Lessons from the Ancient One

The final stages of a dispute over an ancient Native American skeleton signal the need for clearer oversight of such human remains.

The decades-long battle over the fate of the remains of an 8,500-year-old human known as Kennewick Man may be nearing an end. Last week, the US government determined that the remains are Native American and are thus governed by a law that provides for the repatriation of Native American remains and cultural artefacts.

Five tribes are seeking custody of the bones, and if any can now demonstrate that Kennewick Man is one of their own, they will get the reburial that they have been asking for since the remains were found on the banks of the Columbia River near Kennewick, Washington, in 1996.

The return of the Ancient One, as the tribes call the ancient human, would help to heal a rift between researchers and Native Americans. It also demonstrates the need for a rethink of the rules. In an age in which ancient genomes can reveal startling links between historical populations, we should ask not just whether remains should be reburied, but who decides and on what grounds.

Kennewick Man's genome, reported last year in this journal (M. Rasmussen *et al. Nature* **523,** 455–458; 2015) paved the way for the US Army Corps of Engineers, which manages the land where the remains were found, to deem him Native American. Before that, the bones were in limbo and kept off display, but were allowed to be visited by scientists and the tribes seeking reburial.

The genome established that Kennewick Man is more closely related to Native Americans than to other global populations sampled. This was no surprise and it torpedoed fringe theories that Kennewick Man was related to Europeans or an indigenous Japanese group.

But the researchers also found that some South American groups such as the Karitiana, who live deep in the Amazon, are more related to Kennewick Man than are many North American tribes, such as the Ojibwa from the Great Lakes region. Of the five tribes seeking reburial, only members of the Confederated Tribes of the Colville Reservation offered their DNA for comparison. Members of this tribe were found to share a relatively close connection to Kennewick Man, but no more than some other groups from North and South America.

This ancestry offers a glimpse at the peopling of the Americas, which probably began some 15,000 years ago when groups from Asia crossed the Bering land bridge into what is now Alaska. Researchers are still piecing together this trek, and it is one of the most exciting areas of human population genetics research. Evidence from ancient and contemporary genomes suggests that the journey was far from simple: multiple waves of humans probably settled on the continents, later moving around and replacing earlier inhabitants as they went.

Kennewick Man's genetic relationship to contemporary Native Americans, including the Colville tribes, will factor into the next decision that the US government faces: whether any tribe can make a legitimate claim to his bones. To make a case, tribes will need to establish a cultural affiliation with Kennewick Man on the basis of several lines of evidence including archaeological, geographical and biological links.

This is where things get tricky. Members of the Colville and the other four Washington-state tribes seeking reburial may be descendants of Kennewick Man, but so too may be lots of other groups, including some in South America. Could the Karitiana also claim the remains?

It is possible that researchers could find people more closely related to Kennewick Man than members of the tribes (who share a history of intermarriage and probably have similar connections to Kennewick Man). There are huge gaps in the understanding of Native American genetic diversity. And DNA analysis can reveal unexpected links. A study last year found that the Karitiana and another Amazonian group have an unexpected kinship with Aboriginal Australians (P. Skoglund *et al. Nature* **525,** 104–108; 2015).

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Genomic analysis is a powerful tool that is redrafting human history. But the US government should use its broad-brush insights cautiously as it considers the fate of remains.

The Ancient One will probably end up back in the ground, and many scientists will lament the loss. But there are hopeful signs that disputes such as this between researchers and Native Americans will themselves become a relic of the past. A new generation of geneticists is more likely to involve Native Americans in their research, for instance, by drafting plans for the handling of human remains before they are discovered.

Genetics may be equivocal right now on the identity of Kennewick Man's descendants, but such engagement is the best hope to unravel thousands of years of human relationships, to the benefit of all. ■

The nuclear option

China is vigorously promoting nuclear energy, but its pursuit of reprocessing is misguided.

If there's one country that could disprove the old joke among engineers about nuclear power — that nothing can compete with a paper reactor — it may be China. Nuclear power is enjoying a theoretical renaissance in the United States, with researchers advancing a new generation of inherently safe designs and with start-up companies attracting venture capital. But so far, only China has shown the kind of long-term, strategic thinking that would be required to launch a real nuclear revival.

Nuclear engineers from elsewhere know this, and are racking up frequent-flier points on trips to Beijing and Shanghai to support partnerships that may put paper reactors to the test. Already, China is building a 210-megawatt demonstration of a pebble-bed reactor, led by researchers at Tsinghua University in Beijing. It could come online by next year, marking a first for safer 'generation IV' reactor designs.

The Chinese Academy of Sciences is also working with the US Department of Energy on molten-salt reactors, which were originally developed and tested at Oak Ridge National Laboratory in Tennessee in the 1960s. Researchers at the Massachusetts Institute of Technology in Cambridge are pursuing a partnership to advance an entirely new design that includes elements of both molten-salt and pebble-bed reactors. And the relative newcomer TerraPower, which is based in Bellevue, Washington, and funded by Microsoft co-founder Bill Gates and others, has signed a memorandum of understanding with the China National Nuclear Corporation (CNNC) to pursue the company's 'travelling wave reactor', which is designed to minimize the need for uranium enrichment.

These partnerships illustrate the advantages of international collaboration. China thinks big and moves quickly, and the world may one day reap the benefits. But the country's zeal for advanced nuclear technology has an ominous side: China's latest five-year plan also promotes the reprocessing of nuclear fuel. CNNC officials are currently negotiating with the French nuclear giant Areva to build such a facility.

The promise of nuclear reprocessing has not panned out. The idea dates back to the beginning of the nuclear era, when officials feared a shortage of uranium resources. Plutonium extracted from spent fuel would be redeployed in breeder reactors, which produce more fuel than they consume. But as it turns out, there is more than enough uranium for the foreseeable future. Moreover, the technologies proved expensive, and the risks became all too clear in 1974 when India used reprocessed plutonium in its first nuclear bomb.

For all of these reasons, the United States and many other nations abandoned the idea decades ago. The United Kingdom is closing its reprocessing operations, and the world would be a safer place if countries such as France and Japan followed suit. China should abandon reprocessing before the inevitable bureaucratic momentum builds up. Instead, the country should focus on reducing costs and developing technologies that might enable nuclear energy to play a larger part.

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As it stands, the short-term outlook is mixed. Some 444 nuclear reactors currently operate around the world, accounting for as much as 11% of global electricity production. Another 64 are under construction, including 22 in China. But many of the existing reactors are getting old and will need to be replaced.

Meanwhile, the public and politicians in many countries are warier than ever after the 2011 Fukushima accident in Japan. An optimistic projection by the International Atomic Energy Agency suggests that global nuclear-power capacity could increase by a factor of 2.5 by 2050. In a pessimistic scenario, the agency suggests that overall nuclear-power production could remain roughly flat.

New reactors have struggled to compete with other forms of energy production, and perhaps the biggest barrier is the huge upfront cost. It is simpler, faster and cheaper, at least in the short run, to build natural-gas-fired power plants, or to install wind turbines and solar systems.

The US Department of Energy is funding nuclear-energy research, with the support of lawmakers on both sides of the aisle in Congress. But what nuclear power really needs is a comprehensive climate policy that puts a price on carbon emissions and rewards all low-carbon energies. Short of that, the nuclear industry's best hope may be China. ■

Fat lot of good

Humans' exceptional ability to burn through calories fuels our evolution.

In an interview last September with *Cyclist* magazine, five-time winner of the Tour de France, Miguel Indurain, was asked about his extraordinarily low heart rate, which story after story had claimed was as low as 28 beats per minute. "Is it true?" the interviewer asked.

"One day we did a medical test and it read 28, so there is some truth in it," Indurain said. "But normally it was a little bit higher." By normally, the cyclist meant that it was usually 30 or 32 beats per minute. And although that have might have been normal for him, it is extraordinary compared with that of the average adult, whose heart bumps along at closer to 60–100 beats per minute.

Indurain is said to have near-super-human heart and lung capacity to go with his glacial pulse. He may also have an unusually low metabolism — a common way to estimate that particular physiological measure is simply to look at the heart rate. The more the heart pumps, the estimate assumes, the faster the body's cells and tissues will be exhausting their reserves. If that is true, then having a slow metabolism would merely confirm that Indurain has a special physiological status. For as a species, humans tend to burn through calories as if they are about to go out of fashion.

We humans are a conundrum to physiologists when it comes to our energy use, because we seem to have evolved an ability to have our cake and eat it, too. Compared with our primate cousins, we breed more and have larger brains — both of which should sap our energy — and yet we live for longer.

This week, biologists offer an explanation. And it is similar to Indurain's answer when he was asked to explain his success on the roads: we simply work harder.

In experiments described online on 4 May, scientists took direct measurements of daily energy use in more than a hundred people and in all other known species of great ape (H. Pontzer *et al. Nature* http://dx.doi.org/10.1038/nature17654; 2016). Chimpanzees, bonobos, gorillas and orangutans all failed to keep up. Every human expended hundreds of kilocalories a day more than any other ape, and the difference is down to greater metabolic activity in our organs.

In other words, humans have evolved to use more energy. We are the original consumer society: our increased demand for physiological energy is driven by our more efficient way of walking, the energy-dense foods such as meat and tubers we have found, and the methods of cooking we have invented and adopted.

The unusually large energy budget of humans presents both an opportunity and a threat. For a start, it helps to power — and to explain the development of — our unusually large and concomitantly energy-hungry brains. We have always been proud of our large brains. Indeed a century or so ago, men of science (and they usually were all men) would routinely measure human heads and weigh their brainy contents to prove our dominance over the beasts. (They did this as well as making false claims on the primacy of certain human groups over others.) But how we found the fuel to maintain such an expensive cognitive prize, where other primates have not, has long been a puzzle.

Then there is the risk. To have a body that needs to be fed more just to exist is a dangerous strategy in lean times, just as use of gas-guzzling motor vehicles is considered antisocial in a resource-constrained world.

The human culture of food sharing helps us to keep the tank filled. So too does what seems to be a uniquely human trait among the primates: the ability to maintain significant fat reserves as a contingency. Even at his slimmest, Indurain would have struggled to match the body-fat content of the average chimpanzee. We may curse its effects today, but human fat tissue seems to have evolved to protect us from ourselves and our unquenchable thirst for energy. It's true: those who struggle to keep those fat reserves under control really can blame their metabolism. ■

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