

Chapter 7: In Search of Native American Ancestors

Origins Stories

In this section, Reich gives us an overview of how and when the first humans arrived in the Americas. He begins by noting the relatively late arrival of humans to these continents, calling the period since first arrival the "... blink of an eye relative to the extraordinary length of human occupation of Africa and Eurasia. The reason for humans' late arrival to America lies in the geographical barriers that separate the continent from Eurasia: vast stretches of cold, harsh, and unproductive landscapes in Siberia, and oceans to the east and west. It took until the last ice age for Siberia's northeastern corner to be visited by people with the skills and technology needed to survive there at a time when sea levels were low enough for a land bridge to emerge in what is now the Bering Strait region, enabling them to walk across to Alaska."

"How were the Americas first peopled? Until two decades ago, the prevailing hypothesis was that the gates of the American Eden only opened after around thirteen thousand years ago. Evidence from plant and animal remains and the radiocarbon dating of glacial features indicate that by this time, the ice sheets had melted enough to allow a gap to open, and sufficient time had passed to allow the barren rocks, mud, and glacial runoff to give way to vegetation." This is the "ice-free corridor" hypothesis. "The migrants who passed through emerged into North America's Great Plains. Before them was a land filled with massive game that had never before met human hunters. Within **a thousand years**, the humans had reached Tierra del Fuego at the foot of South America, feasting on the bison, mammoths, and mastodons that roamed the landscape."

This hypothesis has a long history, dating back to 1590, but lacked a firm scientific footing. "Scientific evidence for humans in temperate America at the tail end of the last ice age came in the 1920s and 1930s, when archaeologists working at the sites of Folsom and Clovis, New Mexico, discovered artifacts and stone tools—including spear tips mixed in among the bones of extinct mammoths—that were effectively smoking guns proving a human presence. Clovis-style spear tips have since been found over hundreds of sites across North America, sometimes embedded in bison and mammoth skeletons. Their similar style over vast distances—contrasting with the regional variation in stone toolmaking styles of the cultures that followed—is what one might expect for an expansion that occurred fast (as the people were moving into a human vacuum). The available evidence suggests that the Clovis culture appeared in the archaeological record around the time of the geologically attested opening of the ice-free corridor, so everything seemed to fit. It seemed natural to think that people practicing the Clovis culture were the first humans south of the ice sheets, and were also the ancestors of all of today's Native Americans."

"This 'Clovis First' model, in which the makers of the Clovis culture emerged from the ice-free corridor and proceeded to people an empty continent, became the standard model of American prehistory." This model was so widely accepted that claims of pre-Clovis sites were dismissed out of hand.

"A major blow to the idea that Clovis groups were the first Americans came in 1997. That year marked the publication of the results of excavations at the site of Monte Verde in Chile, which contains butchered mastodon bones, wooden remains of structures, knotted string, ancient

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hearths, and stone tools with no stylistic similarities to the Clovis remains from North America. The radiocarbon dates of Monte Verde indicated that some of the artifacts there dated to around fourteen thousand years ago, definitively before the ice-free corridor had opened thousands of kilometers to the north.... acceptance of Monte Verde was followed by the acceptance of finds elsewhere that also pointed to a pre-ice-free corridor and a pre-Clovis human presence in the Americas. Nearly as strong a case for a pre-ice-free corridor occupation has been made at the Paisley Caves in Oregon in the northwestern United States...", also dated to fourteen thousand years ago.

Which leads to the question: "How could humans have gotten south of the ice sheets before the ice-free corridor was open? ...in the 1990s, geologists and archaeologists, reconstructing the timing of the ice retreat, realized that portions of the coast were ice-free after sixteen thousand years ago. There are no known archaeological sites along the coast from this period, as sea levels have risen more than a hundred meters since the ice age, submerging any archaeological sites that might have once hugged the shoreline. The absence of archaeological evidence for human occupation along the coast in this period is therefore not evidence that there was no such occupation in the past. If **the coastal route hypothesis** is right, humans could have walked at that time or later (but still in time to reach Monte Verde) along ice-free stretches of the coastline, possibly bypassing ice-covered sections with boats or rafts, and arriving south of the ice millennia before the interior ice-free corridor opened."

Reich next points to genetic evidence showing the "Clovis First" model is wrong. "In 2014, Eske Willerslev and his colleagues published whole-genome data from the remains of an infant excavated in Montana whose archaeological context assigned him to the Clovis culture and whose radiocarbon age was a bit after **thirteen thousand years ago**. Their analysis showed that this infant was definitely from the same ancestral population as many Native Americans, but his genetic data also showed that by the time he lived, a deep split among Native American populations had already developed. The remains from the Clovis infant were on one side of that split: the side that contributed the lion's share of ancestry to all Native American populations in Mesoamerica and South America today. The other side of the split includes Native American peoples who today live in eastern and central Canada. The only way this could have happened is if there had been a population that lived before Clovis and that gave rise to major Native American lineages."

Mistrust of Western Science

Reich now takes a detour into the basis for the distrust that Native Americans have toward Western science and scientists. This and the following section provide a lengthy and detailed look at this issue. I won't attempt to summarize all the instances, but will just highlight a few of the issues. He begins by noting that "... the last five hundred years have witnessed repeated cases in which people of European ancestry have **exploited the indigenous peoples** of the Americas using the toolkit of Western science. This has engendered distrust between some Native American groups and the scholarly community—a distrust that makes carrying out genetic studies challenging."

He relates the events that led to the mistrust of scientists by "the Karitiana of Amazonia" and "the Havasupai, who live in the canyonlands of the U.S. Southwest." News of these incidents spread widely, and in some cases lawsuits were filed.

"The hostility to genetic research has even entered into tribal law. In 2002, the Navajo—who along with many other Native American tribes are by treaty partly politically independent of the

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United States—passed a Moratorium on Genetic Research, forbidding participation of Navajo tribal members in genetic studies, whether of disease risk factors or population history.”

The moratorium became an issue for Reich’s research as well. He recounts how, in 2012, genetic data he had collected from colleagues was withdrawn from his study because of potential irregularities in getting consent for gathering the data.

Reich makes a plea for the research: “Scientists interested in studying genetic variation in Native American populations feel frustrated with this situation. I understand something of the devastation that the coming of Europeans and Africans to the Americas wrought on Native American populations, and its effects are also evident everywhere in the data I and my colleagues analyze.” But he notes that none of the studies or research on Native Americans resulted in harm to them. He goes on: “... there is an argument to be made that modern studies of DNA variation—not just in Native Americans, but also in many other groups... —are a force for good, contributing to the understanding and treatment of disease in these populations, and breaking down fixed ideas of race that have been used to justify discrimination. I wonder if the distrust that has emerged among some Native Americans might be, in the balance, doing Native Americans substantial harm. I wonder whether as a geneticist I have a responsibility to do more than just respect the wishes of those who do not wish to participate in genetic research, but instead should make a respectful but strong case for the value of such research.”

He elaborates on this issue of harm being done by withholding consent to participate in genetic research, highlighting the differences between individuals and tribal leaders. And he also notes the interest among some tribal leaders and researchers to get “community consent” for participation.

“My own perspective is that we need as a scientific community to arrive at a middle ground, an approach that does not require obtaining permission from every possible interested group or tribe. On the other hand, given the well-founded concerns of tribal communities in North America, which have developed as a result of a persistent history of exploitation, we scientists should aspire to carry out meaningful outreach when we study Native American population history to ensure that any manuscripts we write are sensitive to indigenous perspectives”

Disputes Over Bones

“Ancient DNA studies of population history are mostly not as fraught as studies of present-day people. However, in 1990, the U.S. Congress passed the Native American Graves Protection and Repatriation Act (NAGPRA), which requires institutions that receive U.S. funding to contact Native American tribes and offer to return cultural artifacts, including bones that are from groups to which Native Americans can prove a **biological or cultural connection**. This has meant that Native American remains are being returned to Native American tribes and the opportunity to carry out ancient DNA analysis on many of the samples is disappearing. NAGPRA has had its greatest impact on archaeological remains dating to within the last thousand years, for which a relatively strong case can be made for cultural connections with living Native American tribes.”

Reich goes on to provide a detailed account of the controversy surrounding “Kennewick Man” and a related incident concerning a 10,300 year old skeleton found on a island off the Pacific coast of Canada. He refers the genetic analysis of the ancient DNA in both cases as “wishful interpretation” of the genetic data. “These are just two examples of how the ancient DNA

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literature is beginning to fill up with unsubstantiated claims of direct ancestral links between ancient skeletons and groups living today, a problem that is not limited to the Americas. ”

He notes the difficulties researchers and museums are facing in doing research on the Native American history. “To navigate these competing interests and the law, many museums employ “NAGPRA officers” whose job it is to identify cultural and skeletal remains that can be associated with particular Native American tribes and to reach out to representatives of those tribes in order to return the items. ”

Finally, he describes the approach taken by Eske Willerslev to gain the cooperation of indigenous communities, and the goodwill his approach has generated. But he also notes the dismay of other researchers and museum staff to his operating outside the NAGPRA framework.

“I hope that as the consequences of the genome revolution are more broadly realized, indigenous people will increasingly recognize how DNA can become a tool to connect present-day Native American people to their roots and to each other. This will not solve all the concerns that Native American ethicists and community leaders have articulated, but it may serve to reduce antagonism and promote greater understanding and even collaboration in the future.”

The Genetic Evidence of the First Americans

Reich gets back to business by noting that the first genome-scale study of Native American populations was his lab's paper in 2012 that presented data on 52 diverse populations. But: “A major limitation of the study was that we had no samples at all from the lower forty-eight states of the United States because of anxieties about genetic research on Native Americans.”

“Most of the individuals we studied derived small fractions of their genomes from African or European ancestors in the last five hundred years, reflecting the profound upheavals that have occurred since the arrival of European colonists.” Reich wanted to include these populations in his study, so devised a “... technique that allowed us to identify which sections of people's genomes were of European or African origin. ...Masking out these sections of the genome helped us to peel back the history of five hundred years of admixture in the Americas to understand something about what the structure of Native American population relationships was like before European contact.”

“We compared all possible pairs of Native American populations using the Four Population Test. We used this test to evaluate whether Eurasian populations—for instance, Han Chinese—shared more genetic mutations with one Native American population or another, testing all possible pairs of populations. For forty-seven of the fifty-two populations, we could not detect differences in their relatedness to Asians. This suggested to us that the vast majority of Native Americans today, including all those from Mexico southward as well as populations from eastern Canada, **descend from a single common lineage**. (Five remaining populations, all from the Arctic or from the Pacific Northwest coast of Alaska and Canada, also had evidence of ancestry from different lineages.) Thus the extraordinary physical differences among Native American groups today are due to evolution since splitting from a common ancestral population, not to immigration from different sources in Eurasia. We called this common ancestral population the “**First Americans**.”

“We hypothesized that the “First American” lineage that we had characterized represented the descendants of the first people to spread south of the ice sheets, whether via an ice-free

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corridor or along a coastal route. Genomic studies so far have not been able to determine how small this group was or how many generations it wandered. But whatever happened, we were arguing that this was a pioneer population of limited size that moved into a human vacuum, expanding dramatically wherever it arrived.”

“The genetic data provide support for the correctness of this hypothesis in its broad outlines. As we applied the Four Population Test time and again, it became clear to us that the great majority of Native Americans, from populations in northern North America down to southern South America, can be broadly described as **branches of one tree**, forming a sharp contrast to patterns of population relationships in Eurasia. ...The most striking exception to this pattern was the less than thirteen-thousand-year-old infant associated with the Clovis culture who was found in Montana very close to the present-day Canadian border. The Clovis infant came from a lineage different from that of present-day inhabitants of neighboring Canada, reflecting major population movements that must have happened later.”

“In some places in the Americas, ancient DNA confirms the theory that populations have remained in the same region for thousands of years.”

The Genomic Rehabilitation of Joseph Greenberg

Reich next points out that this genetic discovery explains the “... extraordinary diversity of Native American languages.”

“Linguists can be divided into “splitters,” who emphasize differences among languages, and “lumpers,” who emphasize their common roots. One of the most extreme splitters was Lyle Campbell, who divided about one thousand Native American languages into about two hundred families (groups of related languages), sometimes even localized to particular river valleys. One of the most extreme lumpers was Joseph Greenberg, who argued that he could group all Native American languages into just three families, the deep connections of which he could trace. He argued that these three families reflected three great waves of migration from Asia.”

The two linguists frequently clashed. But Reich notes that “... two of the language families are indisputable: Eskimo-Aleut languages spoken by many of the indigenous peoples of Siberia, Alaska, northern Canada, and Greenland, and Na-Dene languages spoken by a subset of the Native American tribes living on the Pacific coast of northern North America, in the interior of northern Canada, and in the southwestern United States.”

“But it was Greenberg’s third family, “Amerind,” which he claimed includes about 90 percent of the languages of Native Americans, that so many linguists found objectionable. The method that Greenberg used to propose Amerind was to study several hundred words across different Native American languages and to score them according to the extent to which they were shared. By finding high rates of sharing, he claimed evidence for common origin. As he saw it, **proto-Amerind was spoken by the first Americans** south of the ice sheets.” Thus, “... the language data supported a theory of three great waves of Native American dispersal from Asia. If there had been another wave, it would have left another distinct set of languages.”

Reich describes some of the criticism Greenberg’s ideas received. “But Greenberg got something right. His category of Amerind corresponds almost exactly to the First American category found by genetics. The clusters of populations that he predicted to be most closely related based on language were in fact verified by the genetic patterns in populations for which

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data are available. And the present-day balkanization of Native American languages also reflects a history in which the great majority of populations descend from **a single migratory spread**. Anyone looking at a language map of the Americas can see that its appearance is qualitatively different from that of Eurasia or Africa, with dozens of language families restricted to small territories, compared to the vast swaths of territory in Eurasia and Africa inhabited by people who speak closely related tongues in the Indo-European, Austronesian, Sino-Tibetan, and Bantu language families, each of which reflects a history of mass migrations and population replacements. The First American expansion seems to have been so fast that the languages of the continent are related by a rake-like structure with many tines extending in parallel to a common root that dates close to the time of the early settlement of the Americas. So both the genetic and linguistic evidence support a scenario in which many of the present-day Native American populations are direct descendants of populations that plausibly lived in the same region shortly after the first peopling of the continent. This suggests that after the initial dispersal, population replacement was more infrequent in the Americas than it was in Africa and Eurasia.”

But Reich thinks Greenberg missed something important: “Although Eskimo-Aleut and Na-Dene speakers are genetically distinguishable from other Native Americans because they carry ancestry from distinct streams of migration from Asia, both have large amounts of First American ancestry: around a 60 percent mixture proportion in the case of the Eskimo-Aleut speakers we studied, and around a 90 percent proportion in the case of some Na-Dene speakers. So while Greenberg’s three predicted language groups correlate well with three ancient populations, First Americans have made a **dominant demographic contribution** to all present-day indigenous peoples in the Americas.”

Population Y

Another surprise in the genomes of Native Americans: “Some physical anthropologists studying the shapes of human skeletons had for years been asserting that there are some American skeletons, dating to before ten thousand years ago, that do not look like what one would expect for the ancestors of today’s Native Americans.” They looked like indigenous peoples from Australia and New Guinea. Were there peoples in America before the arrival of the First Americans?

This led Pontus Skoglund in Reich’s lab to look more deeply at Native American genomes, looking for ancestry different from First Americans. He reasoned: “If there were ancient people on the continent who were displaced by First Americans, they may have mixed with the ancestors of present-day populations, leaving some statistical signal in the genomes of people living today.”

“He found two Native American populations, both from the Amazon region of Brazil, that are more closely related to Australasians than to other world populations. ... [he also] found weaker signals of genetic affinity to Australasians, but still probably real, in other Native American populations ringing the Amazon basin. He estimated that the proportion of ancient ancestry in these populations was small — 1 to 6 percent — with the rest being consistent with First American ancestry.”

While initially skeptical, and after ruling out other explanations, Reich and Skoglund concluded: “It really looked like evidence of a migration into the Americas of an ancient population more closely related to Australians, New Guineans, and Andamanese than to present-day Siberians. We concluded that we had found evidence of a **“ghost” population**: a population that no

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longer exists in unmixed form. We called this “Population Y” after the word *ypykuéra*, meaning “ancestor” in Tupí, the language family of the populations with the largest proportions of this ancestry.”

They found two Tupi-speaking populations: “The Tupí-speaking population in which we found the most Population Y ancestry was the Suruí...” “Another group belonging to the Tupí language family in which we found Population Y ancestry is the Karitiana.”

“The third population in which we found substantial Population Y ancestry is the Xavante, who speak a language of the Ge group, which is different from the Tupí language group spoken by the Suruí and Karitiana.”

“The Population Y geographic distribution is largely limited to Amazonia, providing yet more evidence for an ancient origin. The fact that Population Y ancestry is restricted to difficult terrain far from the Bering link to Asia is perhaps what one would expect from an original pioneering population that was once more broadly distributed and was then marginalized by the expansion of other groups. This pattern mirrors the distribution of some other language families—for example, the Tuu, Kx’a, and Khoe-Kwadi languages spoken by the Khoe and San in southern Africa—where islands of these speakers in rugged terrain are surrounded by seas of people speaking other languages.”

“What, then, does the genetic pattern mean? We already know from archaeology that humans probably arrived south of the ice sheets before the opening of the ice-free corridor, leaving remains at archaeological sites including Monte Verde and the Paisley Caves. But the big population explosion, marked by the Clovis people, only occurred once the ice-free corridor had opened. The genetic data could be giving evidence of early peopling of the Americas by a minimum of two very different groups moving in from Asia, perhaps along two different routes and at different times. If Population Y spread through parts of South America before the First Americans, then it seems likely that after this initial peopling, the First Americans advanced into nearly all of the territories the Population Y people had already visited, **replacing** them either completely or only partially, as in Amazonia. Population Y ancestry may have survived better in Amazonia than it did elsewhere because of the relative impenetrability of the Amazonian environment. This could have slowed down the movement of First Americans into the region enough to allow people living there to mix with the new migrants rather than simply being replaced.”

“Our estimate of around 2 percent Population Y ancestry in the Suruí is based on the assumption that Population Y traversed the entirety of Northeast Asia and America without mixing with other people it encountered. If we allow for the likelihood that there was mixture with populations related to First Americans on the way, the proportion of Population Y in the Suruí could be as high as 85 percent and still produce the observed statistical evidence of relatedness to Australasians. If the true proportion is even a fraction of this, then the story of First Americans expanding into virgin territory is profoundly misleading. Instead, we need to think in terms of an expansion of a highly substructured founding population of the Americas. The history and timing of the arrival of Population Y in the Americas is likely to be resolved only with recovery of ancient DNA from skeletons with Population Y ancestry.”

After the First Americans

Reich now turns his attention to “... what genetic data has to say about more recent times and how populations got to be the way they are today.”

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He uses as an example "... the origin of speakers of Na-Dene languages, who live along the Pacific coast of North America, in parts of northern Canada, and as far south as Arizona in the United States. The overwhelming consensus among linguists is that these languages stem from an ancestral language no more than a few thousand years old, and that their dispersal over this vast range in northwestern America must have been driven at least in part by migrations. In an astonishing development in 2008, the American linguist Edward Vajda documented a deeper connection between Na-Dene languages and a language family of central Siberia called Yeniseian, once spoken by many populations, though today only the Ket language of the Yeniseian family is still used on a day-to-day basis. These results suggest that despite the enormous distance, a relatively recent migration from Asia gave rise to Na-Dene speakers in the Americas."

Looking at genetic data: "Our 2012 study found that the Na-Dene-speaking Chipewyan carry a type of ancestry not shared with many other Native Americans, providing evidence for the later Asian migration theory. We estimated that this ancestry constituted only around 10 percent of Chipewyan ancestry, but it was striking all the same. We wondered whether we could use this distinctive strain of ancestry in the Chipewyans as a tracer dye to document an ancestral link between Na-Dene speakers like Chipewyans and individuals from past archaeological cultures who could be studied with ancient DNA."

Reich backtracks to a study by Willerslev's team in 2010 that hypothesized the existence of a population they called "Paleo-Eskimos". "All these individuals were broadly related, and the authors argued that they represented a distinct migration from Asia that was different from all prior and subsequent ones. They argued that the Paleo-Eskimos largely went extinct without leaving descendants after the arrival of Eskimo-Aleut speakers around fifteen hundred years ago."

Reich's 2012 study contradicted this finding: "... we found no statistical evidence for a distinct migration. Instead, our tests were consistent with the possibility that the Saqqaq derived their ancestry from the same source that contributed to the Na-Dene-speaking Chipewyans, just in different proportions. Since we know from genetic data that only around 10 percent of the ancestry of many Na-Dene speakers today is from this late Asian migration, it is easy to understand why the clustering analysis used by Willerslev's team missed the connection to Na-Dene speakers. We proposed that the Na-Dene and Saqqaq might both derive part of their ancestry from the same ancient migration from Asia to the Americas."

"In 2017, Pavel Flegontov, Stephan Schiffels, and I confirmed that the Paleo-Eskimo lineage did not die out, and instead lives on in the Na-Dene. By examining rare mutations that reflect recent sharing between diverse Native American and Siberian populations, we found evidence for recent common ancestors between the ancient Saqqaq individual and present-day Na-Dene. In fact, the hypothesis that Paleo-Eskimo lineages went extinct after the arrival of Eskimo-Aleut speakers is even more profoundly wrong than I had originally suggested in my 2012 paper. The correct way to view the ancestry of present-day speakers of Eskimo-Aleut languages is as a mixture of lineages related to Paleo-Eskimos and First Americans. In other words, far from being extinct, the population that included Paleo-Eskimos lives on in mixed form not just in Na-Dene speakers, but also in Eskimo-Aleut speakers."

"Our 2017 work also revealed an entirely new and unifying way to view the deep ancestry of the peoples of the Americas. In this new vision, there were just two ancestral lineages that contributed all Native American ancestry apart from that in Population Y: the First Americans and the population that brought new small stone tools and the first archery equipment to the Americas around five thousand years ago and founded the Paleo-Eskimos. We could show this because, mathematically, we can fit a model to the data in which all Native Americans

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excluding Amazonians with their Population Y ancestry can be described as mixtures of two ancestral populations related differentially to Asians. Mixtures of these two ancestral populations produced the three source populations that migrated from Asia to America and that are associated with Eskimo-Aleut languages, Na-Dene, and all other languages”

“A second genetic revelation about Native American population history is clearest in the Chukchi, a population of far northeastern Siberia that speaks a language unrelated to any spoken in the Americas. My analyses revealed that the Chukchi harbor around 40 percent First American ancestry due to **backflow** from America to Asia.” Reich explores and rejects the idea that the Chukchi are the closest cousins of the First Americans in Asia. “... the genetic data clarify that the affinity is due to back-migration, as the Chukchi are more closely related to some populations of entirely First American ancestry than to others, a finding that can only be explained if a sublineage of First Americans that originated well after the initial diversification of First American lineages in North America **migrated back** to Asia. The explanation for this observation is that the Eskimo-Aleut speakers who established themselves in North America mixed heavily with local Native Americans (who contributed about half their ancestry) and then took their successful way of life back through the Arctic with them to Siberia, contributing not only to the Chukchi but also to local speakers of Eskimo-Aleut languages.”

“A third example of what genetics can offer is the story of the arrival of agriculture to the U.S. Southwest from northern Mexico” Reich describes the controversy among researchers as to whether the flow of population was from north to south or, vice versa, south to north. The theories are based on linguistic analyses. No ancient DNA data is currently available, but Reich thinks gathering such data would settle the issue. “Studying the ancient DNA of people who lived before and after the arrival of maize in the region, along with comparison to the present-day inhabitants, can test this theory [the south to north theory] at least in part. We are beginning to find some clues in ancient DNA.... It will only be a matter of time before we are able to test whether new peoples moved with the new crops.”

Reich sums up: “The dream, of course, is to carry out studies like these more systematically. Modern genetic studies and ancient DNA enable us to discover how Native American cultures are connected by links of migration, and how the spread of languages and technologies corresponded to ancient population movements. Many of these stories have been lost because of the European exploitation that has decimated Native American populations and their culture. Genetics offers the opportunity to rediscover lost stories, and has the potential to promote not just understanding but also healing.”