



Indigenous biospecimen collections and the cryopolitics of frozen life

Journal of Sociology

2015, Vol. 51(1) 63–80

© The Author(s) 2015

Reprints and permissions:

sagepub.co.uk/journalsPermissions.nav

DOI: 10.1177/1440783314562316

jss.sagepub.com



Emma Kowal

Centre for Citizenship and Globalisation, Deakin University, Australia

Joanna Radin

Program in History of Science and Medicine, Yale University, USA

Abstract

In the mid-20th century, scientists began to collect and freeze blood samples for a range of purposes. This article considers the broader implications of scientific freezing for conceptions of time and life by drawing on empirical research with scientists associated with a large collection of samples assembled from Indigenous Australians in the 1960s. We first review some key critiques of cryopreservation posed by Indigenous scholars and by science and technology studies. We then propose ‘cryopolitics’ as a concept to express the various political, ethical and temporal conundrums presented by the practice of freezing. We frame cryopolitics as a mode of Michel Foucault’s biopolitics. If biopolitical assemblages make live and let die, cryopolitical ones reveal the dramatic consequences of mundane efforts to make live and *not let die*. In our case study, we argue that frozen blood vacillates between two cryopolitical states, ‘latent life’ and ‘incomplete death’. Samples seen as latent life cannot be destroyed; samples understood as incomplete death require destruction. A state of incomplete death can be resolved through the return of blood samples to the Indigenous groups they were collected from, a process that has occurred in North America. Our cryopolitical analysis suggests another potential resolution: reviving a form of latent life aligned with futures envisaged by Indigenous communities themselves.

Keywords

Australia, collection, cryopreservation, freezing, Indigenous, science

Corresponding author:

Emma Kowal, Centre for Citizenship and Globalisation, School of Humanities and Social Sciences, Deakin University, Victoria 3125, Australia.

Email: emma.kowal@deakin.edu.au

The hum of fridges and freezers is a sound common to scientific institutions the world over. The average laboratory contains many devices for cooling: cold rooms maintained at 4 degrees Celsius, walk-in freezers at -20 degrees, laboratory refrigerators for easy access to thawing samples, and liquid nitrogen freezers that cool to -196 degrees and require personal protective equipment to use. These variations of cooling act to slow down the life processes of biological substances and prevent decay. Samples of blood, saliva, surgically excised tissue, placenta, and many other pieces of human and non-human organisms are now collected and frozen to enable analysis by scientists along an ever receding horizon of future time.

This article considers the implications of scientific freezing by focusing on certain frozen samples increasingly associated with controversy: those collected from people self-identified or marked as native, Aboriginal or Indigenous. We focus on blood samples collected from Aboriginal and Torres Strait Islander¹ communities in Australia and, in particular, one large sample collection first formed in the 1960s and currently held in various freezers at a major Australian university. We use this case to illustrate two different forms of 'cryopolitics', a theoretical frame we offer to analyse the effects of cryo-preservation on time and life.

The ability to freeze cells so that they could be successfully thawed became possible in 1949 when it was discovered that adding glycerol prevented irreparable cell damage (Landecker, 2005, 2007; Parry, 2004; Radin, 2013). By the 1960s, mechanical laboratory freezers and techniques for mobile cold storage using dry ice facilitated the accumulation of blood samples from hard-to-reach places. Researchers travelled the world collecting samples for transportation to the laboratory for immediate analysis, and for storage for future analysis. In human biology, an important boost to this global effort came with the International Biological Program (IBP).

The IBP was an international effort to take stock of the biosphere. Its Human Adaptability (HA) section was one of seven and the only one concerned with humans. Running from 1964 to 1974, the IBP-HA functioned as an umbrella for coordinating the effort of human biologists to collect hundreds of thousands, if not millions, of blood samples from Indigenous and non-Indigenous people in dozens of countries (Radin, 2012). The IBP-HA sought to place the study of humans in the context of the biosphere, enabling global science to ensure 'the future of man in his environment' (Worthington, 1975: 52). This was seen as an urgent task in the face of great change, as expressed by IBP organizers in 1966:

At this stage of human history vast changes are affecting the distribution, population density, and ways of life of human communities all over the world. The enormous advances in technology make it certain that many communities which have been changing slowly or not at all will relatively soon be totally transformed. (Collins and Weiner, 1977: 3)²

The comparative study of humans in their environments was agreed upon as the best strategy for understanding and preparing for these transformations. IBP-HA organizers felt their studies had 'enduring value' through providing 'important base-line and reference data' with which to measure the effects of cultural, social, demographic and technological change. Obtaining this base-line data required the creation of a massive global

archive of human bio-variability. As of 1974, 800 field visits had taken place under the auspices of the IBP with over 1.25 million individuals measured and/or sampled (Collins and Weiner, 1977: 14).

Of special interest to human biologists involved with this comparative project were 'simple societies still living under difficult 'natural' conditions'. Groups now known as 'Indigenous' 'would provide object lessons of the actual adaptability achievable by man when relying largely on his biological endowment' (Collins and Weiner, 1977: 3). These scientists believed that Australian Aboriginal populations, among other Indigenous groups, would soon cease to live as 'traditional' hunter-gatherers. Store-bought food and other European innovations would change the physiology of 'simple societies' forever, leaving open only a small window of scientific opportunity to collect vital biological and genetic information (Collins and Weiner, 1977: 4). The bodies of members of such groups were thought to contain unique markers of adaptability and heredity that could be beneficial for solving current and future health problems faced by all human populations (Radin, 2013). Those involved with the salvage projects of the IBP-HA sought to preserve this biological knowledge, and the actual bodily material it derived from, before it was too late.

Australia contributed eight projects to the IBP-HA, of which two concerned Indigenous Australians. A major figure in the Indigenous projects was Robert (Bob) Louis Kirk, an English biologist who settled in Australia in the 1950s where he began the coordinated collection of samples from Indigenous communities across Western Australia, the Northern Territory and Queensland. Kirk's lab was an important international node of the IBP-HA, receiving samples from collaborators around the globe.

Kirk's samples were initially used to map regional variation in blood proteins that provided clues to the long history of human migration. On his retirement in 1987, the collection was passed on to departmental colleagues who used it for similar research and, as genomic techniques advanced, extracted DNA from a few hundred of the samples. Around the same time, in the 1990s, certain scientists became concerned that using the samples for genomic and other purposes raised ethical concerns. Eventually, the Director of the Institute decided the collection should be closed to scientific use. This period is our focus. Drawing on interviews with scientists and laboratory technicians, we consider what happened to the collection as its identity shifted from that of a scientific resource to an ethical problem.

In our usage, 'ethics' describes normative paradigms for guiding practice supported by the discipline of bioethics. Rather than seeking to improve or amend existing normative paradigms, we consider 'ethics' as an object of our study, building on key anthropological critiques (Brodwin, 2000; Hoeyer, 2005; Ong, 2011; Petryna, 2005; Scheper-Hughes, 1995). Shifting ethical frameworks for research involving Indigenous communities form the background to the story we tell here. In turn, the cryopolitical analysis we propose offer insights into these shifts and points to where they might be heading.

At the time of the IBP, despite resistance from several scientists who questioned the assumptions underlying such salvage projects, the collection of samples from Indigenous peoples was considered by those involved to be a public good (Radin, 2013). But by the 1980s, Indigenous critiques of 'western' research had begun to circulate widely and by the 1990s threatened to derail scientific projects predicated on the use of Indigenous

body parts (Smith, 2012). The Human Genome Diversity Project (HGDP) became a flash point for critiquing what Indigenous scholars and certain cultural anthropologists considered to be oppressive research practices (Liloqula, 1996; Lock, 2001; Mead, 1996). The HGDP was a global effort to sample human genetic diversity that recapitulated the epistemological basis of the IBP in many ways (M'charek, 2005; Reardon, 2005; Santos, 2002). Indigenous groups worldwide called it the 'vampire project' and saw it as an exemplar of 'biocolonialism', which pointed to the potential for exploitation of Indigenous peoples' biological resources for material gain (Harry, 2009; Mead and Ratuva, 2007; Indigenous Peoples Council on Biocolonialism, 2000; Reardon, 2005).

These critiques ran in parallel to emerging efforts to reclaim Indigenous human remains held in museums and research institutions (Fforde et al., 2002; Kakaliouras, 2012). Throughout the 19th and early 20th century, bodies and skeletons of Indigenous people were obtained, often through grave-robbing or other dishonourable means, by doctors, anatomists, anthropologists and farmers and sent to the museums and universities of colonial and metropolitan centres (MacDonald, 2010; Roque, 2010). From the 1980s, members of Indigenous communities living in Australia, North America and New Zealand began to advocate for the repatriation of these remains (Fforde, 2004; Fine-Dare, 2002). They argued that human (or 'ancestral') remains should be seen as cultural heritage and cultural property, rightfully owned by communities or families with responsibilities to ensure an appropriate burial. Such claims resulted in legislation and funding that facilitated the return of many remains within and across national borders, a process that continues today.

As the 1990s progressed, scientists working on Kirk's collection began to worry that the frozen blood samples in their possession were implicated in the repatriation movement. These nascent concerns foreshadowed two cases in the last decade where Indigenous groups in the Americas have drawn on the arguments of repatriation to reclaim blood samples originally collected for scientific research. The more recent case involves members of the Havasupai, a Native American tribe in Arizona who objected to specific secondary uses of their samples by researchers from Arizona State University (ASU). After a long legal battle the tribe received a settlement and 151 remaining samples were returned to the Havasupai in a ceremony conducted by tribal elders over the freezer in the ASU laboratory (Harmon, 2010).

In the second case, that of the Yanomami, blood samples collected in the 1960s and 1970s and held at various laboratories in the United States were claimed on cultural grounds amidst fierce controversy about allegedly unethical practices of the researchers involved (American Anthropological Association, 2002; Borofsky, 2005; Tierney, 2001). Yanomami and their advocates argued that frozen blood samples held in the United States prevented their deceased donors from successfully departing the world. As reported in *Science* magazine, the Yanomami requested that samples be returned. Shamans and elders would ritually destroy them to ensure the separation between the world of the living and the dead (Couzin-Frankel, 2010). Yanomami spiritual beliefs are far more complex and heterogeneous than depicted in the international media. However, the *Science* article suggests that for the Yanomami, the persistence of preserved blood samples was troubling because they appeared to exist in a liminal state between life and death.

Cryopolitics

Indigenous people are not alone in their concern for the biosocial effects of freezing. Experts from disciplines ranging from bioethics and law to philosophy and history to anthropology and sociology have sought to understand the implications of making frozen bodily extracts – be they Indigenous blood samples or cosmopolitan gametes and embryos – persist through time (Anderson, 2008; Franklin, 2007; Haraway, 1997; Rabinow, 1999; Rheinberger, 1997; Thompson, 2005). Among the vexing questions raised by cryotechnologies (including ethical questions of ownership, benefit, justice, and personhood) is that of life itself. What is the status of tissues that were once living inside bodies, and can be made to live again, at least *in vitro*?

Hannah Landecker's work is important here. She argues that the mundane technology, the humming freezer, makes biological material mobile through time and space. This mobility is the foundation of modern biological science, enabling assisted reproductive technologies, stem cell science, cloning, and much else. The apparent ability to stop and start time, preserving and reanimating cells at will, has changed what it means to be biological. '[T]o be biological, alive, cellular' is now to be 'suspendable, interruptible, storable, freezable in parts' (Landecker, 2005).

Here we need to pause to notice the intermingling of the concepts 'biological', 'alive' and 'cellular' in Landecker's formulation quoted above. Since cell culture technologies have been developed, cells metabolizing, growing and reproducing in culture medium are widely considered to be living matter. Although Landecker uses 'living matter' and 'biological matter' interchangeably, the category of 'human biological matter' is a larger category than living cells. For example, 'biological matter' could include tissues that do not have cells (e.g. plasma) or that are not living (e.g. tissue sections on slides).

On a practical level, the distinction between living cells (or frozen cells that could be made to live again) and biological matter that is not considered to be technically living at any given point in time is important. Extending the label of 'life' to biological material that cannot metabolize, grow and reproduce may imply that frozen blood samples could be readily thawed to produce living cells, or even clone an organism whose genetic sequence is encoded in preserved DNA. It is not yet clear whether the sample collection of interest to this article contains 'life' in this sense. Nearly all samples were collected without the intention of producing immortalized cell cultures and cannot at present be used to do so. The possible exceptions are a few dozen cell cultures currently immersed in liquid nitrogen deep within a freezer, for which viability has not been established.

Regardless of whether the sample collection, or a fragment of it, can be agreed upon as living, this discussion highlights a potential disjuncture between the natural sciences and the social sciences in their usage of the concept of 'life'. Scientists who read, for example, Rose's (2001: 13) claim that life was 'molecularized' beginning in the 1930s may conclude that social analysts of the life sciences use the term 'life' loosely. Living cells are made up of molecules, but individual molecules themselves cannot easily be thought of as living.

The point to take from this discrepancy is that social scientists see the definition of life as a social phenomenon subject to continual revision as new technologies and practices emerge (Fischer, 2003; Franklin and Lock, 2003; Helmreich, 2011; Waldby and Squier,

2003). The approach of some social scientists to the question of life is expressed in Helmreich's concept of 'form of life' (adapted from Wittgenstein). Forms of life are 'cultural, social, symbolic and pragmatic ways of thinking and acting that organize human communities' (Helmreich, 2009: 6; see Helmreich and Roosth, 2010). Historians have observed, for example, that the notion of life as genetic code – and more broadly as information – was ascendant in 20th-century science, social science and popular culture (Fox Keller, 2000; Nelkin and Lindee, 2004). Within this scheme, DNA is seen to contain the essence of life. This is an example of a form of life as opposed to a life form. Forms of life shape how 'life' is understood and experienced (the conception of life as DNA code), while 'life forms' are living beings (cells and organisms containing DNA). Both forms of life and life forms mutate as they are exposed to new technologies and fields of scientific knowledge (Helmreich, 2011).

The arguments that are made in this article concerning the 'latent life' of blood samples respond to these debates about life's limits in the 20th and 21st century. Our conception of latent life is intended as a 'form of life' – a way of thinking and acting that organizes human communities – rather than necessarily a life form. The act of freezing blood in the mid-20th century conjured novel forms of life that reorganized 20th-century human biology, and may be reorganizing attitudes among Indigenous communities in the 21st century.

We wish to focus here on one aspect of the form of life invoked by the suspendable, interruptible, storable, freezable human; the perpetual deferral of death. We propose 'cryopolitics' as a theoretical frame to analyse the form of life brought into existence by the practice of freezing. Cryopolitics is a mode of Foucault's biopolitics (Foucault, 2003; Rabinow and Rose, 2006), which describes the intensification of the management of life at individual and population levels since the early 19th century. In his famous formulation, Foucault contrasted concentrated sovereign power that seeks to 'let live and make die' with a distributed biopower that seeks to 'make live and let die' (Foucault, 2003). Public health measures that sought to maximize the health of the population (e.g. demography, vaccination, social insurance) are among those paradigmatic biopolitical strategies that arose in the 19th century and persist into the 21st. Scholars who argue that 21st-century life has become 'molecularized' similarly recognize new forms of 'molecular biopolitics', with measures to optimize individual and population health now aimed at identifying susceptibility and enhancing life forms at cellular and genomic levels (Rose, 2007).

Artificial freezing, which also has its roots in the 19th century, has become a critical tool of 21st-century biopolitics.³ We propose that cryopreservation produces a specific form of molecular biopolitics. If biopolitical assemblages make live and let die, cryopolitical ones reveal the dramatic impacts of mundane efforts to make live and *not let die*. Cryopreservation of a range of human and non-human tissues – from gametes to blood to whole organisms – has come to be valued by scientists because it promises to perpetually defer the death of individuals, populations or species, transforming life itself in the process.⁴ The use of artificial cold as a means of deferral makes temperature work as a temporal prosthesis, promising it is never too late to revive an individual, race, or species. In the specific case of 20th-century human biologists, scientists responded to the perceived endangerment of Indigenous peoples by freezing their genetic material, creating a form of life without death.

Latent life

Below, we draw on the management of Kirk's collection to illustrate how cryopolitical life vacillates between two states we elaborate here: 'latent life' and 'incomplete death'. 'Latent life', a concept used by mid-20th-century cryobiologists and developed by Radin, is oriented towards the future potential of preserved samples to yield life.⁵ The term was used first by Alexis Carrel, a founder of the practice of tissue culture, and popularized by Basile Luyet, a founder of the discipline of cryobiology in the mid-20th century, to describe a state between life and death (Radin, 2013). Latency is what happens to temporality when life becomes plastic. When linear timescales no longer apply, when the ability to bring biological material 'back to life' in another time is made possible, the potentiality that would otherwise ebb with the passing of time is preserved and even intensified (Landecker, 2007; Taussig et al., 2013).

Existing between states, and within bits of bodies, in the frozen form latent life becomes highly mobile – across space and across time – offering infinite potential for knowledge production using the novel technologies of the imagined future. Here, we extend Radin's discussion of latent life as a zone of potential, arguing that, in the realm of cryopolitics, latent life may be understood to transgress the boundaries of accepted bioethical practice when it is interpreted as life *without* death. From the perspective of many scientists, the potentiality of latent life is often incompatible with death, which may be unacceptable to certain groups with stakes in the management of frozen biospecimens.

Samples collected for the IBP-HA illustrate these varied properties of latent life. They were collected with the explicit belief that they preserved biological knowledge of populations that would soon vanish, either from disease, assimilation, or both. Freezing pieces of these thought-to-be endangered groups would allow them to be mobilized by future scientists for purposes 'as yet unknown' (Radin, 2014). Along with their focus on obtaining knowledge about human variation in the short term, scientists shared a pessimistic view of the survival of Indigenous peoples and an optimistic orientation towards the future of innovation over the long term.

These and other kinds of frozen samples have come to be emblematic of life without death. However, latent life is not distributed equally across all samples. A case in point is the recent distinction some scientists have begun to make between 'stored' samples and 'biobanked' samples. Stored samples become 'biobanked' when they are labelled, annotated, connected with phenotypic information and a data set for analysis, all features that augment the latent life of the samples. After that point, samples should be managed so that, ideally, they are never depleted (Brooks, 2013). In this conceptualization, stored samples may be destroyed in the face of restricted freezer space or tight budgets, but biobanked samples should endure indefinitely. This would mean that scientists are encouraged to use existing data sets produced from biobanked samples (such as genome sequence data) rather than receive a portion of the actual, original sample. It would be expected that any data produced from the sample itself would be returned to the biobank and made available to other scientists, further enhancing the latent life of the sample.

Samples also differ in the kinds of labour required to produce and maintain latent life. In the wake of Indigenous critiques of research outlined above, the maintenance of

Indigenous samples requires social as well as scientific work. As Kowal has argued elsewhere, in Australia, ‘affective networks’ (personal relationships sustained by emotional labour) between scientists, donors, ethics committees and funding bodies must be perpetuated if the latent life of samples is to remain accessible to science (Kowal, 2013).⁶ We will see later that Kirk’s abrupt withdrawal from the collection of Indigenous samples impacted the potentiality of this latent life.

Incomplete death

The uncertain fate of Kirk’s collection today illustrates that the biophysical state of latent life as potential also has a perceptual double: ‘incomplete death’. We draw here on Deborah Rose’s concept of the ‘zone of the incomplete’ (Rose, n.d.), a term inspired by the Christian belief that dead humans are ‘suspended, awaiting resurrection’. She develops her argument from another iteration of cryopolitics; the use of cryopreservation to save non-human species threatened with extinction. In the realm of non-humans, biologists employ a range of tactics to preserve endangered species, from captive breeding programs that mobilize frozen gametes between zoos and wildlife reserves to ensure sufficient genetic diversity, to ‘frozen zoos’ where blood, gametes or whole animals are frozen to preserve the possibility that endangered or extinct species might be brought back to life (‘reanimated’) in the future by genetically engineering animals (Friese, 2013).

Rose argues that while these various ‘de-extinction’ efforts claim to reverse death, they instead suspend both death *and* life. For instance, species that are kept alive through captive breeding programs can lose the social behaviours integral to their survival (van Dooren, 2014). Zoos have long been seen as producing a lesser form of animal life and diverting attention from threatened animal habitats. Frozen zoo projects take this to its logical extreme, supplanting actual living animals and instead preserving their parts. Matthew Chrulew argues that as a species becomes more endangered, animal life is made increasingly abstract, as scientists prioritize ‘species over individuals, code over life, genes over bodies’ (Chrulew, 2011). Alongside accounts of such an impoverished form of life, Rose argues that the ‘zone of the incomplete’ is itself also an impoverished form of death (Rose, n.d.). Efforts to preserve life and cheat death through freezing may suspend both life and death, erasing the potential that death may offer.

The distinction between latent life and incomplete death can be illustrated through different actors’ competing assessments of Indigenous biospecimens, discussed earlier. Viewing such blood samples as latent life orients users towards their future potential. Viewing the same samples as incomplete death focuses on the relations to the past that are foreclosed or undermined by their persistence in the frozen state. Certain members of Indigenous communities have been outspoken in their rejection of the latent potential of samples to produce knowledge prized by scientists. Instead of casting their minds towards future promise, some link samples to the past, recognizing them as coextensive with the bodies of deceased kin (Reardon and TallBear, 2012).⁷ Human remains held in museums – preserved through freezing or by other means – are the paradigmatic case of ‘incomplete death’: repatriation has been considered justified when it restores the trajectory of materials such as bones, wrongly interrupted on their journey towards death. Human biological material removed from living bodies may be becoming ‘repatriable’ in

the same way, at least when such bodies are marked as Indigenous.⁸ The freezer emerges from this account as a time machine (Radin, 2012) and a life machine, making things live and deferring death through time.

In what follows, we hope to illustrate the utility of a cryopolitical framework. Latent life and incomplete death are closely linked: objects that maintain the potential for life necessarily stave off death. However, while both are cryopolitical states, a perspectival shift of emphasis from latent life to incomplete death marks a very different human relationship to biological matter, with drastic implications for samples.⁹ Samples understood as latent life cannot be destroyed; samples understood as incomplete death demand destruction.

From latent life to incomplete death

The futuristic design of the John Curtin School of Medical Research at the Australian National University, Canberra, juxtaposes a zigzagging glass façade with massive concrete panels depicting scientific symbols. The new building, completed in 2012, obscures the view of the original 1960s building that has been progressively demolished to make way for it. Similarly, the basement freezers of the new building conceal the vital legacies of an older era of biological research. Among the millions of samples contained in freezers of various temperatures across the institute are 100,000 samples from around the globe accumulated by Bob Kirk, including a subset of around 7000 collected from Indigenous Australian communities.

The story of this biospecimen collection is a chapter in the larger story of 20th-century human biology.¹⁰ One way to understand the Cold War promise of latent life and its more recent undoing is through the biography of Bob Kirk. He was born in 1921 in the Midlands of England, the last of three boys in a lower middle-class family. Kirk was educated at boarding school before studying chemistry at university. His progressive politics moved him to register as a conscientious objector in 1939, even though he was already exempt for service as a science undergraduate. This in turn led to an invitation from the brilliant and radical biologist Lancelot Hogben to complete graduate studies at Birmingham University.

Kirk took up an opportunity to join the zoology department at the newly established University of Western Australia in 1951 and settled in to teaching and developing his genetic research program on flies and snails. An interest in human genetics arose by chance when his secretary exhibited an extreme sensitivity to potassium cyanide fumes emanating from his lab. He went on to investigate the genetic basis of this trait (Kirk, n.d.). With his interest in human genetics piqued, he began collaborating with Dr Gerard Vos from the King Edward Memorial Hospital on blood group research. This was a turning point in Kirk's career and the origin of what would become his life's work: studies of genetic diversity in Indigenous Australian and Papua New Guinean populations. This watershed was partly technological: Kirk and Vos began to use starch-gel electrophoresis, a technique that Kirk recalled having 'turned out to be immensely valuable, and a new world of anthropological genetics was opened up for us' (Kirk, n.d.). This new world of human biological research was itself reliant on advances in mobile freezing technology (Radin, 2013).

At the same time, Kirk recognized untapped potential for research in the Aboriginal population of Western Australia, a vast state occupying half of the Australian continent with many areas 'remain[ing] largely undisturbed, except by pastoral activities' (Kirk, n.d.). Collecting and analysing blood samples from Aboriginal people in the Kimberley and the Western Desert regions became his main research activity over the subsequent decade. By the time planning began for the IBP in the early 1960s, Kirk was in an excellent position to contribute. He was sought out by the Australian representative on the central IBP-HA committee, R.J. Walsh – himself a crucial node in global efforts to analyse blood – to lead a major study of human adaptation among Australian Aborigines (Walsh, 1974).

Kirk's collection expanded exponentially after he moved to the John Curtin School of Medical Research at the Australian National University in 1967. There, he assembled a state-of-the-art starch-gel laboratory that occupied the bench space of two labs. The laboratory was the biggest and best facility of its kind in the world.¹¹ It attracted 'a constant stream of samples' from researchers collecting in Asia and the Pacific, Eurasia, the Middle East and beyond.¹² A corresponding stream of boxes of Canadian potato starch kept the starch-gel electrophoresis factory running, rapidly producing multiple blood group and protein results. This information was used to plot the geographical distribution of genetic markers across the region. As new statistical methods were developed, Kirk worked with colleagues to create phylogenetic trees that depicted probable evolutionary relationships between different human populations (Kirk, n.d.).

Despite his initial investment in innovative starch-gel electrophoresis techniques in the late 1960s, as the 1970s and 1980s progressed, Kirk's colleagues recall that they felt he was 'left behind' by rapid changes in DNA technology and in the reorganization of Australian universities. His meticulous methods of analysis and mapping were less valued as statistical modelling and new laboratory methods emerged. The early stages of the neoliberalization of the university were equally difficult for him; the army of support staff in the institute was gradually attenuated, including the typing pool, three staff photographers, and the large workshop that made all lab equipment and furniture to order. A former colleague compared Kirk to the main character in the 2011 movie *The Artist*, a silent film star who could not accept the transition to sound. 'It was like that. Bob didn't need to make the transition. He wouldn't admit it but DNA was too hard. It was really difficult for the old guys. They lost their secretaries, they had to start using computers and the techniques of protein electrophoresis were overtaken by molecular genetics.'¹³ Kirk's increasing displacement from the laboratory environment had implications for the sample collection he had assembled, contributing to their shift from latent life to incomplete death.

In 1987 Kirk retired and took up an Honorary appointment with the Anthropology and Archaeology department. There, he built on relationships with colleagues he had developed over the previous two decades. To them, Kirk offered a useful genetic supplement to their (largely cultural) knowledge. Untroubled by the increasing sophistication of statistical methods, Kirk enjoyed participating in broad discussions of population histories. Yet by the early 1990s, Kirk had tired of even these conversations, leaving the university completely and setting up a small publishing business in the rural town of Gundaroo, north of Canberra.

Back at the lab, his former colleagues found him difficult to engage after his retirement. When asked about the collection, he gave only vague answers or deflected questions. Most samples were not physically collected by Kirk himself but by government officials, medical officers, hospital pathologists, and researchers outside the university. Kirk was the only person who had known them and how to contact them. His unwillingness to answer questions, or link current staff with those who had directly collected samples, created challenges through the 1990s. Although samples continued to be used by research staff after Kirk's retirement, and DNA was extracted from several hundred of them, this became increasingly difficult without him to vouch for the samples and the manner in which they were collected.

By the mid 1990s, the possibilities for the use of the collection were affected by global shifts in ethical norms for human subjects research, in particular research involving Indigenous peoples. The Human Genome Diversity Project (HGDP, discussed in the introduction) raised the ire of Australian Indigenous activists just as the first Indigenous-specific ethical guidelines were being produced (NHMRC, 1991). Australian Indigenous leaders refused to participate in the HGDP and no samples were collected in Australia (Anonymous, 1994). Regardless, the HGDP cast a long shadow over the use of Indigenous samples at precisely the time when the paradigm of 'Indigenous research ethics' was gaining ground and changing expectations about who could contribute to shaping the goals and conduct of research. It had become clear that continuing to use the samples in their current state posed ethical challenges, and by the end of the 1990s Kirk's collection was closed – but not destroyed – by the head of the institute. The absence of formal informed consent, which had since become accepted as best practice for human subjects research, was the most obvious problem. It left the institute highly vulnerable to critique in an environment of increasingly global Indigenous resistance to involvement with genetic research.

This was a difficult time for the current guardian of the collection (who had taken over responsibility when Kirk retired). PhD students who were using the collection had to abandon their projects mid-way through; promising honours theses went unpublished. Using the cryopolitical terms we are proposing, perceptions of the samples shifted irrevocably away from promising latent life and towards incomplete death. Kirk's abandonment of the collection contributed to this shift. His displacement from the lab and the erosion of his affective ties with his network of sample collectors and donor communities was a major factor. In his absence, the latent life of the samples could not be maintained as the political and ethical environment evolved outside the freezer, highlighting the importance of maintaining affective ties as part of the broader labour of maintaining latent life over multiple generations (Kowal, 2013).

A sense of this shift is evident in recent comments made by the head laboratory technician recruited by Kirk in the early 1970s. He was responsible for maintaining the collection from when he started working at the lab after finishing university until his retirement 35 years later. He recounted his mixed emotions at the time the collection closed down. 'I didn't know what I should do,' he told me. 'Do I quietly take it out and autoclave it all [destroy it through vaporization]? Do people want it back?' The identity of the samples as 'Indigenous' abruptly became significant and unsettling for lab staff. 'From a management point of view its identity [of the samples] is well hidden,' he said,

'Aboriginal is hardly ever mentioned [on the lists of samples]. But all the names ...' he trailed off, referring to the detailed lists of names and other information of people who contributed samples (called 'bleeding lists' by scientists) kept in filing cabinets elsewhere in the building. The lists of names, kin and language groups that gave the samples their provenance also irrevocably marked them as 'Indigenous', even if their material presence, boxes of glass tubes with aluminium stoppers and newer plastic cryovials, seemed no different from any of the thousands of other such tubes in the lab.

At this point, no Indigenous Australians had made any claims on the samples. Rather, the shifting political context of Indigenous rights and the changing status of human remains in museums (discussed in the opening section) had wider effects on other kinds of biological matter, including frozen samples, which made those who might use such materials wary. No longer simply a valuable raw material of science, the collection was now also subject to a set of potential interests located beyond the laboratory. Scientists connected to the collection could not articulate what had happened to the samples except to reach a general agreement that the collection should be maintained but no longer used for scientific study.

The impulse to dispose of the samples – to 'autoclave it all' – was an understandable response to this uncertainty. Terminating the material presence of the samples offers an obvious way to solve the ethically ambiguous predicament they presented. For another scientist associated with the collection, however, this suggestion was untenable and tantamount to 'scientific vandalism'. Scientists' attitudes towards cryopreserved collections, which are often compared to unique and invaluable archives, tends to prohibit the destruction of latent life and requires that death remain a perpetually receding horizon. But this destructive impulse could also be interpreted as an intuition on the part of the lab technician that the values guiding the appropriate use of such materials had begun to shift from the domain of latent life to incomplete death.

The end(s) of cryopolitics

The shift perceived by scientists in the late 1990s had mutated the samples towards incomplete death, effectively barring anyone from accessing the latent life of the collection (Kowal et al., 2013). Today, the future management of the collection remains fraught for the institution that holds them. The cryopolitical framework presented in this article suggests that the tension between the potential of latent life and the angst of incomplete death must be resolved in one of two ways. Either the latent life of the samples can be harnessed in ways that generate knowledge to benefit those from whom this material was derived, or the samples should be stewarded towards a satisfactory death.

This second possibility would follow the examples of the Havasupai and Yanomami, who have requested the repatriation of samples so they can receive mortuary rites. Indigenous Australian communities or families may share the view that blood samples collected from a deceased relative and held in a freezer should be returned to the community of origin to complete the death interrupted by cryopolitical life. If Indigenous communities express these beliefs and desires, samples may be returned. Outside the freezer, they would quickly degrade, and would likely be buried or otherwise disposed of.

It is striking that both repatriation of samples and autoclaving by scientists result in the same material outcome – the depletion or destruction of samples. The destruction of samples by either Indigenous people or scientists violates a tacitly accepted scientific imperative to ensure the persistence of biobanked samples. However, the two modes of destruction are grounded in very different cryopolitical states. Destruction by scientists would be a defensive reaction to their reduced ability to access latent life and an effort to manage the confusion and anxiety this produces. Destruction by Indigenous people would constitute the fulfilment of incomplete death.

An alternative generated by our cryopolitical framework is for the latent life of samples to be recast in ways that are perceived by Indigenous people to offer possible benefits. As the long shadow of the HGDP slowly recedes, some Indigenous scholars have expressed interest in the capacity of genetics to contribute to Indigenous health. Epigenetics, in particular, has attracted attention. As an explanation for how stressful life experiences effect the expression of genes across the life course and across generations, it *potentially* offers a powerful biological basis for trans-generational trauma (Bombay et al., 2009; Brockie et al., 2013; Hopkins, 2011).¹⁴ Advocates of this approach argue that samples collected in the mid-20th century could be used as the basis of comparative research to investigate the biological effects of colonial trauma over time and space.

In effect, this would shift samples back from the domain of incomplete death to latent life, but a form of latent life that is radically reconfigured. The latent life of samples collected in the mid-20th century and preserved in freezers was initially grounded in their ability to produce ‘as yet unknown’ scientific knowledge in the indefinite future for the benefit of western notions of human life (Radin 2014). This alternative form of latent life, at least as it has been proposed, would be a distinctly ‘Indigenous’ form, oriented towards Indigenous futures under Indigenous control, futures in which the potential of samples could be used to explore the ramifying effects of past harms (Clifford, 2013). It is yet unclear what form such futures would take, and whether Indigenous people stand to benefit more from the productive potential of samples, from completing the death foreclosed by latent life, or from pushing science to embrace new forms of life.

Funding

Emma Kowal is supported by an Australian Research Council Discovery Early Career Researcher Award (DE120100394).

Notes

1. Aboriginal and Torres Strait Islanders is the currently accepted term for the Indigenous peoples of what is now the Australian nation. In this article the term ‘Aboriginal and Torres Strait Islanders’ is used interchangeably with ‘Indigenous Australian’ peoples. ‘Indigenous’ is also used to refer to Indigenous peoples internationally. The research on which this article was based was approved by the Human Research Ethics Committee of the Australian National University. Some details of interviewees have been changed to protect their identity.
2. It is important to distinguish the IBP from earlier kinds of scientific interest in human difference popularly known as ‘race science’. The 19th century saw a ‘hardening’ of racial categories and a proliferation of scientific interest in racial types. Later in the 19th century, Darwin’s evolutionary theory was harnessed as ‘Social Darwinism’ to explain the supposed superiority

of some racial groups over others, see Stocking (1968) and Stepan (1982). This form of knowledge about race was linked to eugenics, anti-miscegenation laws and, ultimately, the Holocaust. In the wake of the Second World War and revelations of Nazi atrocities, the idea of biological race was decidedly rejected by the vast majority of scientists, see Montagu (1972). In its place, the 'modern synthesis' in physical anthropology sought to delineate clinical variation among and between populations, rather than absolute differences between races, see Washburn (1951).

3. National biobanks that seek to act on frozen, decorporealized pieces of citizens in the name of a healthy population and a blossoming bioeconomy offer some of the clearest examples of molecular biopolitics. See for example, Gottweis and Petersen (2008), Waldby (2009).
4. There are, of course, other means to preserve organisms and tissues (formaldehyde, paraffin) and to keep organisms literally alive indefinitely through artificial respiration. In fact, the development of artificial respiration for polio patients in the 1950s raised new bioethical questions about preventing death, and connections between that debate and cryopolitics would be fruitful to pursue in future work. Thanks to an anonymous reviewer for raising this point.
5. Latent life is one aspect of a broader discourse of science as future potential. See Fortun's (2008) concept of promissory genomics and Taussig et al. (2013) on potentiality.
6. That article draws on the concept of 'biovalue', but the same argument could be applied to 'latent life'.
7. As Anderson (2008) has noted, scientists may be equally troubled by the stubborn inalienability of samples that retain traces of donor personhood.
8. Indigenous people in Canada, for example, have argued that biological samples should be considered 'on loan' to researchers and eventually be returned (see Arbour and Cook, 2006; Canadian Institutes of Health Research, 2007).
9. We do not consider latent life and incomplete death to be dichotomous ontological states that samples switch between, but 'forms of life' as explained earlier. Particular samples can simultaneously be considered latent life by one person or group and incomplete death by another.
10. This is a story that is just beginning to be told, but can be glimpsed in the work of: Sommer (2010), Anderson (2008), papers included in Lindee and Santos (2012) and Little (2009).
11. According to a former staff member. Interview, 23 April 2012.
12. Interview, 3 May 2012.
13. Interview, 23 April 2012.
14. One of us (EK) has heard Indigenous leaders from the United States, Canada, New Zealand and Australia discuss the promise of epigenetics in public talks, there is little yet published that makes this argument. The link between epigenetics and racial disparities in general has received much attention (see Kuzawa and Sweet, 2009).

References

- American Anthropological Association (2002) *El Dorado Task Force Papers*. Final report submitted to the American Anthropological Association Executive Board, 18 May.
- Anderson, W. (2008) *The Collectors of Lost Souls: Turning Kuru Scientists into Whitemen*. Baltimore, MD: Johns Hopkins University Press.
- Anonymous (1994) 'Concerns at "Vampire" Project', URL (consulted November 2014): <http://www.greenleft.org.au/node/7328>.
- Arbour, L. and D. Cook (2006) 'DNA on Loan: Issues to Consider when Carrying Out Genetic Research with Aboriginal Families and Communities', *Community Genetics* 9: 153–60.
- Bombay, A., K. Matheson and H. Anisman (2009) 'Intergenerational Trauma: Convergence of Multiple Processes among First Nations peoples in Canada', *Journal of Aboriginal Health* 5(3): 1–47.

- Borofsky, R. (2005) *Yanomami : The Fierce Controversy and What We Might Learn from It*. Berkeley, CA: University of California Press.
- Brockie, T.N., M. Heinzemann and J. Gill (2013) 'A Framework to Examine the Role of Epigenetics in Health Disparities among Native Americans', *Nursing Research and Practice*, URL (consulted November 2014): <http://www.hindawi.com/journals/nrp/2013/410395/>
- Brodwin, P.E. (2000) *Biotechnology and Culture: Bodies, Anxieties, Ethics*. Bloomington: Indiana University Press.
- Brooks, A. (2013) *Optimizing Bioprocessing and Sample Management Strategies to Achieve Successful Translational Research and Drug Development*. Sydney, Australia.
- Canadian Institutes of Health Research (2007) *CIHR Guidelines for Health Research Involving Aboriginal People*. Ottawa: Canadian Institutes of Health Research/Instituts de recherche en santé du Canada.
- Chrulew, M. (2011) 'Managing Love and Death at the Zoo: The Biopolitics of Endangered Species Preservation', *Australian Humanities Review* 50.
- Clifford, J. (2013) *Returns: Becoming Indigenous in the Twenty-first Century*. Cambridge, MA: Harvard University Press.
- Collins, K.J. and J.S. Weiner (1977) *Human Adaptability: A History and Compendium of Research in the International Biological Programme*. London: Taylor and Francis.
- Couzin-Frankel, J. (2010) 'Researchers to Return Blood Samples to the Yanomamo', *Science* 328(5983): 1218.
- Fforde, C. (2004) *Collecting the Dead: Archaeology and the Reburial Issue*. London: Duckworth.
- Fforde, C., J. Hubert and P. Turnbull (eds) (2002) *The Dead and Their Possessions: Repatriation in Principle, Policy and Practice*. London: Routledge.
- Fine-Dare, K.S. (2002) *Grave Injustice: The American Indian Repatriation Movement and NAGPRA*. Lincoln, NE: University of Nebraska Press.
- Fischer, M.M. (2003) *Emergent Forms of Life and the Anthropological Voice*. Durham, NC: Duke University Press.
- Fortun, M. (2008) *Promising Genomics: Iceland and deCODE Genetics in a World of Speculation*. Berkeley: University of California Press.
- Foucault, M. (2003) *Society Must Be Defended: Lectures at the Collège De France 1975–1976*. New York: Picador.
- Fox Keller, E. (2000) *The Century of the Gene*. Cambridge, MA: Harvard University Press.
- Franklin, S. (2007) *Dolly Mixtures: The Remaking of Genealogy*. Durham, NC: Duke University Press.
- Franklin, S. and M. Lock (eds) (2003) *Remaking Life and Death: Toward an Anthropology of the Biosciences*. Santa Fe: School of American Research Press.
- Friese, C. (2013) *Cloning Wild Life: Zoos, Captivity, and the Future of Endangered Animals*. New York: New York University Press.
- Gottweis, H. and A. Petersen (eds) (2008) *Biobanks: Governance in Comparative Perspective*. New York: Routledge.
- Haraway, D. (1997) *Modest_Witness@second_Millennium. FemaleMan_Meets_OncoMouse™*. New York: Routledge.
- Harmon, A. (2010) 'Indian Tribe Wins Fight to Limit Research of Its DNA', *New York Times* 21 April.
- Harry, D. (2009) 'Indigenous Peoples and Gene Disputes', *Chicago-Kent Law Review* 84(1): 147–89.
- Helmreich, S. (2009) *Alien Ocean: Anthropological Voyages in Microbial Seas*. Durham, NC: Duke University Press.

- Helmreich, S. (2011) 'What Was Life? Answers from Three Limit Biologies', *Critical Inquiry* 37(4): 671–96.
- Helmreich, S. and S. Roosth (2010) 'Life forms: a keyword entry', *Representations* 112(1): 27–53.
- Hoeyer, K. (2005) 'Studying Ethics as Policy: The Naming and Framing of Moral Problems in Genetic Research', *Current Anthropology* 46(suppl.): 71–90.
- Hopkins, R. (2011) 'Epigenetics: Scientific Evidence of Intergenerational Trauma', Indian Country Today Media Network, URL (consulted 30 Nov. 2014): <http://indiancountrytodaymedianetwork.com/2011/11/26/epigenetics-scientific-evidence-intergenerational-trauma>
- Indigenous Peoples Council on Biocolonialism (2000) *Indigenous Peoples, Genes and Genetics: What Indigenous Peoples Should Know About Biocolonialism*. URL (consulted 15 August 2014): <http://www.ipcb.org/publications/primers/index.html>
- Kakaliouras, A. (2012) 'An Anthropology of Repatriation', *Current Anthropology* 53(S5): S210–S21.
- Kirk, R. (n.d.) *Patterns in Blood: A Memoir*. unpublished.
- Kowal, E. (2013) 'Orphan DNA: Indigenous Samples, Ethical Biovalue and Postcolonial Science', *Social Studies of Science* 43(4): 578–98.
- Kowal, E., J. Radin and J. Reardon (2013) 'Indigenous Body Parts, Mutating Temporalities, and the Half-Lives of Postcolonial Technoscience', *Social Studies of Science* 43(4): 465–83.
- Kuzawa, C.W. and E. Sweet (2009) 'Epigenetics and the Embodiment of Race: Developmental Origins of US Racial Disparities in Cardiovascular Health', *American Journal of Human Biology* 21(1): 2–15.
- Landecker, H. (2005) 'Living Differently in Time: Plasticity, Temporality and Cellular Biotechnologies', *Culture Machine* 7.
- Landecker, H. (2007) *Culturing Life*. Cambridge, MA: Harvard University Press.
- Liloqula, R. (1996) 'Value of Life: Saving Genes Versus Saving Indigenous Peoples', *Cultural Survival Quarterly* 20(2): 42–8.
- Lindee, M.S. and R. Santos (2012) 'The Biological Anthropology of Living Human Populations: World Histories, National Styles, and International Networks', special issue of *Current Anthropology* 53(S5).
- Little, M. (2009) 'History of the Study of Human Biology', pp. 29–47 in M. Muehlenbein (ed.) *Human Evolutionary Biology*. Cambridge: Cambridge University Press.
- Lock, M. (2001) 'The Alienation of Body Tissue and the Biopolitics of Immortalized Cell Lines', *Body & Society* 7(2–3): 63–91.
- M'charek, A. (2005) *The Human Genome Diversity Project: An Ethnography of Scientific Practice*. Cambridge: Cambridge University Press.
- MacDonald, H. (2010) *Possessing the Dead: The Artful Science of Anatomy*. Melbourne: Melbourne University Press.
- Mead, A. (1996) 'Genealogy, Sacredness, and the Commodities Market', *Cultural Survival Quarterly* 20(2): 46–52.
- Mead, A. and S. Ratuva (2007) *Pacific Genes and Life Patents: Pacific Experiences and Analysis of the Commodification and Ownership of Life*. Tokyo: Call of the Earth/Llamado de la Tierra, United Nations University – Institute of Advanced Studies.
- Montagu, A. (1972) *Statement on Race: An Annotated Elaboration and Exposition of the Four Statements on Race Issued by the United Nations Educational, Scientific, and Cultural Organization*. London: Oxford University Press.
- Nelkin, D. and M.S. Lindee (2004) *The DNA Mystique: The Gene as a Cultural Icon*. Ann Arbor, MI: University of Michigan.
- NHMRC (1991) *Guidelines on Ethical Matters in Aboriginal and Torres Strait Islander Health Research*. Canberra: National Health and Medical Research Council.

- Ong, A. (2011) 'An Analytics of Biotechnology and Ethics at Multiple Scales', pp. 1–51 in A. Ong and N. Chen (eds) *Asian Biotech: Population, Security, and Nation*. Durham, NC: Duke University Press.
- Parry, B. (2004) 'Technologies of Immortality: The Brain on Ice', *Studies in History and Philosophy of Biological and Biomedical Sciences* 35(2): 391–413.
- Petryna, A. (2005) 'Ethical Variability: Drug Development and Globalizing Clinical Trials', *American Ethnologist* 32(2): 183–97.
- Rabinow, P. (1999) *French DNA: Trouble in Purgatory*. Chicago: University of Chicago Press.
- Rabinow, P. and N. Rose (2006) 'Biopower Today', *BioSocieties* 1(1): 195–217.
- Radin, J. (2012) *Life on Ice: Frozen Blood and Human Biological Variation in a Genomic Age, 1950–2010*. PhD dissertation, University of Pennsylvania.
- 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.
- Radin, J. (2014) 'Unfolding Epidemiological Stories: How the WHO Made Frozen Blood into a Flexible Resource for the Future', *Studies in History and Philosophy of Biological and Biomedical Sciences* 47(Part A): 62–73.
- Reardon, J. (2005) *Race to the Finish: Identity and Governance in an Age of Genomics*. Princeton, NJ: Princeton University Press.
- Reardon, J. and K. TallBear (2012) 'Your DNA is Our History', *Current Anthropology* 53(5): s233–s45.
- Rheinberger, H.-J. (1997) *Toward a History of Epistemic Things: Synthesizing Proteins in the Test Tube*. Stanford, CA: Stanford University Press.
- Roque, R. (2010) *Headhunting and Colonialism: Anthropology and the Circulation of Human Skulls in the Portuguese Empire, 1870–1930*. Hampshire: Palgrave Macmillan.
- Rose, D.B. (n.d.) 'Zone of the Incomplete'. Unpublished, UNSW, under review.
- Rose, N. (2001) 'The Politics of Life Itself', *Theory, Culture & Society* 18(6): 1–30.
- Rose, N. (2007) 'Molecular Biopolitics, Somatic Ethics and the Spirit of Biocapital', *Social Theory and Health* 5: 3–29.
- Santos, R. (2002) 'Indigenous Peoples, Postcolonial Contexts and Genomic Research in the Late 20th Century: A View from Amazonia (1960–2000)', *Critique of Anthropology* 22(1): 81–104.
- Scheper-Hughes, N. (1995) 'The Primacy of the Ethical: Propositions for a Militant Anthropology', *Current Anthropology* 36(3): 409–40.
- Smith, L.T. (2012) *Decolonizing Methodologies, Research and Indigenous Peoples*, 2nd edn. London: Zed Books.
- Sommer, M. (2010) 'DNA and Cultures of Remembrance: Anthropological Genetics, Biohistories and Biosocialities', *BioSocieties* 5(3): 366–90.
- Stepan, N.L. (1982) *The Idea of Race in Science: Great Britain 1800–1960*. London: Macmillan.
- Stocking, G.W. (1968) *Race, Culture and Evolution: Essays in the History of Anthropology*. New York: The Free Press.
- Taussig, K.-S., K. Hoeyer and S. Helmreich (2013) 'The Anthropology of Potentiality in Biomedicine', *Current Anthropology* 54(S7): S3–S14.
- Thompson, C. (2005) *Making Parents: The Ontological Choreography of Reproductive Technologies*. Cambridge, MA: MIT Press.
- Tierney, P. (2001) *Darkness in El Dorado: How Scientists and Journalists Devastated the Amazon*. New York: W.W. Norton.
- van Dooren, T. (2014) *Flight Ways: Life and Loss at the Edge of Extinction*. New York: Columbia University Press.
- Waldby, C. (2009) 'Biobanking in Singapore: Post-developmental State, Experimental Population', *New Genetics & Society* 28(3): 253–65.

- Waldby, C. and S.M. Squier (2003) 'Ontogeny, Ontology, and Phylogeny: Embryonic Life and Stem Cell Technologies', *Configurations* 11(1): 27–46.
- Walsh, R.J. (1974) 'Historical and Social Background of the Peoples Studied in the I.B.P.', *Philosophical Transactions of the Royal Society of London: Biological Sciences* 268(893): 223–8.
- Washburn, S. (1951) 'The New Physical Anthropology', *Transactions of the New York Academy of Sciences* 13(7): 298–304.
- Worthington, E.B. (ed.) (1975) *The Evolution of IBP*. Cambridge: Cambridge University Press.

Author biographies

Emma Kowal is Associate Professor of Anthropology in the School of Humanities and Social Sciences at Deakin University. She is a cultural anthropologist who has previously worked as a medical doctor and public health researcher in Indigenous health settings. Her research interests include Indigenous–state relations and settler colonialism, racism and anti-racism, science and genomics. She is the author of *Trapped in the Gap: Doing Good in Indigenous Australia* (Berghahn, 2015).

Joanna Radin is Assistant Professor in the Program for History of Science and Medicine at Yale University. Her work deals with the history and anthropology of emerging biomedical technologies. She is currently working on a book that deals with Cold War era scientists' efforts to collect and freeze blood samples from Indigenous peoples.