by about 50,000 years ago. This is broadly in line with most archaeological evidence and previous genome studies² (see 'Mapping ancestors'). Australia's Indigenous groups also say their connection to the continent is ancient. Within a couple of thousand years, this founding group split into populations that expanded west and east — and then largely stayed put. On the basis of mitochondrial lineages, at least, there hasn't been a lot of movement around Australia over broad geographical and time scales, says Tobler. "That's remarkable because you don't really see that anywhere else."

Cooper and his team have now sequenced the nuclear genomes of about 150 hair samples. They plan to seek permission to sequence

DNA from up to 1,000 hair samples.

However, the project has been on hold for almost a year while the team has worked to comply with state laws on conducting research with Aboriginal participants. The project is set to resume this month.

Although the hair samples are not being repatriated to the families, the map that is based on their DNA could help to match unprovenanced remains in museums to present-day groups, enabling their return.

TALES OF THE ANCIENT ONE

In the United States, the 1990 Native American Graves Protection and Repatriation Act (NAGPRA) and similar state legislation oblige museums to audit their collections and return what they can in the way of ancestral remains and sacred objects to Native American communities.

So far, NAGPRA has led to the return of hundreds of thousands of culturally affiliated ancestral remains and artefacts. And in the past few years, the US government has cited ancestry information gleaned from ancient DNA in returning some unaffiliated remains to tribes.

One of the most contentious is the 8,500-year-old skeleton of 'Kennewick Man', which was uncovered by teenagers in 1996 in a riverbank near Kennewick, Washington. Several Native American groups claimed the remains of the individual, whom they call the Ancient One, as ancestral and demanded their return under NAGPRA. But a coalition of archaeologists argued that the person lived too long ago to be culturally linked to present-day Native Americans under the law, and won a 2002 federal lawsuit to block their repatriation.

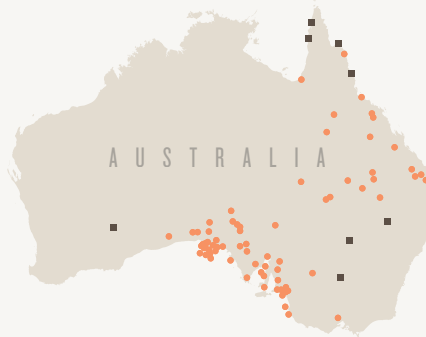
The remains were stored out of view in a Seattle museum, available to scientists and Native American groups, for over a decade. But several years ago, the US government asked Willerslev whether his lab could test the remains for DNA. After consulting with all of the Native American groups seeking Kennewick Man's return, Willerslev's team obtained enough DNA to generate a low-quality genome sequence.

Comparisons with DNA from present-day individuals confirmed that Kennewick Man was more closely related to Indigenous groups in North and South America than to other global populations⁴. They also determined that Kennewick Man was closely related to members of the Confederated Tribes of the Colville, who had participated in the study — one of the five communities seeking repatriation — but also to other groups in the Pacific Northwest and even to some in Central and South America. On the basis of the DNA tests, the

MAPPING ANCESTORS

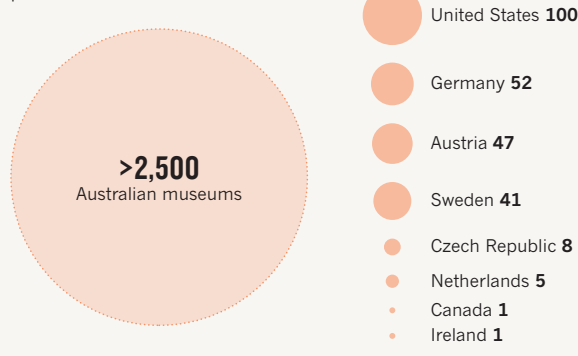
Two teams led by Australian researchers are analysing DNA from ancient and historical remains (shown on map) from Aboriginal people in that country. The efforts are creating maps of the pre-colonial distribution of Indigenous communities, which could help the return of remains kept in museums.

- Aboriginal Heritage Project (ref. 3)
- Griffith University project (ref. 1)



RETURNING HOME

The large dotted circle shows the number of Indigenous people's remains held in Australian museums that were returned to the control of their communities. Other circles represent remains repatriated to Australia from overseas museums and private collections.



US government determined that Kennewick Man was Native American, and therefore eligible for repatriation under NAGPRA. The remains were reburied in 2017 by members of the Yakama Nation, the Wanapum Band and the Nez Perce, Colville and Umatilla tribes.

The US government again cited ancient DNA evidence generated by Willerslev's team when repatriating remains from Nevada in 2016, including a 10,600-year-old male human skeleton known as the Spirit Cave Mummy. As with Kennewick Man, the DNA analysis determined that the remains were Native American, but the study did not link them to any specific groups⁵.

Linking ancient remains to present-day groups is challenging because of huge gaps in scientists' understanding of the population history of the Americas. Few genetic data are available for ancient remains in the Americas, says population geneticist Rasmus Nielsen at the University of California, Berkeley. The preliminary analysis of DNA from remains such

as Kennewick Man and Spirit Cave Mummy suggests that ancient populations in the area moved around, so the ancient inhabitants of a region are likely to be the ancestors of many different Native American groups.

Drawing connections between ancient remains and modern groups is even more difficult, because there are relatively few genomes from present-day Native Americans against which to compare ancient remains, Nielsen adds. "Genetic results are only going to be as good as your comparative database," says Ripan Malhi, a molecular anthropologist at the University of Illinois at Urbana-Champaign, who works with Indigenous groups in North America. The paucity of contemporary Native American genomes is a legacy of the poor treatment of Indigenous groups by non-Indigenous scientists, he adds.

In one case, researchers collected DNA from members of the Havasupai Tribe in Arizona, for health research. But they failed to seek permission when the samples were later used for other kinds of studies, so many Native Americans are now reluctant to share their details.

Some scientists in Australia have also failed to give Indigenous groups proper control over their own data. Such incidents have led to agreements where Indigenous groups decide how their information can be used. For instance, Indigenous communities involved with Lambert's study permit their data to be shared with other groups wishing to verify the results, but only if the scientists get ethics approval. If researchers want to use the data for other purposes, they must get consent from the participants.

Some researchers have criticized such restrictions, saying that they could prevent Indigenous groups from seeing the benefits of future studies using their data. But Lambert and Indigenous groups say it is about time that non-Indigenous scientists ceded control.

And Aboriginal people are starting to embrace the chance to be involved, says Hanchant-Nichols. "For many, many years, science kept us out. We had no role in museums other than for them to steal our stories, steal our artefacts and steal our bones." ■

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