

Ancient DNA and modern identity: the promise and pitfalls

Colleen Gibbs examines the way that studies of DNA provide potential new means of understanding identity, but also how it presents a number of new questions.

In 2018, the Natural History Museum in London unveiled its reconstruction of the Cheddar Man - a Mesolithic inhabitant of what is now Britain found in Gough's Cave in Cheddar Gorge, Somerset - who appeared to have blue eyes and dark skin. 'Was Cheddar man white after all? There's no way to know that the first Briton had "dark to black skin" says scientist who helped reconstruct his 10,000-year-old face', wrote the Daily Mail shortly thereafter, in response to the negative reaction by the British public (Collins 2018). Over the past hundred years, the public's interest in the past, their own personal histories, and that of their neighbours has increased as new sources of both genetic and genealogical information have become increasingly accessible. In the context of archaeology and heritage studies, the process of communicating to the public the nuanced findings of a rapidly changing field of study has descended into an ongoing crisis. Academic research seeks to resolve questions about the past and persuade the reader to incorporate new concepts, but when that evidence challenges widely held beliefs, the very act of sharing it threatens trust between the public and the academic worlds. Politicians and the public crave identities that are monolithic and easily differentiated, but the tools of scientific inquiry have repeatedly shown that populations and societies are complicated and fluid, across both time and geography.

Recently, the settlement of the British Isles and the development of agriculture in Europe have been subjects of contention within archaeology that have been difficult to explain to the public. The Mesolithic-Neolithic transition in human history marks the move from hunter-gatherer collectives to societies with developed agriculture and animal domestication (McCarter 2007, 16-47). While the Neolithic transition occurred at different times and in different places across the globe, the earliest certifiable appearances of agriculture are in the Fertile Crescent, a region of southwestern Asia (Larson, 2007). Typically, agriculture is believed to have spread from there into Europe over a few thousand years (Cummings 2017, 9-10). The impetus for the Mesolithic-Neolithic transition is the subject of two competing theories: that the technology was adopted by the locals (Thomas 2013), or through a migration event that entirely replaced the material culture and genetic composition of European populations within the region (Sheridan 2010, 89-105).

At the turn of the twentieth century, European cultural identity entered a transitional period and the field of archaeology was in its infancy as an academic discipline. This early archaeological theory was heavily influenced by linguistics, classics, history, and antiquarianism - the precursor to the field as we know it today. Gustaf Kossinna, an early twentieth century writer on the spread of Indo-European languages and an extreme German nationalist, was one of the first archaeologists to propose the concept of an archaeological culture (Trigger 2006, 235-242). While his methodology and theories remain important, his theory of Indo-European language spread was controversial, both with his contemporaries and with modern scholars. Kossinna posited that, on the basis of Corded Ware Pottery Culture development and its associated human remains, the Proto-Indo-European language may have originated in a region of Germany in the Neolithic period. His theories were used to support German nationalist beliefs in the period and were influential in the rise of Nazism. Within the field of archaeology, Kossinna's work in the study of Germanic Prehistory is contested, but his contribution of the concept of an archaeological culture is respected. This concept was further developed by the archaeologist Gordon Childe, who solidified the idea of cultural association with artefacts and the remains of the people who were discovered in conjunction with them (Trigger 2006, 240-242). These interpretations came before

there had been large scale studies of the Mesolithic and Neolithic in continental Europe, and long before any chronology was established with radiocarbon dating (Cummings 2017, 7). Communication between academics and the public with regard to the past should be a priority, so that it cannot be used to justify any actions in the present that support personal identity protectionism.

As Britain's oldest near complete human skeleton, the 'Cheddar Man' is an elegant example of incongruous ancestry and location of origin, and provides an unusual look into the representation of Britain's prehistoric national heritage. Recently, the ancient DNA (aDNA) sequencing and subsequent facial reconstruction of the 'Cheddar Man' brought controversy as his genetic make-up indicated dark to black skin, dark hair, and light eyes, generally deviating from the native British public's understanding of their looks and ancestry. When examined further, it became apparent that the 'Cheddar Man' may not have looked like the projections his aDNA analysis indicated, but he was also not from a haplogroup related to more than a quarter of the British population (Brace et al. 2018). This indicated that he did not share a common ancestor along the matrilineal or patrilineal line with the majority of the native British population, and that he did not represent the genetic past of the majority of the British people. A noteworthy detail in the biography of the 'Cheddar Man' is that carbon dating places him in the early Mesolithic, far before the advent of agriculture, and far detached from any known modern society; when the 'Cheddar Man' was alive, Britain was most likely still a part of mainland Europe. At this point, disregarding the actual modelling of the 'Cheddar Man's' genetics, the public backlash to the findings are indicative of a greater issue. When the public's view of the past does not coincide with academia's current findings, the tendency for the public to further discredit academia, even in the case of solid research, becomes an ongoing problem. When academics who research topics that are primarily funded by the public reveal findings contrary to the popular mythos of the public's identity, conflict is bound to occur. With enough backlash, research can become discredited or researchers will even distance themselves from their own work, as is the case of those who performed the genetic reconstruction of the 'Cheddar Man' (Barras 2018).

Deoxyribonucleic-acid (DNA) and the human genome are becoming prominent features of individual identity, as the cost of genome sequencing has dropped, and the public have begun to take significant interest in their genetic past to create more accurate depictions of their personal heritage. Unfortunately, there are some major issues with mass market DNA, testing not just in terms of accuracy, but in terms of method (Rutherford 2018). For the most part, single nucleotide-polymorphisms (SNPs) - which are made up of small mutations on long strings of genetic code - are compared with the genetics of modern populations; ancestry is then determined by matching variations in non-coding regions of genetic code with other groups in modern populations that have those same mutations (Zeng, 2016, 891-896). Most modern ancestry testing takes place in the form of analysing non-coding SNPs from the mitochondrial DNA recovered and does not take into account the nuclear DNA (Williams, 2002, 246-259). This indicates that most DNA analysis is designed to only trace the maternal line, and as such is only indicative of part of the picture (Wallace, 781-785).

Beyond the issues of SNPs' reflection of ancestry in modern samples, aDNA is made up of small fragments of genetic code that are typically significantly shorter in length than modern DNA. Ancient DNA strands tend to be around forty to five hundred base pairs in length, whereas modern DNA consists of 3.2 billion base pairs in the nucleus (Brown 2011, 9-37). This means that contamination by modern human DNA can occur easily and that, even as cases of aDNA genetic reconstruction get better, as geneticists increase their understanding of the human genome, the reconstructions of ancient remains can only go so far; the physical archaeological sample is limited, and sampling must be undertaken with caution due to its destructive nature.

In the late 1990s, the skeleton of a Paleo-American was uncovered in Washington State, the United States of America (USA). The remains of this individual are commonly referred to as the Kennewick Man or, in the Native American community, the Ancient One (McManamon 2004). Under the Native American Graves and Repatriation Act (NAGPRA) the remains of native peoples found on federal lands are to be returned to the most closely related group. When the Kennewick Man was first uncovered this led to controversy, as the extreme age of the remains made it difficult to determine which group he should belong to. This issue was exacerbated by the popular press when the initial analysis of the remains made reference to the description of 'Caucasoid features'(Burke, 2008, 27-37). This term was quickly misinterpreted in the popular media to mean Caucasian or white. As the confusion regarding the Kennewick Man's lineage spread and became national news, groups all over the country claimed the remains, including the Asatru Folk Assembly, a neo-

pagan organisation (Burke 2008). The controversy around the Kennewick Man's lineage persisted for twenty years and was only resolved in 2015 when aDNA analysis revealed the genetic link between the remains and local tribes, as well as links with a group in South America. While the remains were eventually reburied by the local tribes, the similarity in genetics meant that had a competing group chosen to do so, the claim could have been disputed (Anonymous 2016, 7). This episode exemplifies the complexity of human lineage, and the fact that genetic analysis can be a powerful tool to either resolve uncertainties or to create fertile ground for new disputes. While the perception of academics has always differed from the public to some degree, in the age of targeted advertising it is more important than ever to reinforce the notion that identity is a fluid concept in regards to the past, and that theories reflect the interests of the public and the researchers at present.

Clearly, the reaction in North America is indicative of a wider social phenomenon, and the reaction in the United Kingdom (UK) is also indicative of an opposite phenomenon. The tie between social identity and genetic past is often blurred in North America due to an emphasis on the 'melting pot' of American culture which initially sought to create a cohesive national identity (Stoll 2018, 11-17). The reactions in the USA to the Kennewick Man are in stark contrast to those in the UK regarding the 'Cheddar Man' because, in one case, genetic reconstruction solved the controversy surrounding the remains, and in the other, it was the cause of the controversy in the first place.

However, in Britain, where many people believe that their families have resided there for thousands of years, the idea that new data may suggest that one is descended from colonists or immigrants may provoke ire, even if those immigrants came thousands of years ago (Kumar 2003, 3-7). The benefit of aDNA reconstruction in the study of population migration is irrefutable but, like the exploitation of Kossinna's theories for German nationalist agendas, the overinterpretation of DNA data with regards to modern mythologies represents a danger. In the past three years genetic analysis has revealed that Kossinna's theories of Indo-European language spread have grounding in genetics (Bramanti et al. 2009, 137-140). Where the tools of genetic analysis brought clarity to the Kennewick Man case, a thorough genetic analysis of material remains has returned credibility to Kossinna's unpopular theories.

Past material culture, genetics, and intangible culture all inform the development of our identities as we perceive them today. Allowing for any one theory to have a major impact on individual or communal identity is potentially harmful, not just to the study of the human past, but to the relationship between those who interpret our past and the public's understanding of the present. The controversies that developed surrounding Kossinna's theories, the 'Cheddar Man', and the Kennewick Man represent a mismatch between the historical, archaeological, and genetic perspectives in academia and the public present surrounding identity.

This article has been edited by Triin Sulengo (International Editor) & Abigail Adams (Chief Regional Editor), peer reviewed by Stephanie Berke and Samantha Kichmann (Chief Peer Reviewer), copy edited by Evie Patel, Grace-Frances Doyle, Harriet Steele, Nicola Crowe and Ben Malcomson (Chief Copy Editor), checked and approved by the following executives: Robert Jacek Włodarski (Editor-in-Chief) and Emily Hall (Deputy Editor-in-Chief), and produced by James Hanton (Chief of Production).

Bibliography:

- Anonymous.** 2016. 'Lessons from the Ancient One'. *Nature*, vol. 533 (7601).
- Barras, Colin.** 2018. 'Ancient 'dark-skinned' Briton Cheddar Man find may not be true'. *New Scientist*.
- Brace, Diekmann., et al.** 2019. 'Ancient Genomes Indicate Population Replacement in Early Neolithic Britain'. *Nature Ecology & Evolution* 3(5), 765-771.
- Brandt, Guido., et al.** 2012. 'Ancient DNA Reveals Key Stages in the Formation of Central European Mitochondrial Genetic Diversity'. *Science*. 342 (6155), 257-261.
- Bramanti, Thomas., et al.** 2009. 'Genetic Discontinuity between Local Hunter-gatherers and Central Europe's First Farmers'. *Science*. 326 (5949), 137-140.
- Brown, T.A., Brown, Keri., and Wiley InterScience.** 2011. *Biomolecular Archaeology an Introduction*. Chichester: Wiley-Blackwell, 9-37.
- Burke, Heather., Smith, Claire., Lippert, Dorothy., Watkins, Joe., and Larry Zimmerman.** 2008. 'Kennewick Man: Perspectives on the Ancient One'. *Archaeology and Indigenous Peoples Series*. Walnut Creek, California: Left Coast Press, 27-37.
- Callaway, Ewen.** 2018. 'Divided by DNA: The uneasy relationship between archaeology and ancient genomics'. *Nature* 555 (7698). Gale Academic OneFile. Available at: https://link-gale-com.ezproxy.is.ed.ac.uk/apps/doc/A532684470/AONE?u=ed_itw&sid=AONE&xid=4c1aafbf. (Accessed 23rd February 2020).
- Collins, Tim.** 2018. 'Was Cheddar man white after all? There's no way to know that the first Briton had 'dark to black skin' says scientist who helped reconstruct his 10,000-year-old face'. *Daily Mail Online*. Available at <https://www.dailymail.co.uk/sciencetech/article-5453665/Was-Cheddar-man-white-all.html>. (Accessed 22nd February 2020).
- Cummings, Vicki.** 2017. *The Neolithic of Britain and Ireland. Routledge Archaeology of Northern Europe*. London: Routledge.
- Kumar, Krishan.** 2003. *The Making of English National Identity. Cambridge Cultural Social Studies*. Cambridge: Cambridge University Press.
- Larson, Greger; Umberto Albarella, Keith Dobney, Peter Rowley-Conwy, Jörg Schibler, Anne Tresset, Jean-Denis Vigne, Ceiridwen J. Edwards, Angela Schlumbaum, Alexandru Dinu, Adrian Bălăçescu, Gaynor Dolman, Antonio Tagliacozzo, Ninna Manaseryan, Preston Miracle, Louise Van Wijngaarden-Bakker, Marco Masseti, Daniel G. Bradley, and Alan Cooper.** "Ancient DNA, Pig Domestication, and the Spread of the Neolithic into Europe." *Proceedings of the National Academy of Sciences* 104, no. 39 (2007): 15276-15281.
- McCarter, Susan Foster.** 2007. *Neolithic*. New York; London: Routledge.
- Rutherford, Adam.** 2018. 'How Accurate Are Online DNA Tests?'. *Scientific American*. Available at: <https://www.scientificamerican.com/article/how-accurate-are-online-dna-tests/>. (Accessed 23rd February 2020).
- Sheridan, J.A.** 2010. 'The neolithization of Britain and Ireland: the big picture'. In B. Finlayson & G. Warren (eds) *Landscapes in Transition*. Oxford, Oxbow, 89-105.
- Stoll, David.** 2018. 'Rednecks, Norteños, and the Next American Melting Pot?' *Society* 55 (1), 11-17.
- Thomas, Julian.** 2013. 'The Neolithic Transition in Britain: A Critical Historiography'. In *The Birth of Neolithic Britain*: Chapter 5. Oxford University Press.
- Trigger, B.** 2006. *A History of Archaeological Thought*. Cambridge: Cambridge University Press, 235-242.
- Wallace, Douglas C.** "Why Do We Still Have a Maternally Inherited Mitochondrial DNA?" *Insights from Evolutionary Medicine*. 76, no. 1 (2007): 781-821.

Williams, Sloan R., Napoleon A. Chagnon, and Richard S. Spielman. "Nuclear and Mitochondrial Genetic Variation in the Yanomamö: A Test Case for Ancient DNA Studies of Prehistoric Populations." *American Journal of Physical Anthropology* 117, no. 3 (2002): 246-59.

Zeng, Xiangpei, David Warshauer, H. King, Jonathan Churchill, L. Chakraborty, and Jennifer Budowle. "Empirical Testing of a 23-AIMs Panel of SNPs for Ancestry Evaluations in Four Major US Populations." *International Journal of Legal Medicine* 130, no. 4 (2016): 891-96.