Article

S|S|S

Social Studies of Science
43(4) 509–533

DOI: 10.1177/0306312713483893
sss.sagepub.com
SAGE

Genomic articulations of indigeneity

Kim TallBear
Department of Environmental Science, Policy, and Management, University of California, Berkeley, Berkeley, CA, USA; Department of Anthropology, University of Texas at Austin, Austin, TX, USA

Abstract
Indigenous peoples' and genome scientists' respective definitions and practices of making 'indigeneity' illustrate their competing notions of identity, origins, and futures. This article explores these genomic and indigenous 'articulations' of indigeneity, both their similarities and profound differences. Scientists who study ancient global human migrations and human genome diversity draw on an understanding of 'indigeneity' that appears to overlap with, but fundamentally contradicts, the use of this concept by the global indigenous movement. Genomic articulations privilege genetic ancestry as defining indigenous 'populations'. In contrast, indigenous articulations of indigeneity emphasize political status and biological and cultural kinship constituted in dynamic, long-standing relations with each other and with living landscapes. To demonstrate how differences in definitions matter, I draw examples from several scientific and indigenous projects that entangle DNA knowledge with judgments about indigenous identities, and I note resulting policy implications. I first examine two key narratives of indigeneity and race that underlie the genomic articulation of indigeneity: 'indigenous peoples are vanishing' and 'we are all related/all African'. I then explore two cases where genomic and indigenous articulations clash and overlap – the 'Kennewick Man' case and the use of DNA testing for tribal enrollment. Yet genomic articulations, with their greater truth-governing power, may inadvertently reconfigure indigeneity in ways that can undermine tribal and First Nations' self-determination and the global indigenous anticolonial movement. Indeed, some indigenous peoples have recently adopted genomic articulations of identity, perhaps to their own detriment.

Keywords
indigenous peoples, Native Americans, race and genetics, tribal DNA testing

Narratives of history and identity that draw on new genomic technologies have gained much traction in the last two decades (Keller, 1995, 2002; Nelkin and Lindee, 1995;

Corresponding author:
Kim TallBear, Department of Environmental Science, Policy, and Management, University of California, Berkeley, 130 Mulford Hall, #3114, Berkeley, CA 94720, USA.
Email: kimberly.tallbear@berkeley.edu

Roof, 2007; TallBear, 2007). This genomic articulation of identity is informed by concepts such as continent-level 'founding populations', 'genetic ancestry', and 'admixture' that privilege molecular sequences tracked across continents. Tracing evolutionary relationships and frequency differences between genetic markers in populations – tracing their relatedness – goes hand-in-hand with tracing the movements and the presence of those humans in certain geographic locations. Molecular ancestry inhered in human bodies is the goal of population geneticists, molecular anthropologists and evolutionary biologists, a cluster dubbed 'gene hunters' in a popular science documentary series (Lent, 2000). That ancestry is seen as increasingly diluted with 'admixture', defined as genetic exchanges between human populations that evolved separately in different regions after earlier fissions within the human species (Cavalli-Sforza et al., 1994: 25, 28). Groups now known as 'indigenous' have been a particular focus of this field of research since its emergence in the mid-20th century (Radin, 2013). The blood of indigenous peoples, understood as storehouses of unique genetic diversity due to their presumed long physical and cultural isolation, is highly sought after, and to be collected quickly. Genetically defined, indigenous peoples are seen to be vanishing in an increasingly global world (Human Genome Diversity Project (HGDP), 1992a, 1992b, cited in Reardon, 2005).

Indigenous peoples themselves also privilege biological connection to ancestors (alongside connection to land), but they have evolved a more multifaceted definition of 'indigenous' that entangles political self-determination and mutual networking for survival in a global world. Indeed, rather than vanishing, the number of people who define themselves as indigenous worldwide is growing. This is not only about birthrates but also about the generative power of the category (De la Cadena and Starn, 2007; Indian and Native American Employment and Training Coalition Special Report, 2004; Ogunwole, 2006; Thornton, 1987, 1997). In many countries, peoples identifying as indigenous have increased in number in recent decades, as greater numbers claim that identity category because it captures their social relationships to place, to settler or more powerful states, and to one another. For them, indigeneity is much more complex than biological relations alone. In addition, for indigenous peoples, location is not simply an aid to tracking the movements of human bodies and relationships of markers. Rather, indigenous peoples understand themselves to have emerged as coherent groups and cultures in intimate relationship with particular places, especially living and sacred landscapes. In short, indigenous peoples' 'ancestry' is not simply genetic ancestry evidenced in 'populations' but biological, cultural, and political groupings constituted in dynamic, long-standing relationships with each other and with living landscapes that define their people-specific identities and, more broadly, their indigeneity.

In arenas in which both indigenous people and scientists are invested, scientific activities are often granted exclusive jurisdiction over knowledge production, with indigenous contributions and critiques understood as 'political' superstructure. States are often more amenable to the particular historical truths articulated by genome science than they are to indigenous historical truths. Thus, when in conflict, states have tended to privilege genome knowledge claims over indigenous knowledge claims (see discussion of Kennewick Man in the following). There are also early signs that indigenous governance bodies are incorporating genomic definitions of bodies into their own

definitions of belonging and citizenship, a move I will argue is to their and our detriment as indigenous peoples.

To explore the particularities of overlapping contexts that draw on and affect definitions of indigeneity, I draw examples from several scientific and indigenous projects that entangle DNA knowledge with judgments about indigenous identities and their resulting policy implications. After first presenting my use of 'articulation' and what I mean by an indigenous articulation of indigeneity, this article turns to genomic articulations of indigeneity and critically interrogates their assumptions and effects. The subsequent section focuses on cases where indigenous peoples have been forced or have chosen to interact with genomic science, in the 'Kennewick Man' controversy concerning ancient human remains and in the domain of DNA testing for tribal enrollment. In each of these cases, I argue that the work of *both* scientists and indigenous peoples is simultaneously generative of knowledge and of politics. Viewing the work that scientists and indigenous people do in the world as a contest between science and culture, or science and politics, is misleading. Instead, we need to take a coproductionist approach (Jasanoff, 2004), recognizing how genomics has the effect of producing forms of indigeneity that partake of a certain kind of politics, politics that might serve genome scientists better than they do indigenous people.

The cases I draw from are all rooted in US-based scientific, federal, and tribal government institutions and histories on this 'North American' continent where I live and work as a social scientist and humanist, an indigenous scholar – a Dakota – who crosses the fields of indigenous studies, science and technology studies, and anthropology. Yet these projects also entangle globalized knowledges and discourses of human history and biology. Likewise, evolving concepts of global indigeneity intersect with issues deep in the heart of US tribal lands and institutions. 'Indigenous', a late 20th-century construction (De la Cadena and Starn, 2007; Niezen, 2003; Wilmer, 1993), helps facilitate networking and mutual recognition between peoples from across the globe, even while the category intersects with different regimes of race, ethnicity, and class in different parts of the world (Baviskar, 2007; De la Cadena and Starn, 2007; Gibbon et al., 2011; Li, 2000; Niezen, 2003; Nyamnjoh, 2007; Schein, 2007; Tsing, 2007; Yeh, 2007). Indigeneity also intersects different state–indigenous relationships. Before the rise of global indigeneity, 'First peoples' in the United States were already organized into political–cultural entities that we call tribes, or sometimes tribal nations, with federal recognition critical to tribal self-governance. In Canada, 'First Nation' is the term that prevails.[1] Thus, both genomic and indigenous knowledges, networks, and politics are rooted locally yet simultaneously routed globally in 'complex histories of dwelling and traveling' (Clifford, 1997: 2; Gibbon et al., 2011; Lindee and Santos, 2012). That is, neither genomics nor indigeneity is simply locked into particular contexts or formations. Both may have 'roots' in particular places, but as they travel, they get translated to do work in new contexts.

Articulation

In order to clarify the conjunctures and distances between genomic and indigenous peoples' definitions of 'indigenous', I import the analytic concept and metaphor of 'articulation' from cultural studies and sociocultural anthropology (Clifford, 2001, 2003;

Grossberg, 1986; Hall, 1986; Tsing, 2007; Yeh, 2007). Articulation is often described with reference to the articulated lorry, a cab, and trailer that are hooked together but potentially unhooked and recombined with other cabs and trailers anew. Thus, articulation helps us to understand how previously disparate elements are conjoined into new cultural and social formations in acts of borrowing, interpretation, and reconfiguration. It takes us beyond dichotomous, 'realist versus constructionist' views of indigeneity in which the category is either essentially determined, primordial and static, or 'constructed' and therefore artificial. James Clifford (2001) explains that

> in articulation theory, the whole question of authenticity is secondary, and the process of social and cultural persistence is political all the way back. This does not negate 'realness'. It is assumed that cultural forms will always be made, unmade, and remade. (p. 479)

Some critical theorists and indigenous people might consider me too generous in using articulation theory to analyze genomic knowledge practices that indigenous critics have deemed 'biocolonial'. Human genome diversity research has been said to extract biological resources from indigenous peoples' bodies – much as indigenous land and cultural properties were appropriated in earlier centuries – for the economic, intellectual, and national identity benefits they would provide to colonizing states (Indigenous Peoples Council on Biocolonialism (IPCB), 2000; Marks, 2005; Mataatua Declaration, 2007; Mead, 1996; Mead and Ratuva, 2007; Reardon and TallBear, 2012; Tsosie, 2005). When I apply the theory of articulation to human genome diversity research, I am reading those scientific practices as not necessarily inauthentic or illegitimate but as robustly reconfiguring indigeneity in ways that – even without exploitative intent – can undermine tribal and First Nations' self-determination and the global indigenous anticolonial movement. Some genome scientists note that they have no desire to explicitly challenge indigenous peoples' own articulations of their origins (Wells and Schurr, 2009). Yet their science reiterates genomic concepts of identity and history that oppose most indigenous peoples' own articulations.

The scientific cosmology – or worldview at work – of one global human history and set of migrations contrasts with a view of time bifurcated into a colonial 'before-and-after' that structures indigenous peoples' views of history. When genome scientists make claims to indigenous biological resources according to their own continuous, global worldview, this challenges indigenous peoples' own anticolonial, anti-assimilationist views and their efforts to control their biological and other resources. An important example I will explore is the use of DNA testing in tribal enrollment decisions. While indigenous peoples in the United States have been slower than many US Americans to make the transition from blood to DNA discourses in our identity-making practices (Nelkin and Lindee, 1995; TallBear, 2013), the use of DNA tests for tribal enrollment is emerging (Bardill, 2010; TallBear, 2008). The genomic articulation of indigeneity may be becoming part of an *indigenous* articulation of indigeneity, informing understandings of indigeneity and belonging (or not belonging) to particular places and indigenous peoples' own expressions of their history, identity, and citizenship.

Articulation brings re-conjoined formations into view, helping us see better the cultural and political work that genetic scientists and indigenous peoples perform. However,

this work of articulation takes place within the context of highly unequal power relations. Beyond highlighting dynamism in cultural practice, the articulation concept highlights the role of power in establishing and validating new cultural formations. Who has power to get others to buy into their representations and definitions? Who has the institutional, legal, and intellectual authority to determine who or what counts as 'indigenous'? Not every articulation will be accepted as legitimate. For example, some groups in the United States are denied their requests for government recognition *as tribes* because they are not successful in getting the federal government – the party with meaningful authority and money – to accept their articulation of themselves as such.[2] Federal authorities look for cultural and political 'continuity' in groups claiming to be Native American tribes, drawing on anthropologists, legal specialists, historians, and other recognized scientific experts to testify for or against that continuity (McCulloch and Wilkins, 1995). Those who exhibit practices, organizational structures, and phenotypes that fit with expectations of cultural and social stasis are more likely to receive recognition, while those with characteristics that contradict expectations are denied recognition and status (Clifford, 1988; McCulloch and Wilkins, 1995). The fact that nongenomic anthropological knowledges are already privileged in US federal decisions about recognition of Native American rights and resources paves the way for (anthropological) genetics to eventually be used as well in these contexts. Genomic articulations of indigeneity have the potential to recapitulate and strengthen the parameters laid out by these existing formations, profoundly effecting indigenous peoples' lives.

Indigenous articulations of indigeneity: Generativity, origins in place, and opposition

In order to understand the potential impact of a genomic articulation of indigeneity, we must first understand how the category has been defined through practice and discourse by those engaged in indigenous social movements, as observed by scholars. The international indigenous movement gained momentum in the 1970s and 1980s (Niezen, 2003; Wilmer, 1993), and many international and US domestic nongovernmental organizations (NGOs) and other groups have since organized under its rubric.[3] Today, worldwide estimates claim that 250 to 600 million individuals belong to over 4000 'indigenous' groups (De la Cadena and Starn, 2007; Durning, 1992; Goering, 1993; Niezen, 2003; World Bank, 1991).

This would have seemed highly improbable at the end of the 19th century, when scholars, policy-makers, and writers widely predicted the demise of native societies – of the 'Indian', 'Aboriginal', or 'savage'. The idea that such groups represented earlier stages in human evolution was generally agreed upon by the 19th-century European and American thinkers, whether the author was eager for or lamented their inevitable demise in the face of Western progress (Berkhofer, 1979; Bieder, 1986; Dippie, 1991; Morgan, (1877) [1909]).) Indigenous articulations of indigeneity stand in contrast to scientific articulations predicated on the imminent vanishing of indigenous peoples. This is the myth of the 'vanishing Indian' (Berkhofer, 1979; Dippie, 1991), or as I call it in 21st century parlance, the 'vanishing indigene'. This extinction was and continues to be

figured in biological terms, but is also expressed culturally and socially, as I will discuss.

Estimates of indigenous people worldwide are, of course, contingent upon how they are classified. Common definitions focus on historical continuity with precolonial societies and ancestral territories, cultural distinctiveness from settler societies, economic and cultural nondominance, and determination to persist as culturally and/or nationally distinct entities (Anaya, 2000; Cobo, 1986). Indigenous studies scholars Taiaiake Alfred (Kahnawake Mohawk) and Jeff Corntassel (Cherokee) define indigeneity accordingly as an 'oppositional, place-based existence, along with the consciousness of being in struggle against the dispossessing and demeaning fact of colonization by foreign peoples' (Alfred and Corntassel, 2005: 597). Similarly, preeminent Native American Studies scholar and Dakota, Elizabeth Cook-Lynn, defines indigeneity as not simply

> a political system based in economics and the hope for a fair playing field. Nor is it a belief system like religion. It is, rather, a category of being and origin and geography, useful for refuting other theories of being and origin (e.g. those of Christianity and science).

'Today', she concludes, 'indigeneity may be thought of as the strongest focus for resistance to imperial control in colonial societies …' Furthermore, she argues, indigenous peoples as a class are 'expanding rather than vanishing or diminishing' (Cook-Lynn, 2012: 15). One can see that expansion as both an artifact of greater numbers of births over deaths, and as reflecting additional people newly articulating their identities as indigenous.

In the volume *Indigenous Experience Today*, anthropologist Mary Louise Pratt (2007) explains indigeneity as generative or productive, as enabling mutual recognition and collaboration by indigenous peoples across disparate histories and geographies, thus contributing to the rise in numbers of indigenous peoples (p. 399). This ability to recognize one another certainly enables the anti-imperial work that is Cook-Lynn's focus and another form of productivity. Therefore, indigenous peoples generally embrace a global definition of indigeneity that facilitates survival and acknowledges the historical rupture of colonialism. Pratt notes the etymological roots of terms such as indigenous, native, aboriginal, and First Nations all refer to 'prior-ity in time and place', denoting 'those who were "here (or there) first," that is, before someone else who came "after"'.

Yet a relational definition predicated upon invasion – indeed that prioritizes the temporality of the invaders – is often not the primary identity of such peoples, but rather they may be 'Maori, Cree, Hmong, Aymara, [or] Dayak' (Pratt, 2007: 398–399). I offer a small addition to Pratt's helpful definition. It is not simply firstness in relation to the temporality of settlers that grounds indigenous peoples' identities *in place*. They narrate their peoplehoods as emerging in concert with particular land- and/or waterscapes. They were not simply first but they arose *as peoples, as humans* in relationships with particular places (Deloria, 2001; Mead, 1996). This is an important difference between the way that indigenous peoples wield the idea of 'origins' and the way that human genetics does; in the latter case, landscapes are places *through* which humans and their molecules move and *settle*. An environment/human divide is presumed in the genomic narrative that is absent from the indigenous narrative. Indigenous notions of *peoplehood* as emerging *in*

relation with particular lands and waters and their nonhuman actors differ from the concept of a genetic *population*, defined as moving *upon* or *through* landscapes.

Indigenous articulations of indigeneity challenge colonial conceptions that bind indigeneity to cultural stasis and economic deprivation. Such articulations can limit efforts by indigenous peoples to build their autonomy and control resources in order to resist the assimilationist state. Jessica Cattelino (2008, 2010) writes about the Seminole Nation of Florida, a successful contemporary gaming tribe, and the predicament caused for the category of indigeneity by wealth generated in high-stakes gambling. Cattelino (2010) explains the 'double bind that faces indigenous peoples in the Anglophone settler states' in which tribal nations, as other polities,

> require economic resources to exercise sovereignty, and their revenues often derive from their governmental rights; however, once they exercise economic power, the legitimacy of tribal sovereignty and citizenship is challenged in law, public culture, and everyday interactions within settler society. (pp. 235–236)

Longtime director of the American Indian Law Center, Sam Deloria (2002), illustrates Cattelino's concept of the 'double bind' as he points out the (double) standard to which indigenous groups – tribal nations – in the United States are subject as the category of indigeneity gets legitimated according to political, cultural, and economic criteria:

> Nobody visits Liechtenstein periodically to make sure they are sufficiently poor and sufficiently culturally distinct from their neighbors to merit continued political existence. They're just around. So when we're waxing eloquent about … cultural sovereignty and all other kinds of sovereignty, be damned careful that we're not saying to this society, 'In exchange for a continued political existence, we promise to maintain some kind of cultural purity', because you think it's going to be by our standards. Hell no … it's going to be by THEIR standards. (pp. 58–59)

And 'THEY', Deloria continues, 'see culture as static'. Elsewhere, Deloria asks if the 'concept of indigenous peoples' engenders in us 'an obligation to the rest of the world to stay in the jungle … To the degree that our right to exist is based on *cultural difference*, we're making that bargain' (Genomics, Governance, and Indigenous Peoples, 2008). He notes that concepts of cultural distinctiveness and economic status (i.e. poverty) overlap in dominant views of indigeneity. Deloria calls attention to how we are testing the robustness of this category in the United States as economic changes in Indian Country unbraid these multiple threads of distinctiveness – political (i.e. jurisdictional or tribal nation status), cultural, and economic. 'If you took two of those away [i.e. cultural and economic distinctiveness]', Deloria asks, 'do you still have a right to exist?' Speaking of another prominent gaming tribe, he explains that 'Indians who are not identifiable to non-Indians as being culturally [and phenotypically] distinct, and who are rich, still asserting a right to a distinct political existence, are on very tenuous grounds' (Genomics, Governance, and Indigenous Peoples, 2008).

Although some scientists and indigenous peoples claim that genomic articulations can be used to address colonial histories and empower indigenous peoples, such claims are challenged by the cases outlined below, where genomic articulations of indigeneity

seamlessly contribute to and strengthen colonial conceptions, while potentially weakening indigenous articulations.

A genomic articulation of indigeneity: Molecular origins, disappearance, and relatedness

Formations of indigeneity, like formations of race (Omi and Winant, 1994), are explicitly political, historically situated, and contingent. When genomic knowledge enters the picture, formations of indigeneity are (re)articulated, a conjoining of old and new concepts. I focus here on intersecting notions of indigeneity in the English-speaking indigenous and human genome research worlds. Genomic indigeneity is an articulation that focuses on biological descent and relations between groups across time and space. Within this articulation, an indigenous group becomes a biological-based or population-based category in which individuals from different 'tribes' or 'peoples' are sampled in order to build knowledge about broader population histories. What unites indigenous peoples globally, from a genomic perspective, is not opposition to colonialism or autochthonous cosmology, but relatively straightforward genetic descent from founder populations on particular continents. The biogeographic notion of indigeneity evokes older and persisting ideas of race, for example, a 'Native American *race*', with 'origins' in the American continents. But biogeographic indigeneity does not account for human–landscape *social* relations in the same way that indigenous people's own place-based identities do. Genomic ideas of indigeneity are founded in the expectation of inevitable disappearance. In other words, indigenous characteristics are valuable precisely because indigenous peoples are seen as disappearing.

Such a definition of indigeneity overlooks concepts of indigenous self-determination and colonial opposition that undergird indigenous peoples' own articulations of indigenousness. Genetic articulations of indigeneity recognize indigenous *difference from* the invading states as an organizing principle and therefore focus on less 'admixed' populations that are usually tied physically to a land base and presumed to be culturally and biologically separate and distinct. Such formations cannot account for *resistance to* the state and indigenous attempts to survive and flourish that underpin contemporary indigeneity. For example, they overlook the way that 'indigenous' is used by indigenous peoples to highlight their relations to original peoples from around the world, united not by racial similarity but by colonial historical similarities and a common cause against settler and other forms of colonialism. This is the reason that 'indigenous' has come to rank with Dakota or Dayak in self-definitions. In the 21st century, the global indigenous movement and narratives are precisely about indigenous peoples' survival and their will not only to survive but also to thrive. Indigeneity recast as genetic becomes a discourse of scarcity and death, rather than what it is an indigenous social movement, a discourse of survival.

The questions at the heart of research into human genetic diversity reach far beyond genetics: Who in the world is related to whom? How far back in human history do they share ancestors? Where did those ancestors come from? In which directions did they travel? and Who were the founding populations? Powerful narratives, including the two I explore here, are employed to configure these questions as genetic questions and to

recast indigeneity as a genetic category that offers answers. Ancient and contemporary genetic populations and genetic forebears are named for the purpose of genomic study with reference to modern geopolitical, continental, ethnic, and racial labels, suggesting other things at play besides the presence or absence, order, and frequency of molecules. Glancing over just a few important research articles on human migrations, molecular anthropology, and human genetic diversity, the following categories jump out (typed exactly as they appear): Archaic Canada, Aleut-Eskimo, Inuit, Chinese, Japanese, and Bering Sea Mongoloids (Greenberg et al., 1986); Native Americans, Chukchi, Asiatic Eskimos, Han Chinese, East Asians, and Taiwanese Hans (Torroni et al., 1993b); Bella Coola, Ojibwa, Guaymi, Yanomama, Haida, and Apache (Torroni et al., 1993b); Navajo, Ticuna, Hopi, and Pomo (Torroni et al., 1992); Nuu-Chah-Nulth, Japanese, and sub-Saharan Africans (Ward et al., 1991); Asians, Europeans, purebred Papagos, purebred Hualapai, Hohokam, and Pima (Wallace et al., 1985); and Siberian hunter-gatherers, Paleo-Indians, Maya, Pima, and Tohono-O'odham (Papago) descended from the Hohokam, Caucasian, and North American tribes (Schurr et al., 1990). I could list hundreds or thousands of such categories used and reused across the literature. Genomic articulations of indigeneity embed long-standing social and cultural notions of race that loop back to reconfigure social understandings as genetic – giving them added or a renewed legitimacy and power to affect peoples' lives (De la Cadena and Starn, 2007; Gibbon et al., 2011).

Narrative 1: The vanishing indigene

> Our genes allow us to chart the ancient human migrations from Africa across the continents. Through one path, we can see living evidence of an ancient African trek, through India, to populate even isolated Australia. But to fully complete the picture we must greatly expand the pool of genetic samples … In a shrinking world, mixing populations are scrambling genetic signals. The key to this puzzle is acquiring genetic samples from the world's remaining indigenous and traditional peoples whose ethnic and genetic identities are isolated. But such distinct peoples, languages, and cultures are quickly vanishing into a 21st century global melting pot. (Genographic Project website[4])

The centuries-old narrative of the 'vanishing American' or the 'disappearing Indian' was widely represented in the late 20th century in 'the end of the trail' image often replicated in popular art: a prototypical Native American male with bare torso and breech cloth sits bareback, slumped over atop a horse in an empty landscape, before a setting sun. On the cover of Brian Dippie's monograph, *The Vanishing American* (1991), we see another version of the Indian's end, as the breech-cloth clad Indian in full headdress throws back his head and outstretches his arms almost as if on a crucifix, offering himself up to a greater power. Such iconic images are recast on the Genographic Project website in genetic terms. Instead of extermination through war or federal government policy aimed at assimilating Indians into the American population, we now face the hastening and inevitable admixing of the world's 'populations' – assimilation or endangerment via recombination.

While indigenous peoples focus on the threat of assimilation to distinct social and cultural practices, for geneticists, this impending loss of biological purity constitutes grounds from which to urgently make moral claims to Native American and other

indigenous biological resources (e.g. Barragán, 2011; IPCB, 2000; Reardon, 2005; TallBear, 2013). Not only the highly marketed Genographic Project, but its intellectual ancestor, the HGDP (Reardon, 2005), other global research efforts working to systematically archive human genetic diversity, and smaller scholarly research projects deploy the vanishing indigene trope both as lamentation and as source of authority.

The vanishing indigene informs research questions and methods that sort and delineate peoples into *genetic populations* in ways that oversimplify entanglements of biology and peoplehood. For example, indigenous individuals who are viewed as too highly admixed are eliminated from samples of the population. Those same individuals are considered legitimate members when the indigenous groups' legal and/or social requirements (e.g. tribal or First Nation citizenship rules) are applied. Indigeneity then gets mapped onto genetics, and that mapping becomes entrenched, in the following steps:

1. Scientists worry about indigenous peoples 'vanishing' because they view them as storehouses of unique genetic diversity.
2. Since the genetic signatures of 'founding populations' are confounded in those who are more highly *admixed*, those people are less useful for research.
3. The 'admixed' indigene becomes not indigenous enough. This is illustrated by common sampling standards wherein a good research subject should have three or four 'indigenous' grandparents, not one.[5]
4. If admixture is on the rise, indigenous people are – by genetic definition – vanishing.

To be clear, indigenous peoples in the United States and Canada do not discount (in today's terminology) 'biological' relatedness from consideration of group belonging. Indigenous political citizenship in these countries is almost always based on specific rules about biological relatedness – rules that have changed over time and from group to group in response to changing political and economic conditions (Gover, 2008; TallBear, 2011). However, this use of biogenetic relatedness to deal with belonging and peoplehood is entangled with legal enactments of indigenous sovereignty as well as collectively held practices and histories.

Genetics-based assertions about the impending doom of the indigene contradict key indigenous claims. A pivot-point of indigenous organizing is that while peoples acknowledge the assaults on them and their lands, they view themselves as working toward survival as peoples, toward greater autonomy. Not surprisingly, they resist terms that objectify them as historical or biological curiosities or vestiges. The very identification of indigenous peoples under the rubric of 'indigenous' is articulated precisely in order to better fight for their survival as 'Peoples' who are distinct from settler societies. Thus, the chasm between indigenous and genomic articulations of indigeneity is not easily bridged.

Narrative 2: We are all related, we are all African

Paradoxically, although admixture is seen as a problem for research, it is also often framed in a positive light, as a 'we are all related' story. This narrative is valued by many

people of European origin who celebrate the rise of Civil Rights and multiculturalism in the wake of eugenics and the genocides of 20th-century Europe. The narrative that 'we are all related' also is important to national cultural histories. In addition, it has particular resonance for the life sciences that played a controversial role in the race politics of the early 20th century. After World War II, geneticists decried the racial cleansing of Nazi Germany and tried to distance themselves from US complicity in eugenics (Gannett, 2001, 2003; Reardon, 2005). Like the vanishing indigene, this more recent but equally powerful narrative is entangled with European and American colonial history, again with particular resonance for geneticists.

One version of the idea that we are all related is the narrative that we are all African. With the popularization of the theory of 'Mitochondrial Eve' (mtEve) – the single genetic mother of all living humans (Cann et al., 1987) – the idea that we are all really 'African' has become a powerful idea within and without scientific circles. But this narrative, like the others highlighted here, is conditioned by European and American colonial history.

In a photograph leading a 2002 interview with Spencer Wells, a prototypical White man (Wells) stands behind a prototypical African (*Rediff.com*, 2002). The White man's face is slightly out of focus and half concealed behind the African. Appearing with the caption 'We are all really Africans under the skin', this photo asserts a 19th-century racial science view of connectedness where 'Africans' precede the modern White man on the evolutionary chain of humanity. The living African represents the White man's past, and the White man represents modern humanity. We see a scientific metaphor that conjoins old with new elements to help build a new genetic articulation of indigeneity and race.

On one hand, it is nonsensical to say we are all African. Africa, as it has been named and conceived in human political memory did not exist 200,000 years ago. Tracing all human lineages to mtEve does not make us all 'African' in any meaningful sense. But the claim itself is meaningful because Africa is not simply a name given by some humans to a particular landmass. Enduring colonial perspectives are at play. Africa has long been seen as fundamentally different. Postcolonial philosopher V.Y. Mudimbe (1994) writes about the two forms that African otherness takes in European colonial thought. In the first, Africa is seen as primordial and less evolved. It has been characterized as outside of time and history – as a place of irrationality, famine, and savagery. Alternatively, Africa is portrayed as a 'Rousseauian picture of [a] golden age of perfect liberty, equality and fraternity'. Either way, 'Africa' embodies more than the notion of one particular continental landmass out of which came the ancestors of all modern humans.

American Indians were also seen as lower on that chain of human evolution, but they were seen as closer to moderns, that is, Whites. And while many scientists viewed Africans as permanently less evolved, the Indian was seen as capable of being biologically absorbed by Whites (Ben-Zvi, 2007; Bieder, 1986; Morgan, 1877 [1909]). But, crucially, Indians were seen culturally antecedent to moderns, again Whites. One rarely finds in contemporary discourse the oppressive language of race hierarchy that characterized the racial science of earlier times. Today 'populations' – the younger conceptual relative to that older idea of 'race' – are seen as connected (Gannett, 2001, 2003; Reardon, 2005). Yet the ideas that we are all one and that we share the same ancient genetic heritage continue to rely on representing living African bodies and living indigenous bodies

as primordial, as a genetic window to the past, as the source of 'all of us'. But 'us' cannot then include living Africans who stand in for modern humanity's ancestors, nor can it include the vanishing indigene.

A genomic articulation of 'Kennewick Man' (interrupted)

As they are entangled with the genome sciences, the narratives I have outlined here can have the unintended consequence of challenging existing indigenous articulations of identity based on nonmolecular knowledges and attendant legal rights. In 1998, activist Deborah Harry and the late Hopi geneticist Frank Dukepoo, writing on behalf of the organization that would become the Indigenous Peoples Council on Biocolonialism (IPCB), raised an alarm about this particular issue in relation to the HGDP. IPCB continues to raise similar concerns with the ongoing Genographic Project:

> Scientists expect to reconstruct the history of the world's populations by studying genetic variation to determine patterns of human migration. In North America, this research will likely result in the validation of the Bering Strait theory. It's possible these new 'scientific findings' concerning our origins can be used to challenge aboriginal rights to territory, resources and self-determination. Indeed, many governments have sanctioned the use of genomic archetypes to help resolve land conflicts and ancestral ownership claims among Tibetans and Chinese, Azeris and Armenians, and Serbs and Croats, as well as those in Poland, Russia, and the Ukraine who claim German citizenship on the grounds that they are ethnic Germans. The secular law in many nations including the United States has long recognized archetypal matching as legitimate techniques for establishing individual identity. (Harry and Dukepoo, 1998)

The controversy over so-called Kennewick Man shows the potential for human genome diversity research to challenge indigenous identity claims and rights over human remains. When 9000-year-old remains were found near the Columbia River in Washington State in 1996, the first scientist to examine them, James Chatters, assumed that they belonged to a Euro-American settler (Thomas, 2000). Carbon dating analysis soon revealed them to be much older than that, and a group of Native American tribes invoked the Native American Graves Protection and Repatriation Act (NAGPRA), claiming the remains for reburial.

Despite the antiquity of the remains, the involved scientists hoped to disrupt tribal claims by showing that 'Kennewick Man' – Umatilla tribal members referred to him as 'the Ancient One' (Howe, 2001) – could not be traced directly to contemporary Native Americans. In order to repatriate, NAGPRA requires the 'cultural affiliation' of those remains with a contemporary Native American tribe. Specifically, the law requires that a 'relationship of shared group identity' must be able to be 'reasonably traced historically or prehistorically between members of a present-day Indian tribe or Native Hawaiian organization and an identifiable earlier group' via a 'preponderance of the evidence – based on geographical, kinship, biological, archeological, anthropological, linguistic, folklore, oral tradition, historical evidence, or other information or expert opinion' (Native American Graves Protection and Repatriation Act, 1990 and National Park Service).

With relatively recent remains, burial practices and accompanying material artifacts can be used to affiliate remains with living Native American groups whose more recent histories, practices, and kinship ties are documented. But these remains offered no such evidence. In addition, independent forensic analyses had assessed the ancient human as having morphological similarities to several other studied populations, both contemporary Native American and Asian populations. The Department of Interior (DOI) initially ruled in favor of repatriating the remains to Native American Tribes (Babbitt, 2000), but in the hope of finding more definitive evidence to determine the disposition of the remains to a specific tribe, the DOI called for genetic analysis of the type used in human genetic diversity research (McManamon et al., 2000). NAGPRA allows for the documentation of a 'lineal descent' relationship between contemporary Native Americans and the remains or cultural patrimony claimed. In the absence of conclusive cultural or other material evidence, it was hoped that lineal descent might be substantiated via evidence of genetic ties to contemporary tribal groups – that is, through finding a Native American mtDNA or Y haplotype in the genome of the ancient human remains. It should be noted that all the tribal claimants – the Umatilla, the Yakama, the Nez Perce, and the Wanapum Band – opposed destructive DNA testing as it might establish 'a precedent for the application of such examinations' (McManamon et al., 2000). In the end, researchers were unable to extract DNA due to mineralization of the bones (Kaestle, 2000; Smith et al., 2000).

Morphological and genetic examinations were ultimately inconclusive about with which specific Native American tribes the remains should be affiliated. Still, the DOI determined that cultural affiliation was satisfied by a 'preponderance of evidence' – the location of the remains in the aboriginal territory supported by tribal oral tradition of their long occupation of that region. Despite lack of material evidence that would provide conclusive evidence of cultural continuity between the remains and contemporary Indian tribes, 'the unique legal relationship between the United States and Indian tribes' required that 'any ambiguities in the language of the statute must be resolved liberally in favor of Indian interests' (Babbitt, 2000).

Subsequently, a group of scientists challenged DOI's ruling in court. In 2004, the court confirmed the material, cultural, and historical evidence as inadequate to 'support a finding that Kennewick Man is related to *any* particular identifiable group or culture' (Bonnichsen et al. v. United States et al., 2004). American Indian law scholar Rebecca Tsosie explains that after the court found that the remains were 'not "Native American" for the purposes of NAGPRA', scientists requested further DNA testing (Tsosie, 2005: 14). She notes that plaintiff Bonnichsen (Center for the Study of the First Americans at Texas A&M University) wanted to 'do the most detailed look at a first American that has ever been put together' (Bonnichsen in Tsosie, 2005), a study that might 'hold the key to determining the identity of the "first Americans"' (Tsosie, 2005: 14). Tsosie summarizes contemporaneous research that living Native Americans may well not be direct descendants from the very first peoples to settle in what is today the Americas. Rather, contemporary Native American people may be descended from later migrants, with earlier migrants' direct descendants wiped out after European contact. Citing Bonnichsen and the press surrounding the case, Tsosie (2005) argues that this hypothesized historical frame in part contextualizes the intense desire by some scientists, press, and lay people

to sue for the right to study Kennewick Man, in order to 'prove … that the "first Americans" were not the ancestors of contemporary Native American people' (p. 14). Tsosie (2005) argues that from the standpoint of Bonnichsen (and others who see DNA evidence as supporting estimations about cultural affiliation), 'cultural identity' becomes 'a euphemism for racial identity' and a way to appropriate the concept of indigeneity away from indigenous peoples' own definitions (p. 15).

Two scientists sum up what is at stake with DNA testing of remains and ask, albeit using different terminology, whether a genomic articulation of indigeneity should be accepted and under what terms?

> What would be done with any genetic typing (or lack thereof) of this skeleton. If haplogroup A, B, C, or D is found, and a likely determination of American Indian biological affiliation is made, will this set the standard for all future new finds of human skeletal remains? Will this type of analysis never have to be done again, and will all skeletons that predate the arrival of Europeans to the Americas be assumed to be ancestral to American Indians? If the results are ambiguous or if no DNA remains in the skeleton, how will this be interpreted, and what will be the ramifications? (Tuross and Kolman, 2000)

Definitions of 'cultural affiliation' that draw on genetic lineal descent, oral tradition, and contemporary tribal citizenship can be highly divergent. They may overlap but they are never pinned perfectly to one another like fabric to a pattern. We are therefore certain to be confronted again and again with conflicts over remains and claims to historical truth. Just as morphological examination offers at best imprecise indications of 'cultural affiliation', genetic evidence (due to population bottlenecks rendered by colonial diseases and extermination and the fact that most ancient humans do not have direct descendants living today) will often not result in determination of a direct biological relationship of ancient remains to living, unambiguous, Native Americans in the same geographical vicinity. Genome evidence is likely to further complicate an already complex legal, historical, and cultural field. The concern expressed by IPCB and other groups is that genomic definitions of relatedness that inform decisions about 'cultural affiliation' will prevail over indigenous definitions and knowledge claims.

Over 15 years later and with a 2004 9th Circuit Court of Appeals ruling awarding scientists the right to study the remains (Bonnichsen et al. v. United States et al., 2004), the case of Kennewick Man is still open. Scientists, federal agencies, Congress, and Native American tribes continue to assert, legislate, and attempt to regulate who has rights to the remains.[6] Kennewick Man or Ancient One lies in the University of Washington Burke Museum, 'the court appointed neutral repository for the remains' with 'all decisions concerning access to the remains … made by the Army Corps of Engineers as the landowners of the property where the remains were found'. The Museum website notes that 'the plaintiffs have made three visits to the Burke Museum to carry out scientific research on the remains', but the results 'have yet to be published and the case remains open until research is completed'.[7] All these years later, DNA testing has not yet substantiated or contradicted claims to the remains. But scientists note that improvements in methods and laboratory techniques may enable successful DNA extraction even from poorly preserved remains in the future (Smith et al., 2000). We do not know whose articulations of indigeneity will prevail. But the state has

opened a door to make way for DNA evidence that might eventually arbitrate truth claims.

New genomic articulations of the tribal citizen

During the past decade, Native American tribes in the United States and First Nations in Canada have increasingly adopted DNA testing in tribal enrollment. But tribes and First Nations do not seek to pinpoint the same continental genetic ancestry that human genome diversity researchers search for in their subjects. North American indigenous governmental entities are not interested in mtDNA or Y-chromosome markers that trace descent from founder populations in the Americas. Rather, indigenous governments use the common DNA parentage test, or DNA profile, simply in order to prove that a potential tribal or First Nation citizen is the biological offspring of a tribally enrolled parent. In blood samples from an individual, and one or both of that person's biological parents, the DNA profile examines repeated sequences of nucleotides called 'short tandem repeats' (STRs). STRs are inherited from both parents. Therefore, while a single such sequence is not unique, when viewed in combination with other STRs, an individual's total STR pattern becomes increasingly distinctive, or in practical terms, unique. For example, only 1 in 60 million individuals might exhibit such a pattern. This is the same form of DNA analysis commonly used in criminal cases – to prove, for example, that a strand of hair or skin cells found on a crime victim belong to an individual suspect. DNA evidence is then used to fulfill a longer standing requirement for tribal 'enrollment' or citizenship: biological descent from an enrolled tribal member (TallBear, 2013). While enrollment into a tribe by marriage or adoption was allowed in many US tribes through the mid-20th century, today, almost without exception, tribal citizens must be biologically descended from enrolled members (Gover, 2008).

While hard data on the number of tribes and First Nations that use DNA testing are difficult to come by – not all make their citizenship rules and ordinances publicly available, and enrollment records are confidential – I regularly do fieldwork, attend professional meetings, and visit friends and family on reservations all over the United States and occasionally in Canada. 'Enrollment' rules in the United States and 'status' rules in Canada are always a hot topic of conversation. I am also regularly contacted by reporters and sometimes by tribal program staff who want me to comment or give advice on DNA testing for tribal enrollment in particular cases. Finally, my attendance at two national tribal enrollment workshops in 2003 and 2010 (TallBear, 2013) that featured panels and participant conversation on DNA testing provides me a window into the politics of DNA in Indian Country.

DNA testing on a case-by-case basis, that is, when parentage is in doubt, is a widespread practice. Some tribes, including my own, will also accept a signed affidavit from several relatives claiming an individual as their child, niece, nephew, or grandchild, and so on, in lieu of a DNA test. Other tribes require across-the-membership DNA testing and sometimes even require retroactive testing of already enrolled members. One can imagine the social and familial troubles that result when 'false biological parentage' is uncovered, a not infrequent occurrence in any population. Members are disenrolled, their present and future descendants made ineligible for enrollment and for all

associated program and financial benefits; and families can be torn apart. Judging by the press surrounding such disenrollments and by my anecdotal evidence in Indian Country, the most rigid DNA rules and controversial disenrollments tend to occur in a small minority of very small, wealthy gaming tribes with highly profitable casinos near to urban areas. The monthly payouts of 'per capita' payments to individual members in such tribes can amount to as much as tens of thousands of dollars. The returns to individuals are kept high if numbers of enrolled citizens are kept low, motivating the move to rigid DNA testing requirements in these communities.[8]

The politics of gaming and enrollment intersect with DNA testing in controversial and sometimes heartbreaking ways in Native American communities. In these cases, I view per capita payments, rather than DNA testing or even gaming, as the chief problem that leads to divided communities. But DNA testing for enrollment is having an insidious effect on our thinking about who is a tribal member and more broadly on who is indigenous. At the 2003 tribal enrollment conference I attended, DNA testing for enrollment was front and center in panel presentations. Yet a poll taken by a show of hands in the ballroom of 300 conference participants revealed that all except 10 participants had no opinion on how useful or important DNA would be in enrollment. In 2010, while tribes were still talking in terms of symbolic blood and using the DNA test in order to support existing enrollment criteria long figured through concepts of blood, increasing numbers of tribes were combining gene and blood concepts to rearticulate the notion of tribe.

Unlike symbolic blood and blood rules, DNA testing has the advantage of claims to scientific precision and objectivity. One DNA testing company spokesperson whom I interviewed noted that in using a DNA profile analysis for tribal enrollment, there is 'no possibility of incorporating a subjective decision into whether someone becomes a member or not'. Yet whether or not someone is a verifiable biological kin of the type indicated by a parentage test is not 'objective' as an enrollment criterion. Allowing a DNA profile to trump other ways of reckoning kin (e.g. blood quantum as a proxy for cultural affiliation by counting relatives, or a signed affidavit of family relatedness) for purposes of enrollment prioritizes technoscientific knowledge of certain relations over other types of knowledge.

Furthermore, the idea of scientific definitiveness attached to genetic testing is influential, even if it is not realized. The DNA profile may increasingly look like a good complement to traditional blood (quantum) and other nongenetic documentation – especially if traditional documentation of named relations is difficult to obtain or if enrollment applications are politically and economically contentious. The increasing use of the DNA profile in concert with existing blood rules may condition tribes' eventual acceptance of DNA knowledge as a substitute for tracking blood relations. Some will see such a move as advantageous, as scientifically objective and less open to political maneuvering. Yet DNA testing will not solve what is the most crucial and divisive problem in contemporary enrollment debates: in the majority of cases, parentage is not in question, but due to out-marriage, increasing numbers of tribal members' offspring cannot meet blood requirements. They simply do not have enough sufficiently 'blooded' parents and grandparents to meet the standards set by tribes. Therefore, while not solving core existing enrollment problems, widespread DNA testing adds to them.

Using DNA tests on a case-by-case basis, that is, when biological parentage of one individual is in doubt, is one thing, although other means of documenting kinship, such as the affidavit, are also available, but the increasing tribal practice of DNA testing *across the entire membership* (as opposed to a case-by-case basis) risks re-racializing Native Americans by promoting the idea that the tribe is a genetic population. Despite their significant technical differences, many tribal members will not distinguish STR testing of relatedness between specific people from DNA analysis used in human genome diversity research that is interested in research 'populations' on particular continents of 'origin'. In addition, if continental genetic ancestry analyses come to be coupled with the DNA profile – one scientist at the 2010 tribal enrollment conference noted the occasional use of mtDNA lineage tests to ascertain maternal lineages in tribal enrollment cases – 'race' is certain to loom larger in our conception of Native American tribal and First Nations identity in the United States and Canada.

All these present cause for worry because a too-heavy focus on genetics risks undercutting the legal foundations of Native American sovereignty and self-governance. In the United States, indigenous peoples have an unusual degree of nation-state–recognized authority to self-govern as compared with indigenous peoples in many parts of the world. Treaties between the United States and tribal nations and case law articulate the 'government-to-government relationship' of the United States with tribal nations. They set out rights and responsibilities of tribal self-governance, and the United States 'trust' relationship with tribes. That federal–tribal legal regime – while colonial in its own right and laden with problems – is still critical for contemporary indigenous governmental authority, including the right to determine tribal citizenship. Genetic understandings of history and identity in US popular and scientific imaginations operate without reference to that legal history. It is 'race' and 'population', respectively, that matter in the minds of the public and of scientists, not indigenous citizenship. If tribes and First Nations play an increasing hand in the geneticization of what we understand as political categories (i.e. tribe, First Nation, and citizen), we aid the ascendancy of genetics as legitimate grounds for identity claims that may rival or even overtake the existing historical–legal foundations of indigenous governance authority and citizenship. We may undermine our own sovereignty while adding to a growing genetic fetishism in the broader society. This is what is at stake in the genetic articulation of indigeneity.

Conclusion

Articulation has been applied by other scholars to analyze indigenous peoples' dynamic maneuvers as they confront colonial practices that appropriate land and attempt to vanquish or shape their identities and cultures too narrowly in the service of nation-state interests (Clifford, 2001, 2007; Li, 2000; Yeh, 2007). In this article, I too have shown how indigenous peoples define indigeneity and tribe in dynamic ways using entangled social, place-based, and political criteria in the service of their own interests. In addition, I borrow the concept of articulation to analyze a set of scientific practices and representations that also happen to focus on defining indigeneity narrowly in the service of disciplinary interests and nationalist sentiment. Contemporary scientific practice articulates

with previous narratives of racial hierarchies and colonial expansion, and the new formation has similar implications for indigenous assimilation and death.

Genomic practices and articulations have great conceptual influence on US popular culture, where they increasingly ground perceptions of what counts as truth, kinship, ancestry, and identity (Nelson, 2008). Indigenous peoples in the United States have begun to add genetic concepts, in the form of DNA tests for tribal enrollment, to our identity-making practices (Bardill, 2010; TallBear, 2013). The genomic articulation of indigeneity risks becoming also an *indigenous* articulation of indigeneity as US tribes and Canadian First Nations take up DNA testing. That, coupled with the fact that nongenomic anthropological knowledges are already privileged in US federal decisions about recognition of Native American rights and resources, paves the way for (anthropological) genetics to be used.

This article is a preemptive attempt to demonstrate that decisions to use genomics within processes of recognition – whether at the individual tribal member level or at the level of recognizing an entire people (and the resource allocations that go with that) – will always be simultaneously nonneutral, political acts and science-based governance decisions with profound implications for indigenous peoples' sovereignty. Sound science and politics are not mutually exclusive. We may decide that genetics matter in conferring tribal identity and attendant rights, but we cannot rest in the idea that this is a neutral or so-called objective decision. Privileging genomics in the designation of a citizen and in broader identity constructions is a value decision about which facts matter and which do not. Do we value genetic kin versus kin made through law, ceremony, or love? Do we value these kinship forms in combination? And in which circumstances? And more fundamentally, the histories within which our racial, tribal, and populational categories formed and which today we draw on in doing genomics and in doing politics are histories of colonial power imbalances, resource extraction, and violence. These are political histories. We do science and we use science within and not despite our histories and politics.

Acknowledgements

The author thanks multiple reviewers who kindly gave their time and invaluable critical feedback to this article: three anonymous reviewers; *Social Studies of Science* editor Sergio Sismondo; volume guest editors Emma Kowal and Joanna Radin; Craig Howe, Deborah Bolnick, and David S. Edmunds, who is always my best editor; and various faculty and graduate students who took part in the Berkeley Workshop on Environmental Politics, held on 4 November 2011, at which I presented an earlier draft of this article.

Declaration of conflicting interests

The author declares that there is no conflict of interest.

Funding

This study received funding support from the College of Natural Resources, University of California, Berkeley.

Notes

1. In Canada, there also other indigenous communities, such as Inuit and Métis Communities, but I do not address them in this article. Multiple other indigenous-state formations exist in other countries around the world.
2. 'Recognized' or 'federally recognized' tribes are political entities with which the United States has a government-to-government relationship. Historically, such tribes have signed treaties with the US government and/or gone through recognition processes in which they proved to the satisfaction of the US Department of Interior (DOI) and the US Congress their cultural and political continuity. For some, federal recognition is a controversial designation. Some groups identifying as American Indian or Native American have not proven to the satisfaction of the US government their legitimacy as 'tribes' with 'cultural continuity' from some point in the past. These do not receive federal recognition, funding or benefits, or have not yet undertaken the arduous, lengthy, and costly recognition process. In addition, there are approximately 30–60, depending on the source, tribes recognized by individual states within the United States. See 'State Recognized Tribes' at http://en.wikipedia.org/wiki/State_recognized_tribes (accessed 26 December 2010).
3. For example, the UN Working Group on Indigenous Populations, the World Council of Indigenous Peoples, the International Indian Treaty Council, the Indigenous Environmental Network, North American Indigenous Peoples Biodiversity Project, and the Inuit Circumpolar Conference.
4. https://genographic.nationalgeographic.com/genographic/about.html (accessed 28 December 2010). The Genographic Project is an international privately funded research project that aims to collect DNA samples from indigenous peoples around the world to improve scientific understanding of ancient population movements.
5. The ideal in genetic studies of human evolution is to sample individuals with four grandparents from the same population. Renowned population geneticist Luca Cavalli-Sforza writes that aboriginal populations with '25% or more admixture' are excluded from his global study (Cavalli-Sforza et al., 1994: 24). Smaller-scale studies are even stricter, ranging from 0 percent alleged admixture in individuals (four endogenous grandparents) (Lorenz and Smith, 1994; Torroni et al., 1993b) to populational admixture rates of ≤5 percent (Callegari-Jacques et al., 1993; Neel, 1978; Torroni et al., 1992), 8.7 percent (Torroni et al., 1992), and 12 percent (Torroni et al., 1993a). 'Admixture' is calculated according to the presence in populations of haplotypes or genetic lineages that are tied to non-American geographies. Much genetic scholarship fails to describe how members of the groups of interest are selected (e.g. Crawford, 1998; Relethford, 2003; Santos et al., 1999; Wallace and Torroni, 1992), implying that the authors believe that group boundaries and sampling decisions are self-evident.
6. In 2008, the DOI proposed a new rule, 43 CFR 10.11, regarding the disposition of culturally identifiable human remains. See 'Native American Graves Protection and Repatriation Act Regulations – Disposition of Cultural Unidentifiable Human Remains', Federal Register 72 (199) (16 October 2007/Proposed Rules): 58588–58589. Available at http://www.nps.gov/history/Nagpra/MANDATES/FR%20Notice%20Proposed%20Reg%20%20CFR%2010.11%200-16-2007.pdf (accessed 20 February 2011). Also see 'Native American Omnibus Act of 2005, Sec. 108 Definition of Native American', for a proposed amendment introduced by Senator John McCain (R-AZ) to amend Section 2(9) of NAGPRA by adding language that would broaden the definition of 'Native American' for the purposes of expanding the conditions under which human remains and other cultural patrimony could be repatriated to Indian tribes. The new rule took effect in May 2010. See 'At a Glance: 43 CFR 10.11 – Disposition of Culturally Unidentifiable Native American Human Remains'. Available at http://www.

nps.gov/nagpra/DOCUMENTS/At-a-glance-43CFR10.11.pdf (accessed 21 February 2013). Under the original NAGPRA legislation, present-day Indian tribe or Native Hawaiian organization claimants of funerary objects, sacred objects or other objects of cultural patrimony (including human remains) must document a 'relationship of shared group identity which can reasonably be traced historically or prehistorically' with 'an identifiable earlier group' (Pub. L. 101-601, 25 U.S.C. 3001 et seq., 104 Stat. 3048, 16 November 1990). However, if a direct cultural link cannot be determined with a 'preponderance of the evidence', the new rule allows a decision in favor of Indian tribes and Native Hawaiian organizations if they have more general connections, that is, if they own the land from which the objects were removed at the time of removal; if the land from which objects were removed is the aboriginal territory of the tribes or organizations in question; if the claimants have 'a cultural relationship to the region' from which objects were removed; or if the place of removal is unknown, claimants may be awarded rights if they have a 'cultural relationship to the region in which the museum or Federal agency repository is located'. In summary, the new rule allows for tribes and Native Hawaiian organizations on whose traditional lands remains or objects are found to invoke NAGPRA even when a direct cultural link to objects is undetermined.

7. See http://www.burkemuseum.org/kman/ (accessed 21 February 2013).
8. As a counterpoint, my 10,000-member tribe that is far from any major metropolitan area has three moderately profitable casinos. Our tribal government does not make per capita payments. Gaming proceeds fund tribal environmental, health, scholarship, and other programs. We do not have such disenrollment controversies and do not require across-the-membership DNA testing.

References

Alfred T and Corntassel J (2005) Being indigenous: Resurgences against contemporary colonialism. *Government and Opposition* 40(4): 597–614.

Anaya SJ (2000) *Indigenous Peoples in International Law*. Oxford: Oxford University Press.

Babbitt B (2000) Secretary of the interior letter to honorable Louis Caldera, Secretary of the Army regarding the Department of Interior's final determination and resolution of human skeletal remains recovered on July 26, 1996 from Columbia Park, Washington. Kennewick Man, Archeology Program, National Park Service, U.S. Department of Interior, 21 September. Available at: http://www.nps.gov/archeology/kennewick/babb_letter.htm (accessed 13 January 2013).

Bardill J (2010) Information and misinformation already had: DNA and tribal citizenship. *Gene Watch* 23(3): 8–9.

Barragán CA (2011) Molecular vignettes of the Colombian nation: The places(s) of race and ethnicity in networks of biocapital. In: Gibbon S, Santos RV and Sans M (eds) *Racial Identities, Genetic Ancestry, and Health in South America: Argentina, Brazil, Colombia, and Uruguay*. New York: Palgrave Macmillan, pp. 41–68.

Baviskar A (2007) Indian indigeneities: Adivasi engagements with Hindu nationalism in India. In: de la Cadena M and Starn O (eds) *Indigenous Experience Today*. Oxford and New York: Berg, pp. 275–303.

Ben-zvi Y (2007) Where did red go? Lewis Henry Morgan's evolutionary inheritance and U.S. racial imagination. *CR: The New Centennial Review* 7(2): 201–229.

Berkhofer RF Jr (1979) *The White Man's Indian: Images of the American Indian from Columbus to the Present*. New York: Vintage Books.

Bieder RE (1986) *Science Encounters the Indian, 1820-1880: The Early Years of American Ethnology*. Norman, OK and London: The University of Oklahoma Press.

Bonnichsen et al. v. United States et al. (2004) No. 02-35994 (9th Cir. February 4), 3.
Callegari-Jacques SM, Salzano FM, Constans J and Maurieres P (1993) Gm haplotype distribution in Amerindians: Relationship with geography and language. *American Journal of Physical Anthropology* 90 (4): 427–444.
Cann RL, Stoneking M and Wilson AC (1987) Mitochondria DNA and human evolution. *Nature* 325: 31–36.
Cattelino JR (2008) *High Stakes: Florida Seminole Gaming and Sovereignty*. Durham, NC and London: Duke University Press.
Cattelino JR (2010) The double bind of American Indian need-based sovereignty. *Cultural Anthropology* 25(2): 235–262.
Cavalli-Sforza LL, Menozzi P and Piazza A (1994) *The History and Geography of Human Genes*. Princeton, NJ: Princeton University Press.
Clifford J (1988) Identity in Mashpee. In: Clifford J (ed.) *The Predicament of Culture*: Twentieth-century ethnography, literature, and art. Cambridge, MA and London: Harvard University Press, pp. 277–246.
Clifford J (1997) *Routes: Travel and Translation in the Late Twentieth Century*. Cambridge, MA and London: Harvard University Press.
Clifford J (2001) Indigenous articulations. *Contemporary Pacific* 13(2): 468–490.
Clifford J (2003) *On the Edges of Anthropology: Interviews*. Chicago, IL: Prickly Paradigm Press (University of Chicago Press).
Clifford J (2007) Varieties of indigenous experience: Diasporas, homelands, sovereignties. In: de la Cadena M and Starn O (eds) *Indigenous Experience Today*. Oxford and New York: Berg, pp. 197–223.
Cobo JM (1986) *The Study of the Problem of Discrimination against Indigenous Populations*, vols 1–5 (United Nations Document E/CN.4/Sub.2/1986/7/Add. 4). Geneva: United Nations.
Crawford MH (1998) *The Origins of Native Americans: Evidence from Anthropological Genetics*. Cambridge: Cambridge University Press.
De la Cadena M and Starn O (eds) (2007) *Indigenous Experience Today*. Oxford: Berg Publishers.
Deloria S (2002) Commentary on nation-building: The future of Indian nations. *Arizona State Law Journal* 34: 55–62.
Deloria V Jr (2001) American Indian metaphysics. In: Deloria V Jr and Wildcat DR (eds) *Power and Place: Indian Education in America*. Golden, CO: Fulcrum, pp. 1–6.
Dippie BW (1991) *The Vanishing American: White Attitudes and U.S. Indian Policy*. Lawrence, KS: University Press of Kansas.
Durning AT (1992) *Guardians of the Land: Indigenous Peoples and the Health of the Earth (Worldwatch Paper No. 112)*. Washington DC: Worldwatch Institute.
Gannett L (2001) Racism and human genome diversity research: The ethical limits of 'populational thinking'. *Philosophy of Science* 63(3 Suppl.): S479–S492.
Gannett L (2003) Making populations: Bounding genes in space and in time. *Philosophy of Science* 70(5): 989–1001.
Genomics, Governance, and Indigenous Peoples (2008) Workshop at Arizona State University, Sandra Day O'Connor College of Law, Tempe, AZ, 7–8 November.
Gibbon S, Santos RV and Sans M (2011) *Racial Identities, Genetic Ancestry, and Health in South America: Argentina, Brazil, Colombia, and Uruguay*. New York: Palgrave Macmillan.
Goering B (1993) *Indigenous Peoples of the World: An Introduction to Their Past, Present, and Future*. Saskatoon, SK, Canada: Purich.
Gover K (2008) Genealogy as continuity: Explaining the growing tribal preference for descent rules in membership governance in the United States. *American Indian Law Review* 33(1): 243–310.

Greenberg JH, Turner CG II and Zegura SL (1986) The settlement of the Americas: A comparison of the linguistic, dental and genetic evidence. *Current Anthropology* 27 (5): 477–497.

Grossberg L (ed.) (1986) On postmodernism and articulation: An interview with Stuart Hall. *Journal of Communication Inquiry* 10(2): 45–60.

Hall S (1986) Gramsci's relevance for the study of race and ethnicity. *Journal of Communication Inquiry* 10(2): 5–27.

Harry D and Dukepoo FC (1998) *Indians, Genes and Genetics: What Indians Should Know about the New Biotechnology*. Nixon, NV: Indigenous Peoples Coalition Against Biopiracy. Available at: http://www.ipcb.org/pdf_files/primer.pdf (accessed 13 January 2013).

Howe C (2001) Review: Skull wars: Kennewick Man, archaeology, and the battle for Native American identity. *Wicazo Sa Review* 16(1): 168–177.

Human Genome Diversity Project (HGDP) (1992a) *Human Genome Diversity Workshop 1*. Stanford, CA: Stanford University Press.

Human Genome Diversity Project (HGDP) (1992b) *Human Genome Diversity Workshop 2*. State College, PA: Penn State University.

Indian and Native American Employment and Training Coalition Special Report (2004) Counting Indians in the Washington DC 2000 Census: Impact of the Multiple Race Response Option.

Indigenous Peoples Council on Biocolonialism (IPCB) (2000) Indigenous people, genes and genetics: What indigenous peoples should know about biocolonialism (a primer and resource guide) (June). Available at: http://www.ipcb.org/publications/primers/htmls/ipgg.html (accessed 13 January 2013).

Jasanoff S (ed.) (2004) *States of Knowledge: The Co-production of Science and Social Order*. London: Routledge.

Kaestle F (2000) Report on DNA analyses of the remains of 'Kennewick Man' from Columbia Park, Washington. Kennewick Man, Archeology Program, National Park Service, U.S. Department of Interior Report on the DNA Testing Results of the Kennewick Human Remains from Columbia Park, Kennewick, Washington. Available at: http://www.nps.gov/archeology/kennewick/kaestle.htm (accessed 21 February 2013).

Keller EF (1995) *Refiguring Life: Metaphors of Twentieth-Century Biology*. New York: Columbia University Press.

Keller EF (2002) *The Century of the Gene*. Cambridge, MA: Harvard University Press.

Lent C (2000) *The Gene Hunters*. Toronto, ON, Canada: Cineflix.

Li TM (2000) Articulating indigenous identity in Indonesia: Resource politics and the tribal slot. *Comparative Studies in Society and History* 42(1): 149–179.

Lindee S and Santos RV (2012) The biological anthropology of living human populations: World histories, national styles, and international networks: An introduction to supplement 5. *Current Anthropology* 53(S5): S3–S16.

Lorenz JG and Smith DG (1994) Distribution of the 9-bp mitochondrial DNA region V deletion among North American Indians. *Human Biology* 66(5): 777–788.

McCulloch AM and Wilkins DE (1995) 'Constructing' nations within states: The quest for federal recognition by the Catawba and Lumbee Tribes. *American Indian Quarterly* 19(3): 361–388.

McManamon FP, Roberts JC and Blades BS (2000) Examination of the Kennewick remains – taphonomy, micro-sampling, and DNA analysis. Kennewick Man, Archeology Program, National Park Service, U.S. Department of Interior Report of the DNA Testing Results of the Kennewick Human Remains from Columbia Park, Kennewick, Washington (September). Available at: http://www.nps.gov/archeology/kennewick/fpm_dna.htm (accessed 13 January 2013).

Marks J (2005) Your body, my property: The problem of colonial genetics in a postcolonial world. In: Meskell L and Pels P (eds) *Embedding Ethics*. Oxford and New York: Berg, pp. 29–45.

Mataatua Declaration (2007) The Mataatua declaration on cultural and intellectual property rights of indigenous peoples, June 18, 1993. In: Mead ATP and Ratuva S (eds) *Pacific Genes & Life*

Patents: Pacific Indigenous Experiences & Analysis of the Commodification & Ownership of Life. Wellington, New Zealand: Call of the Earth Llamado de la Tierra and the United Nations University Institute of Advanced Studies, pp. 197–200.

Mead ATP (1996) Genealogy, sacredness and the commodities market. *Cultural Survival Quarterly* 20(2): 46–53.

Mead ATP and Ratuva S (eds) (2007) *Pacific Genes & Life Patents: Pacific Indigenous Experiences & Analysis of the Commodification & Ownership of Life*. Wellington, New Zealand: Call of the Earth Llamado de la Tierra and the United Nations University Institute of Advanced Studies.

Morgan LH (1877 [1909]) *Ancient Society: Or, Researches in the Lines of Human Progress from Savagery, Through Barbarism to Civilization*. Chicago, IL: Kerr.

Mudimbe VY (1994) *The Idea of Africa*. Bloomington, IN: Indiana University Press.

Native American Graves Protection and Repatriation Act (1990) 25 U.S.C. 3001 et seq., November 16. *Section 7a(4)*. Available at: http://www.nps.gov/history/local-law/FHPL_NAGPRA.pdf (accessed 13 January 2013).

Neel JV (1978) Rare variants, private polymorphisms, and locus heterozygosity in Amerindian populations. *American Journal of Human Genetics* 30 (5): 465–490.

Nelkin D and Lindee SM (1995) *The DNA Mystique: The Gene as a Cultural Icon*. New York: W.H. Freeman and Company.

Nelson A (2008) Bio science: Genetic ancestry testing and the pursuit of African ancestry. *Social Studies of Science* 38(5): 759–783.

Niezen R (2003) *The Origins of Indigenism: Human Rights and the Politics of Identity*. Berkeley, CA: University of California Press.

Nyamnjoh FB (2007) 'Ever-diminishing circles': The paradoxes of belonging in Botswana. In: de la Cadena M and Starn O (eds) *Indigenous Experience Today*. Oxford and New York: Berg, pp. 305–332.

Ogunwole S (2006) *We the people: American Indians and Alaska Natives in the United States*. Census 2000 special reports, CENSR 28. US Census Bureau, February. Available at: http://www.census.gov/prod/2006pubs/censr-28.pdf

Omi M and Winant H (1994) *Racial Formation in the United States: From the 1960s to the 1990s*. New York: Routledge Press.

Pratt ML (2007) Afterword: Indigeneity today. In: de la Cadena M and Starn O (eds) *Indigenous Experience Today*. Oxford and New York: Berg, pp. 397–404.

Radin J (2013) Latent life: Concepts and practices of human tissue preservation in the International Biological Program. *Social Studies of Science* 43(4): 484–508.

Reardon J (2005) *Race to the Finish: Identity and Governance in an Age of Genomics*. Princeton, NJ: Princeton University Press.

Reardon J and TallBear K (2012) Your DNA is *our* history: Genomics, anthropology, and the construction of whiteness as property. *Current Anthropology* 53(S5): S233–S245.

Rediff.com (2002) The Rediff interview/Dr. Spencer Wells. *Rediff.com*, 27 November. Available at: http://www.rediff.com/news/2002/nov/27inter.htm (accessed 13 January 2013).

Relethford JH (2003) *Reflections of Our Past: How Human History is Revealed in Our Genes*. Cambridge, MA: Westview Press.

Roof J (2007) *The Poetics of DNA*. Minneapolis, MN: The University of Minnesota Press.

Santos FR, Pandya A, Tyler-Smith C, Pena SDJ, Schanfield M, et al. (1999) The central Siberian origin for Native American Y chromosomes. *American Journal of Human Genetics* 64 (2): 619–628.

Schein L (2007) Diasporic media and Hmong/Miao formulations of nativeness and displacement. In: de la Cadena M and Starn O (eds) *Indigenous Experience Today*. Oxford and New York: Berg, pp. 225–245.

Schurr TG, Ballinger SW, Gan YY, Hodge JA, Merriwether DA, et al. (1990) Amerindian mitochondrial DNAs have rare Asian mutations at high frequencies, suggesting they derived from four primary maternal lineages. *American Journal of Human Genetics* 46(3): 613–623.

Smith DG, Malhi RS, Eshleman JA and Kaestle FA (2000) Report on the DNA testing results of the Kennewick human remains from Columbia Park, Kennewick, Washington. Kennewick Man, Archeology Program, National Park Service, U.S. *Department of Interior*. Available at: http://www.nps.gov/archeology/kennewick/smith.htm (accessed 13 January 2013).

TallBear K (2007) Narratives of race and indigeneity in the Genographic Project. *Journal of Law Medicine & Ethics* 35(3): 412–424.

TallBear K (2008) Native-American-DNA.com: In search of Native American race and tribe. In: Koenig B, Lee SS- J and Richardson SS (eds) *Revisiting Race in a Genomic Age*. Piscataway, NJ: Rutgers University Press, pp. 235–252.

TallBear K (2011) The political economy of tribal citizenship in the US: Lessons for Canadian First Nations? *Aboriginal Policy Studies* 1(3): 70–79.

TallBear K (2013) *Native American DNA: Tribal Belonging and the False Promise of Genetic Science*. Minneapolis and London: University of Minnesota Press.

Thomas DH (2000) *Skull Wars: Kennewick Man, Archaeology, and the Battle for Native American identity*. New York: Basic Books.

Thornton R (1987) *American Indian Holocaust and Survival: A Population History Since 1492*. Norman, OK: University of Oklahoma Press.

Thornton R (1997) Tribal membership requirements and the demography of 'old' and 'new' Native Americans. *Population Research and Policy Review* 16 (1-2): 33–42.

Torroni A, Schurr TG, Cabell MF, Brown MD, Neel JV, et al. (1993a) Asian affinities and continental radiation of the four founding Native American mtDNAs. *American Journal of Human Genetics* 53 (3): 563–590.

Torroni A, Schurr TG, Yang CC, Szathmary EJE, Williams RC, et al. (1992) Native American mitochondrial DNA analysis indicates that the Amerind and the Nadene populations were founded by two independent migrations. *Genetics* 130 (1): 153–162.

Torroni A, Sukernik RI, Schurr TG, Starikorskaya YB, Cabell MF, Crawford MH, et al. (1993b) mtDNA variation of Aboriginal Siberians reveals distinct genetic affinities with Native Americans. *American Journal of Human Genetics* 53(3): 591–608.

Tsing A (2007) Indigenous voice. In: de la Cadena M and Starn O (eds) *Indigenous Experience Today*. Oxford and New York: Berg, pp. 33–67.

Tsosie R (2005) The new challenge to native identity: An Essay on 'indigeneity' and 'whiteness'. *Washington University Journal of Law & Policy* 18: 55–98.

Tuross N and Kolman CJ (2000) Potential for DNA testing of the human remains from Columbia Park, Kennewick, Washington. Kennewick Man, Archeology Program, National Park Service, U.S. *Department of Interior*. Available at: http://www.nps.gov/archeology/kennewick/tuross_kolman.htm (accessed 13 January 2013).

Wallace DC and Torroni A (1992) American Indian prehistory as written in the mitochondrial DNA: A review. *Human Biology* 64(3): 403–416.

Wallace DC, Garrison K and Knowler WC (1985) Dramatic founder effects in Amerindian mitochondrial DNAs. *American Journal of Physical Anthropology* 68(2): 149–155.

Ward RH, Frazier BL, Dew-Jager K and Pääbo S (1991) Extensive mitochondrial diversity within a single Amerindian tribe. *Proceedings of the National Academy of Sciences of the United States of America* 88(19): 8720–8724.

Wells S and Schurr T (2009) Response to decoding implications of the Genographic Project. *International Journal of Cultural Property* 16(2): 182–187.

Wilmer F (1993) *The Indigenous Voice in World Politics: Since Time Immemorial*. London and New Delhi, India: SAGE.
World Bank (1991) *World Data and Statistics*. New York: United Nations World Bank.
Yeh ET (2007) Tibetan indigeneity: Translations, resemblances, and uptake. In: de la Cadena M and Starn O (eds) *Indigenous Experience Today*. Oxford and New York: Berg, pp. 69–97.

Author biography

Kim TallBear is Assistant Professor of Science, Technology, and Environmental Policy at the University of California, Berkeley. She is also a Donald D. Harrington Fellow in Anthropology at University of Texas, Austin in 2012–2013. She studies how genomics and ideas of race and indigeneity are co-constituted. She is currently also doing an ethnography of indigenous bio-scientists, examining how they navigate different cultures of expertise and tradition, both scientific communities and tribal communities. She is a member of the Sisseton-Wahpeton Oyate, a Dakota tribe in South Dakota and a descendant from the Cheyenne and Arapaho Tribes of Oklahoma.