Interspecies love-ins and the offbeat history of our species

May 26 2015, by Darren Curnoe

The ~35,000 year old Pestera cu Oase cranium is probably a hybrid between modern humans and Neanderthals. Credit: Wikimedia Commons, CC BY-SA

Revolutionary developments in the study of the DNA of our fossil ancestors are forcing a major rewrite of the human evolutionary story.

They hold major implications for fundamental questions that cut across biology and shift the spotlight back onto humans as a central model in the study of evolution.

And, they again highlight the weird sex lives of our Palaeolithic ancestors.

Captivated by our past

Most of us find surprises in our family histories when we start digging: there are always distant relatives who didn't quite fit in, did something heroic or shameful, or were perhaps from the wrong side of the railway tracks or even the 'wrong' part of the planet.

In my own family one of our ancestral lines – my maternal grandmother's father's lineage – was never talked about much: "Oh, his ancestors were convicts" my grandmother would say.

After my grandmother died six years ago, my mother began to explore this side of the family more thoroughly with the aid of one of those on-line genealogy sites.

To our surprise, we found that far from an embarrassing convict past, my great grandfather's family seems to be traceable to the small group of English settlers who in 1788 established the fledgling colony that would later become known as Sydney.

From another perspective, he was part of the first wave of European invaders who would come to take over the Australian continent, dislocating its original owners.

It's the same when we dig into the evolutionary genealogy of the human species as contained in our genome, it holds big surprises for us about our past.

Genomic genie out of the bottle

Studies of the human, Neanderthal and Denisovan genomes are turning the science of human evolution on its head.

It turns out we aren't the species we once thought we were: we are in fact mongrels, 'bitsas': bits of this species and bits of that species.

Our genome is a mosaic of DNAs: largely *Homo sapiens*, but with bits of Neanderthal, fragments of Denisovan, and pieces of other, mystery, relatives that we haven't yet identified from the fossil record.

Interbreeding seems to have had important consequences also for modern humans as we dispersed across the Eurasian land mass tens of thousands of years ago, bolstering our immune systems and perhaps even allowing of us to survive at high altitude.

It's a sobering time for scientists like me, who in the post-genomic era are being forced to re-evaluate the theories we've promulgated and assumptions we've held dear over many decades.

How did this happen, you might ask? Well, perhaps *sapiens* was as *sapiens* is?

One of the great surprises of the Internet age is the incredible range of sexual proclivities that we humans indulge in; all there to be viewed in glorious Technicolor for those who might dare to click.

And it seems the broad menu of sexual tastes our species enjoys may have extended all the way back into the murky Palaeolithic, to include other hominin species.

Changing views of species

Modern human (left) and a Neanderthal (right). Despite being a different species to us, around 1-6% of the genome of living non-Africans comprises Neanderthal DNA. Credit: Darren Curnoe

Many of us were taught in high school or university undergraduate biology that species are some how pure lines; groups of organisms that can't interbreed with each other.

They are 'reproductively isolated' from other species, in the language of the mid-20th Century architects of the 'modern synthesis,' Theodosious Dhobzhansky and Ernst Mayr.

One of the great revelations from population genetics over recent decades is the surprisingly common occurrence of interspecies mating: hybridisation.

At least 10% of primate species interbreed naturally, in the wild, and hybridisation is now widely regarded to be a source of evolutionary novelty and to even play a role in the formation of new species.

History rewritten

In 2010, with the first draft sequence of a Neanderthal genome by Richard Green and co-workers, we began to learn that the ancestors of all living non-Africans had in fact mated with our Neanderthal cousins.

The result was that 1-4% of our genome is Neanderthal in origin, although, slightly earlier estimates from studies of the human genome by Jeffrey Wall and his team suggested the contribution of archaic human DNA could be least 6%, and perhaps up to 14%.

The amount varies also between human populations with some East Asians having 40% more Neanderthal DNA than Europeans, according to other research published by Wall and co-workers.

And yet further work by Jeffrey Wall has shown evidence in the genome of some living Africans for interbreeding with another species there, around 35,000 years ago. One we haven't yet identified from the fossils.

Modelling by Armando Neanves and Maurizio Serva has also suggested that Palaeolithic humans need only have interbred successfully once in every 77 generations, or roughly 1500 years, to explain the levels of

Neanderthal DNA seen in living people.

So it would seem to have been a very rare event, occurring perhaps only a handful of times in our evolutionary past, and subsequently captured by natural selection.

And yet further research by Sankararaman and colleagues has suggested that the patchy distribution of Neanderthal DNA in living humans indicates strong selection against hybrids, especially male hybrids who probably suffered reduced fertility or could even have been sterile.

This would strongly support the notion that Neanderthals were a different species to us, as most fossil specialists suspect, and that mating was in fact a cross-species affair.

A truck load more to come

One of the emerging surprises from the fossil record from the period roughly 50,000-10,000 years ago is the remarkably large number of 'enigmatic' remains that have and continue to be discovered.

The 11,000 year old skull from Longlin Cave in Southwest China might be the youngest example of a hybrid between modern and archaic humans. Credit: Darren Curnoe

By enigmatic I mean that 'overall' they resemble modern humans (*H. sapiens*) but also possess a surprisingly large number of features that we would normally associate with archaic groups like the Neanderthals.

I've seen this in my own work with the 'Red Deer Cave people' in Southwest China.

And its a compelling explanation for the mixed anatomy of the Iwo Eleru remains from West Africa, Nazlet Khater 2 skull from Egypt, Lukenya Hill fossil from Kenya, and in Europe, the Mezzena jaw and Pestera cu Oase remains from Romania, among others.

A recent news report in *Nature* announced that DNA had been successfully sequenced from a 35,000 year old jaw from Pestera cu Oase, as described at the Biology of Genomes meeting in Cold Spring Harbor in New York.

Qiaomei Fu, a palaeogenomicist at Harvard Medical School, and her team apparently found that between 5% and 11% of the DNA of this individual (a man) was Neanderthal, including large chunks of several chromosomes.

They even estimated that the Oase man's Neanderthal ancestor had lived only 4-6 generations or roughly 80-120 years earlier.

Unfortunately, the chance of successfully extracting and sequencing DNA from any fossil remains very low, so most of the unusual looking remains will probably never yield genetic clues to their ancestry.

But, those cases where DNA has been extracted from fossils, like the Pestera cu Oase jaw, give us confidence that their enigmatic looking bony features offer reliable insights into their genealogy.

Broad implications

Human evolutionary science was largely sidelined for most of the 20th Century as a quaint and "old fashioned" kind of discipline.

This was partly because anthropologists refused to accept Darwinian evolution as their central theory until the 1950s.

But then, with the "molecular revolution" from the 1960s onwards, fossil studies lost a lot of their shine.

The unfolding ancient DNA revolution over the last decade has put the spotlight firmly back on our species and its fossil record as one of the key models and sources of information for understanding evolution.

The findings are even beginning to revolutionise how we conceive of some of the most fundamental concepts like "species" and how they might arise in nature.

Source: The Conversation

Citation: Interspecies love-ins and the offbeat history of our species (2015, May 26) retrieved 17 April 2024 from
https://phys.org/news/2015-05-interspecies-love-ins-offbeat-history-species.html