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Twenty-First Century Bioarchaeology: Taking Stock and Moving Forward

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INTRODUCTION

1.1 | Bioarchaeology

Over the past 50 years, bioarchaeology[1] has emerged as an explicitly interdisciplinary and aspirationally transdisciplinary[2] field of inquiry with close intellectual links to biological anthropology and anthropo- logical archaeology. Although theoretically grounded in the social and behavioral sciences, it also embraces methods and theories drawn from other sciences and the humanities. Bioarchaeology has matured and diversified into a widely recognized field of study with distinctive evolutionary anthropology and archaeology traditions around the world converging increasingly on a global bioarchaeology. Several English-language journals are devoted to publishing bioarchaeological research, including the *International Journal of Paleopathology*, the *International Journal of Osteoarchaeology*, and *Bioarchaeology International*. Many other top-tier anthropology journals frequently publish bioarchaeological studies, for example, the *American Journal of Biological Anthropology* (AJBA),[3] *Antiquity*, the *Journal of Archaeological Science* (JAS), and *JAS Reports*. Bioarchaeologists have also developed two book series devoted to bioarchaeological research: Bio- archaeological Interpretations of the Past: Local, Regional, and Global Perspectives (University Press of Florida) and Bioarchaeology and Social Theory (Springer Publishing Company), edited by Clark S. Larsen and Debra L. Martin, respectively.

Interest in bioarchaeology among advanced students and young professionals suggests that the current visibility and prominence of the field will be sustained (Martin et al., 2013; Stojanowski & Duncan, 2015). Undergraduate bioarchaeology courses are hugely popular in US colleges and universities. Each year, advertisements for university and museum positions are posted that specify bioarchaeological training as required or desirable qualifications. Bioarchaeological field programs are offered across the globe, and Post- doctoral positions are increasingly available. In 2018, Sabrina Agarwal and Alexis Boutin organized an interest group within the Society for American Archaeology (SAA) dedicated to fostering research and training in bioarchaeology. By 2021, it had approximately 1000 active members. Bioarchaeologists also continue to contribute significantly to the membership and annual conferences of the American Association of Biological Anthropologists and the Biological Anthropology Section of the American Anthropological Association (AAA).

Bioarchaeology is an important conduit for public engagement, enabling people today to connect to lived experiences of past people. Osteobiographical approaches, including those for mummified remains, produce narratives that excite public interest (Hosek & Robb, 2019; Nystrom & Tilley, 2019; Stodder & Palkovich, 2012; Zink & Maixner, 2019) and reduce prejudice (Boutin, 2019; Boutin & Callahan, 2019). Such outreach challenges bioarchaeologists to be ce tain that representations to nonspecialist audiences are firmly grounded in well-contextualized scientific knowledge. A balance must also be struck between the desire for outreach and culturally- grounded sensitivities to the display of human remains.

Topics that bioarchaeologists study (e.g., the effects of climate change, the evolution and biocultural context of human health, population mobility and migration, interpersonal violence) have the poten- tial to inform choices living people make (e.g., Buikstra, 2019a; Robbins Schug, 2020). Stock-taking is thus timely, especially for evaluating the goals and training programs in bioarchaeology. Formal coursework in ethics and responsibilities to descendant communities and other interested communities is insufficient or completely absent within many curricula. Appropriate analytical methods for integrating the highly variable types of data that excite bioarchaeological interest are underappreciated or underutilized by many bioarchaeologists, and there is a general need to enhance and expand training in research design to improve scientific rigor. Hypothesis-testing has been and continues to be a mainstay of bioarchaeological research, though we appreciate that there are other ways of interpreting the past in sys- tematic and rigorous ways. There is a crucial need for further standardized methods, data sharing, and data repositories. Striking a productive balance between methodological specialization and theoretical expertise remains problematic. The Bioarchaeology Workshop reported here represents one step in the collective discussions required for the resolution of such issues.

1.2 | The workshop

An international forum of bioarchaeologists drawn primarily from the United States and from across professional ranks convened March 6–8, 2020, in Tempe, Arizona, to take stock and plan for future bioarchaeological study. Buikstra and DeWitte's recognition in 2017 that bioarchaeology proposals were not faring well within the Biological Anthropology Program at the US National Science Foundation (NSF) provided the initial stimulus for the Workshop. The organizers, therefore, selected participants identified as experienced researchers with successful records in obtaining funding from NSF, the Wenner-Gren Foundation for Anthropological Research, or The Social Sciences and Humanities Research Council of Canada during recent years (2008–2018).

The 2020 Workshop was designed: (1) to seek advice from participants for improving the quality of bioarchaeological research proposals, and (2) to explore important questions suitable for NSF bioarchaeological research proposals, especially topics of salience for the 21st century. As social justice crises and the COVID-19 pandemic loomed increasingly large during the entire process, including the preparation of this article, the second goal became ever more prominent. Some international voices were included in the Workshop to sample global opinion and to explore prospects for further workshops in venues external to the United States. Our goal was not to develop an overarching statement on bioarchaeology but rather to use this meeting as a point of departure for future efforts, which would be composed of diverse and inclusive assemblies of international scholars. After withdrawals necessitated by the pandemic, the two organizers, 41 participants, two NSF observers (Rebecca Ferrell and John Yellen), and four advanced Arizona State University (ASU) gradu- ate students in bioarchaeology convened at ASU for the two-day workshop. Details concerning the organization of the workshop appear in the Data S1.

1.3 | Organization of this article

Rather than provide an exhaustive report, this contribution synthesizes major points from Workshop discussions and adds other relevant perspectives. For example, mindful of an intervening period that included major social upheaval along with the pandemic, it begins by considering significant and thorny issues that bioarchaeologists must address. These include topics of general importance to academic scholarship and education, for example, decolonization and transformation, along with special ethical issues that pertain to bio- archaeology because of its focus on archaeologically recovered human remains and funerary contexts. We then present sequentially the following topics discussed in Workshop sessions: Social Inequality (Section 3), Identity (Section 4), Climate Change (Section 5), Violence (Section 6), Migration (Section 7), Epidemic Disease (Section 8), Adaptation and Plasticity (Section 9), the "Osteological Paradox" and the Developmental Origins of Health and Disease (DOHaD) Hypothesis (Section 10), and Research Design and Quantitative Methods (Section 11).

Graduate Training is considered in Section 12, which draws from the Workshop and additional materials prepared during Summer 2020. Given that most workshop participants were based in the United States, discussion is structured through a review of United States training programs in bioarchaeology, addressing issues concerning the balance between methods and theory, laboratory and field research, and related topics. The closing section (Section 13) summarizes results, while providing recommendations for additional significant research directions, methodological and theoretical advancement, and curricula designed to meet 21st-century needs.

Despite the broad remit of the Workshop, some important topics in bioarchaeology remain beyond the scope of this article. These include details of important analytical techniques and interpretative methods that are newly applied in bioarchaeology, such as: adult age-at-death estimation (Milner et al., 2019, 2021); biomechanics (Longman et al., 2020; Ruff, 2019) cremation analyses (Cerezo-Roman et al., 2017; Kuijt et al., 2014; Tiesler & Scherer, 2018); commingled remains (Adams & Byrd, 2008; Osterholtz, 2014; Osterholtz et al., 2014); human and pathogen DNA (Nieves-Colo,n & Stone, 2018; Orlando et al., 2021); evolutionary medicine (Plomp et al., 2022); and isotope analyses of mobility and diet (Burton & Katzenberg, 2019; Guiry & Szpak, 2021; Katzenberg & Waters-Rist, 2019; Moffat, 2015).

2 | BIOARCHAEOLOGY, DECOLONIZATION, TRANSFORMATION, AND ETHICAL ISSUES

Many discussions during the March 2020 Workshop centered on the coming pandemic and social issues linked to US (and global) politics. Cross-cutting concerns from many sessions were the development of ethical standards, along with decolonizing and transforming bio- archaeology into a transnational discipline, echoing Watkins (2020, p. 20): "Methodological and theoretical developments that do not change the fundamental structural

conditions of the discipline will keep it from attaining a proper level of intellectual rigor and social relevance." Workshop participants were united in their endorsement of change; some focused on social issues and ethics, while others concentrated on theoretical and methodological advancement. We also supported an active, sometimes activist stance, rather than simply reacting passively to emerging social and biological currents surrounding us.

Bioarchaeologists should recognize embedded biases based upon educational and personal experiences. As anthropologists, we must wrestle with the ways that our disciplinary roots are entangled with and have encouraged scientific racism and colonialism. It is relatively easy to condemn instances of racist and colonializing science in the past; it is more difficult to acknowledge the covert ways that this legacy pervades the discipline today and to plan and implement adifferent future. Biological anthropology is now actively engaged in decolonizing efforts (e.g., Bolnick et al., 2019; Marks, 2017; Mulligan & Raff, 2021). Bioarchaeology should also advance this transformative agenda, confronting and challenging assumptions implicit in our research designs and practice (Blakey, 2021). We must amplify and elevate historically underrepresented and marginalized groups and thus connect critically and meaningfully with the current cultural and political environment, seeking to dismantle white suprem- acy and achieve global equity and justice for everyone.

2.1 | Decolonizing and transforming bioarchaeology

Almost three decades ago, Faye Harrison (1991) called for a decolonized anthropology, one that recognized the social contexts from which science emerges. She advocated interdisciplinarity and inclusivity, inviting the public to participate in the production of knowledge and holding scientists accountable for translating their intellectual products into liberation practice. The goal was transformaon at a structural level. While support for decolonization has increased (see, e.g., Bolnick et al., 2019), the stark 21st-century examples of racial discrimination and genocide, especially inequities emerging in concert with the COVID-19 pandemic, have raised awareness and a renewed sense of urgency. There is already a large body of literature on decolonizing higher education (e.g., Bhattacharya, 2015; Gilmore & Smith, 2005; Louie et al., 2017; Parker et al., 2018; Sumida Huaman & Abeita, 2018) and decolonizing anthropology (e.g., Allen & Jobson, 2016; Atalay et al., 2014; Harrison, 1991; Smith, 1999).

The Society of Linguistic Anthropology announcement requiring peer reviewers to evaluate a manuscript's inclusiveness and diversity illustrates a recent, bold step toward decolonizing their publication program that bioarchaeology journals could emulate.[4] In another initiative, the Faculty of Social Sciences and Health at Durham University is actively working to decolonize academic practices and de-center whiteness. This program includes interventions to retain students and staff of color, and reverberates through curricula, research initiatives, and external relations (see also Arday & Mirza, 2018). An Equality, Diversity and Inclusion Race Equality Review was recently conducted and published for the British Association for Biological Anthropology and Osteoarchaeology (BABAO), resulting in recommendations for increasing diversity and

representation, and cultural competency. The ultimate goal of this exercise is for BABAO to become an effective anti-racist organization.[5] A further resource for decolonization efforts in anthropology is the SAA's collection of arti- cles on race, inequality, and decolonization.[6] Compiled by the SAA Publications Committee, it is an organic document, regularly updated, and includes bioarchaeology.

Focusing on decolonization, transformation, and ethical issues especially germane to bioarchaeology, we recognize that "biocentricity" (Wynter, 2003) is a force driving scientifically normative perspectives (Watkins (2020), which a decolonizing discipline should actively question. The singular importance of reflexive perspectives,whichemphasize that cultural constructs are not universal, is a point made across several topical foci discussed in the following sections, ranging from kinship (Section 4) to violence (Section 7). A decolonized, transformed bioarchaeology will doubtless change the way students are trained, alter how practitioners legitimize their careers (i.e., rebalancing time committed to research and outreach and appropriately recognizing the unique demands on BIPOC faculty with respect to mentorship), and renegotiate relationships with the people whose ancestors we study and their descendants. Decolonizing bioarchaeology will require significant shifts in our intellectual *and* institutional spaces—it is not an academic, essentially passive exercise. It *must* be proactive. True transformation will not happen by accident or automatically with time. A bioarchaeology that prioritizes transformation and social justice requires an activist approach to scholarship that is service-oriented and values community stakeholders as co-producers of knowledge (Atalay et al., 2014; Stottman, 2010).

A decolonized bioarchaeology also must acknowledge that many of our broader academic institutions are structurally racist. We therefore need to influence and change at this level, too, examining and transforming recruitment processes and promotions, curriculum content, and assessments, all of which should be reevaluated through an anti-colonial lens. We need to look at the academic pipeline that creates barriers for BIPOC[7] students—from primary school onward—and consider how we can facilitate engagement and progression for students from marginalized groups. For this process to be effective, it requires resources and accountability, and thus institutions as a whole must commit actively to a decolonizing agenda. As individuals, we should be reflexive of our own social identities and positionality and take active steps to address our teaching and research practices. In that spirit, we acknowledge that participants in the Bioarchaeology Workshop largely replicated the white, cis-hetero, academic status quo that typifies the field in general.

We firmly believe that including and truly listening to underrepre- sented and often purposefully excluded voices is crucial for 21st century bioarchaeology. We recognize and appreciate, for example, the concerns expressed in the *American Anthropologist* Vital Topics Forum (Bolnick et al., 2019), which well illustrates perspectives of those who are marginalized in the evolutionary sciences and includes examples of developing collaborations and paths forward.

2.2 | Ethics: Bodies and politics

Decolonization in bioarchaeology is not just about the inclusion of different peoples and views, but it is also about the very material work of the field. Within the past half-century, increased awareness of human remains as part of the

colonization process has led to public outcry and repatri tion legislation. Bioarchaeologists in Canada and the United States have expressed concern for the ethical treatment of Indigenous people for decades (Baker et al., 2001; Buikstra, 2006; Cybulski, 2001; Cybulski et al., 1979; Meloche et al., 2021; Pfeiffer, 2021; Reinhard et al., 1994; Walker, 2004, 2007; Williamson & Pfeiffer, 2003). Repatriation, including the communication and collaboration stimulated by national legislation in the United States, such as the National Museum of the American Indian Act (NMAI, 1989), the Native American Graves Protection and Repatriation Act (NAGPRA, 1990), and CalNAGPRA (2001) in California are now crucial aspects of bioarchaeological engagement (Kakaliouras, 2021a[8]). Similar issues have arisen recently in reference to African American remains from a politically fraught context - the Philadelphia MOVE remains retained and used in teaching by the University of Pennsylvania Museum (Anderson & Hevenor, 1987; Thomas & Krupa, 2021[9]; Wagner- Pacifici, 1994). This together with the treatment of historic Black ceme- teries has prompted calls for an African American Graves Protection and Repatriation Act (Dunnavant et al., 2021).

Views that repatriation hinders anthropological knowledge are waning (Halcrow et al., 2021; Kakaliouras, 2017, 2021a, 2021b; Lippert & Sholts, 2021; Meloche et al., 2021). There is also a growing acknowledgment of the cultural trauma and civil rights violations committed historically through human remains being unethically obtained and held at museums and universities (Halcrow et al., 2021). Most bioarchaeologists consider collaborative approaches with Indigenous people as a productive endeavor that enriches methodologies and knowledge of the historical and archaeological context for answering anthropological questions (Halcrow et al., 2021; Ruckstuhl et al., 2016; Weisse, 2020). For example, work with the *tīpuna* (ancestors) from Wairau Bar, an early site in Aotearoa New Zealand, involved a partnership approach between the local *iwi* (tribe), Otago University, and the Canterbury Museum. Through this collaboration and repatriation project, researchers assessed aspects of past life experiences, origins, identity, and mobility through multiple bioarchaeological methods (Ruckstuhl et al., 2016).

One of the tensions that has developed in implementing NAGPRA and other repatriation initiatives is the definition of "cultural affiliation," which requires a combination of archaeological, biological, folkloric, geographic, historical, linguistic, oral tradition, and expert opinion (Buikstra, 2006). Weighing these different categories is difficult and has been contentious (e.g., the Kennewick example, see Owsley & Jantz, 2014; Thomas, 1999). An instructive recent historic period example is from the Alameda-Stone Cemetery, in Tucson, Arizona, that did not fall under NAGPRA, but rather under Arizona state law (Goldstein et al., 2012), which stimulated "communication and discussion about the data among all parties involved in the process" (Goldstein et al., 2012, p. 92). This approach is a promising model for rigor, transparency, and consultation, which may serve well in other contexts.

For the Chumash of southern California, Walker (2000, p. 30) outlines a solution mutually beneficial for both the Indigenous community and the bioarchaeological researchers. This is a "safe keeping place" in "a specially designed subterranean ossuary," which meets with spiritual concerns and also guards against unwarranted disturbance of the remains that no other site could guarantee.

The New York City African Burial Ground is a compelling illustration of the significant value of consultations with African American descendant communities and multidisciplinary approaches to the excavation of cemeteries that include enslaved people and their descendants (Blakey, 2010; Blakey & Rankin-Hill,

2009; https://www.nps.gov/articles/ afamburial.htm) (see also www.AvondaleBurialPlace.org and Fleskes et al., 2021). Evidence of structural violence against African Americans, both before and after death is well illustrated in the research of de la Cova (2010, 2011, 2019, 2020a, 2020b) and Nystrom (2011, 2014, 2017a,) (see Section 7.2).

There is consensus, though not unanimity, among bioarchaeologists about responsible, ethical behavior (Kakaliouras, 2021b). A considerable literature now exists concerning ethics in bioarchaeology, much of it focused on North America and the United Kingdom (Buikstra, 2019b; DeWitte, 2015a; Kakaliouras, 2012; Lambert, 2012; Lambert & Walker, 2019; Larsen & Walker, 2005; Perez, 2010; Walker, 2007). Some have emphasized museums and university settings (Cassman et al., 2007), while other contributions reflect global and non-Western concerns (Halcrow et al., 2019; Squires, Errickson, & Márquez- Grant, 2019; Turner & Andrushko, 2011). Ethical issues in mummy science, especially mummy autopsies, have also emerged (Piombino- Mascali & Gill-Frerking, 2019; Shin & Bianucci, 2021). Zuckerman et al. (2014, p. 513) have argued that bioarchaeology has an ethical mandate to speak out for "marginalized, disenfranchised, and impoverished individuals and communities." In advancing such initiatives, the formation of partnerships with descendants and other communities of concern is an ethical imperative.

Most repatriation discussions at the Workshop centered on the United States and Canada, but we also emphasized the crucial importance of contexts representing the profound variation across human communities through time and space. Some international participants at the Workshop cautioned that we should not assume communities of concern for ancient human remains are the same globally—or even within the United States and Canada. In effect, we should not impose repatriation guidelines; instead, we must consult, respect, and collabo- rate wherever we work, effectively representing the rich information base that human remains in archaeological contexts embody. We remind all bioarchaeologists that our discipline and its membership, while clearly international, largely represents the interests and activities of people of privilege. We acknowledge that there are bioarchaeologists working in many places in the world where the issue of repairing past wrongs is either not pressing, or not part of the sociocultural context in which bioarchaeology is practiced. Nevertheless, repatriation is no longer just an American, Australian, Canadian, or New Zealand activity. For instance, although not every European country participated in the colonization of the African continent, many did. In 2018, the Sarr-Savoy Report was released from France, which calls for sweeping changes in institutional practices vis-à-vis the repatriation of African cultural heritage.[10] Similarly, Germany recently announced the repatriation of the "Benin Bronzes" to Nigeria.[11] Moreover, in Latin America, efforts to gain access to remains and artifacts held in North American museums continue (e.g., the Peru-Yale Partnership in reference to Machu Picchu[12]). Finally, because a national sense of connection to ancient Indigenous pasts is a central cultural and political tenet of many Latin American countries, the voices of marginalized Mexican, Central, and South American Indigenous peoples have been represented in the literature on repatriation for a few decades (Condori, 1989). Thus, while conscious of the distinctly different cultural contexts in which co leagues work, decolonization and repatriation efforts are on the rise; wise counsel, and especially for bioarchaeology colleagues, is to take seriously and honor these efforts.

Other ethical issues arise in the conduct of our research on ancient human remains, including many that are common to other scientific disciplines. Materials access and data sharing are particularly important, in that repatriation and reburial means that restudy and verification opportunities will be limited. Explicitly reporting ethical standards used in our research is a further matter of concern (Squires et al., 2022). Another related, significant set of issues involves analyses that destroy biological tissues (Squires, Booth, & Roberts, 2019). While there is the potential for significant information that cannot be recovered in any other manner concerning such topics as biological (genetic) relatedness, diet, pathogens, and residential history, consideration of destructive sampling should adhere to recommendations for ethical engagement with relevant communities and be justified in terms of the significance of specific research questions to all stake-holders (Harry, 2009; Somel, 2021; Tsosie, 2021; Wagner et al., 2020).

2.3 | Decolonizing international research and practicing ethical fieldwork

Although most bioarchaeological ethics literature focuses on the United States, Canada, New Zealand, and the United Kingdom, considerable bioarchaeological research and fieldwork is performed outside of those countries. Standards for performing ethical fieldwork in under-resourced countries should minimally include capacity build- ing for local scientists and recognition that national permits and analysis permissions were not granted by descendant or invested communities. Much bioarchaeological research is carried out in countries with stark power and financial differentials. Although not comprehensive, First Nations groups in Canada and Native groups in the United States have legal protections and decision-making authority over the burials of their ancestors. Many Indigenous groups from the Global South, however, do not have sufficient social or political capital within the national government to make decisions regarding excavation, repatriation, reburial, or scientific analysis of their ancestors. Working with local scientists is an important first step (Haelewaters et al., 2021), but greater efforts should be made to include Indigenous stakeholders.

2.4 | Conclusions

When we consider the mandate to decolonize and transition to a more ethical bioarchaeology, several important points emerge: (1) Every effort must be made to create a field that is not only open and welcoming to all professionals and students, but also actively seeks to include other communities as an ethical obligation and for intellectual enrichment contributed by the diverse perspectives thus

engaged. (2) Focus on sensitive and ethical engagement with descendant communities is crucial; forming partnerships that serve the needs of community members and scientists alike is imperative. (3) Bio- archaeologists should advocate for Indigenous and descendant communities having a voice in decision-making on cultural resource management, international research permits, and destructive analyses. Similarly, there are non-descendant local communities of concern who should be recognized in access consultations. (4) Some of bio-archaeology's predecessors engaged in unethical activities. Recognizing this, contemporary energies must be expended to create a future that has overcome the intellectual and practical residues of such antecedents. (5) When possible, we should use the deep time knowledge of bioarchaeology to address topics such as past violence, epidemic disease, and human adaptation to act as a springboard for a more globally aware future; (6) Overall, we need a more radical approach to decolonize academia as a whole and a more open acknowledgment that many institutions are structurally racist and continue to perpetuate harm against minoritized groups. These objectives should extend to funders, publishers, and editorial boards; and (7) The people often at the heart of research endeavors are the ancestors of presently colonized, oppressed, or otherwise politically disadvantaged peoples. Bioarchaeologists should recognize not only their privilege in having access to human remains, but also should work together with descendant groups and other communities of concern on the lawful, proper, and humane disposition of the remains of such individuals and their cultural heritage.

3 | SOCIAL INEQUALITY

3.1 | Bioarchaeology and social inequality

The gap between rich and poor continues to widen; however, by using the contemporary literature as a baseline, bioarchaeologists can explore the complex factors that result in inequalities (e.g., Roberts, 2020c). For groups that have been historically marginalized, underlying sociocultural and structural factors that enforce marginalization can be identified to understand how inequality becomes biologically embodied (see also Section 7.2., Structural Violence). Studies of inequality in the past reveal how cultural and sociopolitical influences, and associated stigma, shaped lived experiences and health outcomes. (e.g., for people with leprosy (Roberts, 2020a) and tuberculosis (Roberts & Buikstra, 2003, see also Roberts, 2020b)) These are relevant lessons for modern problems, such as those identified by Ansell (2017), Dorling (2015), Marmot (2015), and Wilkinson and Pickett (2009).

Bioarchaeology can contribute significantly to scholarship on the way that culture becomes biology (sensu Gravlee, 2009) and how larger structural forces work against marginalized groups (de la Cova, 2010, 2011, 2019; Mant & Holland, 2019). By connecting the past and the present we can begin to understand how persistent marginalization continues to affect these groups biologically, despite shifts in time and cultural changes, thus complementing research being conducted by medical anthropologists (e.g., Farmer et al., 2006; Holmes, 2013; Singer & Clair, 2003). Long term perspectives inspire thinking about the intergenerational effects of

marginalization, as is the case with Black/African Americans, who are still affected biologically by the consequences of slavery (see Jasienska, 2009). Similarly, Indigenous communities worldwide have suffered the impact of colonization and genocide. By shedding light on these factors and how they continue to affect marginalized bodies, such research can effect change at the social and clinical levels. The past can also reveal alternative social systems to those that prevail today and expose the limits of our current understanding, which often consider certain forms of inequality as inevitable. All these approaches require careful attention to context and are enriched by interdisciplinary collaborations and engagement with research methods from contemporary social science research.

There are several bioarchaeological strategies for studying social inequality in the past. The first, the historical method, evaluates the nature of inequality today and extends it into the past to understand the archaeological roots of contemporary problems. An alternative, the transdisciplinary approach, seeks to understand how various socioculural and ecological factors, including ancient climate change, urban settings, and political systems, led to inequality in the past, and how to apply those lessons in the present. To this we might add an ontological turn, sensu Holbraad & Pedersen(2017) and Viveiros de Castro (2004), which encourages anthropological researchers to explore other realities and to conceptualize ways for people to move beyond presently known sociocultural systems. All these strategies principally rely on an ability to identify past inequalities from social and archaeological contexts, including interment structures and health outcomes. The work of Quinn and Beck (2016) and Dong et al. (2017), for example, illustrates the challenges in integrating theories of mortuary behavior with social theories surrounding inequality, along with bioarchaeological methods. As they rightly emphasize, it is crucial that such research into past inequalities does not merely justify a priori conclusions based on deterministic and stereotypical beliefs, such as those based on gender, disability, age, and ethnicity, among other factors.

Future bioarchaeological research on social inequality should continue to unite social theory with osteological methods and pursue interdisciplinary collaborations and methods as we work to improve our ability to identify and evaluate inequality in the past. Global health professionals, for example, are interested in the length and history of social inequality and its impact on health, particularly for multigenerational effects of inequality. A recent example from Mexico illustrates the potential contribution bioarchaeology can make on this point. Tiesler et al. (2020) examined two documented skeletal series from the Yucatán to evaluate changes in health and age-at-death demographics over the 20th century and found that, although the more recent skeletal series had a higher age-at-death, degenerative and metabolic diseases and trauma predominated, reflecting the simultaneous effects of improved healthcare/health interventions (e.g., amputations performed due to the effects of diabetes), globalized food system sedentism and automobile reliance, and violent crime.

Additionally, contemporary research methods from public health, economics, and social science can be brought to bear on the past, such as applications of the Gini coefficient, a measure of statistical dispersion used in economics that represents wealth distribution (Oka et al., 2018; Pitts & Griffin, 2012). The Capability Approach, from economics, has also been applied archaeologically, but deemphasizes income (or wealth) and focuses on well-being, namely that income differences among individuals do not inherently translate into differential abilities of doing and being, as applied by Arponen et al. (2016). The Capability Approach may be particularly useful in identifying and evaluating heterarchies, where unequal status does not imply power imbalance. Finally, public health tools like the World Health Organization's "Dirty War Index", used to evaluate undesired and prohibited outcomes in a given conflict (e.g., child mortality), can be applied to bioarchaeological datasets (Zuckerman & Banks, 2017). Not only do these efforts improve our ability to research social inequality in a bio-archaeological context, but they also connect bioarchaeological studies to contemporary social science research and help forge additional interdisciplinary links and further improve public outreach. Although quantifying inequality with these methods or with archaeological approaches (e.g., Quinn & Beck, 2016) may not capture the full spectrum of inequality at all archaeological sites, systematic data collection may help to better evaluate inequality on a broad temporal and geo- graphic scale and develop testable models following Ortman (2019). Nystrom and Robbins Schug (2020) emphasize that the human cost is absent from several of the economic approaches as originally conceived and that adaptations that include health measures are therefore advantageous.

3.2 | Conclusions

By examining mortuary contexts and skeletal remains that preserve embodied evidence of class, gender, and violence and their impacts on health, social identity, and well-being, bioarchaeological research can address several key questions about inequality in the past, which have implications for today's world. These include: (1) Under what conditions did inequality emerge in the past? (2) Who held power in the past? Under what conditions? For what purposes? (3) What were the embodied consequences for those without power? (4) How did these social formations change? (5) What social and ecological formations existed in the past without our current forms of inequality? (6) How does the study of past inequalities and marginalized people help inform present and future remediation efforts?

4 | INFERRING ANCIENT IDENTITIES

Today, social, political, and economic landscapes are built upon individual and group identities, based in gender, age, religion, political affiliation, ethnicity, and social status. These structure our daily exis- tence and profoundly influence global events. Social news media reinforce the existence of differences across these dimensions, frequently

reinforcing value judgments such that violence all too often ensues. Bioarchaeology has an important role to play in research on the origins, maintenance, and manipulation of identities, focusing upon the way identities are embodied in the human skeleton (Gowland & Knüsel, 2006; Knudson & Stojanowski, 2008, 2009a, 2009b; Sofaer, 2006). The challenge involves moving from biological attributes, frequently evaluated via osteological data that, along with contextual variables, to estimating social constructs, many of which are fundamental to interpreting past lives.

4.1 | Linking skeletal to social categories: Sex to gender, biological age-at-death to social age, and inherited features to ethnicity and kinship

Individual and group identities, such as social age, gender, and ethnicity—and their intersections—are important in the contextualized study of human remains (Gowland & Thompson, 2013; Knudson & Stojanowski, 2009a, 2020). Bioarchaeologists begin their analyses of these social phenomena with assessments of biological sex, age-at- death, the timing of earlier life-course events, and phenotypic expressions of genetic variation. These osteological observations may be supplemented by information from proteomics, ancient DNA (amelogenin gene), and observations of mummified soft tissues, when available. The persistently elusive goal of accurate biological sex determinations in juveniles appears imminently achievable through minimally invasive proteomic procedures (Buonasera et al., 2020; Gowland et al., 2021; Parker et al., 2019; Stewart et al., 2017; Ziganshin et al., 2020) and genetic analyses (Mittnik et al., 2016; Skoglund et al., 2013). Efforts to improve macroscopic approaches to sex estimation in juveniles also continue (e.g., Garvin et al., 2021; Stull et al., 2017).

Responses to late 20th century critiques of paleodemography, paleopathology, and paleoepidemiology (Bocquet-Appel & Masset, 1982; Wood et al., 1992) have stimulated increased attention to developing bias-free and more accurate methods for estimating age-at-death in adults, especially older adults (Caussinus & Courgeau, 2010; Hoppa & Vaupel, 2002; Milner et al., 2019; Milner & Boldsen, 2012). With advances in imaging, dental cementum annuli evaluations offer an important option, when minimally destructive methods are appropriate (Naji et al., 2016, 2021). Studies of phenotypic features in documented genealogies are refining knowledge of the genetics of complex morphological structures (Paul & Stojanowski, 2015; Paul et al., 2017; Stojanowski et al., 2017, see also Section 6).

These advances provide important building blocks for establishing population structure, which is crucial for broad-scale interpretations of health, disease, migration, and violence. It is important to recognize, however, that sociocultural and contextual interpretations of biological parameters shape the lived experience of individuals across the life course. Gender, social age, and ethnicity influence diet, physical activity patterns, the work people did, their socioeconomic status, and health, which are reflected in metrical, morphological, and

biogeochemical features of the skeleton. Notably, these variables can also influence the rate and patterning of skeletal degeneration, which is frequently used as an index of chronological age. Close attention must be paid to the specific cultural contexts from which the skeletal sample or individual skeleton derives. While accurate biological sex and age determinations may be key in beginning to represent past lives, only when we understand how these aspects of identity were shaped culturally, perceived socially, and experienced personally can we cross the threshold into truly reconstructing past lifeways (Gowland, 2006).

4.2 | From skeletal age-at-death to social age

Workshop participants were particularly mindful of the influence of social and cultural factors on aging (Agarwal, 2012), birth, the timing of adolescence, and recognizing old age. Further refinement of methods for estimating the timing of the natal event is necessary, as in utero, childbirth, and neonatal deaths provide important information about the health of the infant and the mother (Gowland & Halcrow, 2020; Han et al., 2018). Studies of mothers and infants as entangled dyads are key future directions for investigation of community health, nutrition, cultural factors influencing childbirth, and cultural perspectives on the roles and relative positions of women and children in society. Thus, bioarchaeology would benefit from greater focus on the earliest stages of the life course, that is, fetal and neonatal development and the social construction of conception, childbirth, and neonatal life (Halcrow et al., 2018; Han et al., 2018; Smith-Oka et al., 2020). Social understandings of pregnancy and cultural constraints on pregnant women that may have health implications are crucial (Lewis, 2017). Greater consideration should be given to the impact of reproductive loss on societies. Biological sex ratios of non- adults could also extend knowledge of health and treatment biases. The implications of the Barker (2003) hypothesis of DOHaD for mo bidity and the skeletal expression of disease are important investigative pathways, particularly in relation to impacts on growth, adult skeletal dimensions, and later life health and mortality patterns (Roberts & Steckel, 2019).

Linked to focus on the life course is a growing interest in understanding the social and biological transitions from childhood through adolescence to adulthood (Halcrow & Tayles, 2008; Inglis & Halcrow, 2018). Researchers have begun to explore skeletal indicators of adolescence to understand variability in pubertal timing and social attitudes toward this key life transition (Lewis et al., 2016; Shapland & Lewis, 2014), as well as what pubertal timing indicates about standards of living in pre-or nonindustrial contexts (DeWitte & Lewis, 2021). More research on older age groups and social definitions of the elderly is also required (e.g., Boutin & Porter, 2019). Older age groups are among the most neglected demographic in archaeology, due in part to the misconception that people in the past did not live to old age. Given the prevailing negative sterotypes surrounding old age in the present (Ng, 2021), it is important that bio-archaeologists address the social construction and experiences of the elderly in the past (Gowland, 2007). Identifying hormonal fluctuations from bones and estimating the timing of menopause would also assist in studies of fertility. Moreover, the life course does not always end with the

physical death of an individual; agency may extend beyond death (Buikstra, 2019b; Crandall & Martin, 2014).

4.3 | Skeletal sex to gender

Bioarchaeologists have historically focused primarily upon the accuracy of biological sex estimation methods, with those for adults emphasizing the bony pelvis. Other, more variable expres- sions of skeletal sexual size differences are less accurate, but may be useful in specific populations, especially with prior knowledge developed in the study of documented collections. The degree of skeletal sexual size differences has also been used to infer health and adaptation through time and space (Clark, 2013; Clark et al., 2014; Vick, 2005). While accuracy in estimating biological sex continues to be a matter of concern, bioarchaeologists have extended their interests to non-dichotomous definitions of biological sex and social expressions of gender, along with the cultural construction of the gendered body and gender roles are in the past (Agarwal & Wesp, 2017; Geller, 2017). Knowledge of nonbinary biological and social expressions of sex and gender should also anchor forensic anthropological observations (Garofalo & Garvin, 2020; Jones, 2014; Schultz, 2021).

The media eagerly and increasingly report inferences about gender and alleged departures from the normative male–female dichotomy and male control of power. For example, *National Geographic* reported, with apparent amazement, a burial from Nakum, "Maya Royal Tombs found with Rare Woman Ruler" (Geller, 2017, p. 145). One might wonder why the presence of powerful women in the past is newsworthy, but such androcentric extensions of today's world into the past persist (Conkey & Spector, 1984; Geller, 2017, 2019). The 21st century has witnessed notable revisions of received wisdom concerning powerful women in the past, frequently revealed in bioarchaeological studies (Buikstra et al., 2004; Knüsel, 2002; Lull et al., 2021; Price et al., 2019)

There are, thus, many reasons to extend the study of biological sex into the more challenging domain of gender (Ghisleni et al., 2016; Gilchrist, 2004; Sofaer, 2012; Walker & Cook, 1998). Among the most central is enriching appreciation of variability in past lives, (e.g., Bolger & Wright, 2012, Tung, 2021; Section 7); examples of gender flexibility counter the heteronormative, essentialized vision of the past that all too often informs visions of binary sex categorization today (Geller, 2017, 2019). An important archaeological example of moving beyond the heteronormative perspective of the past has been voiced by Gabby Omoni Hartemann (2019), a transgender PhD student from Brazil. They emphasize the importance of drawing attention to non- binary identities in the past because not doing so is a form of erasure, which contributes to transphobia and violence against nonbinary individuals today. Recognizing past nonbinary identities in the past helps understanding and acceptance of them today.

4.4 | Skeletal morphology to kinship

Bioarchaeologists have long used phenotypic variability to infer the history of ethnic groups, especially migrations at global and continental scales. These have largely given way to focused studies of regions, communities, and the family. Questions have expanded from mobility and migrations to issues of residence and the way kin relations struc- tured the political, economic, and social lives of past peoples.

Small-scale bioarchaeological studies of kin relationships began with attempts to explore post-marital residence patterns, such as the pioneering work of Lane and Sublett (1972). Similar small-scale foci by researchers such as Alt (Alt et al., 1997; Alt & Vach, 1992, 1995); Konigsberg (1988; Konigsberg & Buikstra, 1995) and Schillaci and Stojanowski (2002, 2003) have continued to be productive, if occasionally contentious (Peregrine & Ember, 2002). Today "biodistance" is the term applied to the inference of inherited relationships through the study of skeletal morphology and dental features (Buikstra et al., 1990). Such small-scale foci are crucial to explorations of human history in that family and kin relations structure how an individual learns and is socialized. Many of the factors that structure human existence, such as socioeconomic status, diet, and health are linked to early life experiences and the family, broadly and flexibly defined (Johnson, 2019). Kinship and family histories are fundamental to understanding the inequalities that plague today's world. Studying the development of these differences over the long term and at various scales is important to understanding today's complexities.

Human mobility and large-scale migrations can also be assessed through the study of phenotypic variation and kinship, as the latter frequently structures the nature of migrating groups. To interpret mobility fully and accurately through biodistance methods, studies should be grounded in the anticipated population genetic impact of human movement, as represented in the work of anthropological geneticists (Fix, 1978, 1979, 1999, 2011), and migration recognition thresholds when using various classes of bioarchaeological data (Frankenberg & Konigsberg, 2011). Impacts of isolation by distance modeling are also important. Similarly, awareness of the myriad recent anthropological studies of kinship and mobility is essential (e.g., Amorim et al., 2018; Walker & Hill, 2014).

Discussions of aDNA, ethics, migration, and kinship highlight the highly malleable nature of human biological relationships as an analytical category that varies on a situational, contingent, and context- specific basis (see Johnson, 2019; Johnson & Paul, 2016). As with other social categories, bioarchaeological studies of kinship contribute to the appreciation of past lives, and they should also reveal the flexi- bility of kin categories beyond those essentialized today (e.g., Gregoricka, 2013; Pilloud & Larsen, 2011; Yaka et al., 2021).

Insofar as DNA can elucidate relationships of biological kinship, it has proven an especially challenging topic for bioarchaeologists collaborating with Indigenous communities, especially those in the United States and Canada (Bolnick et al., 2016; Claw et al., 2017; Reardon & TallBear, 2012; TallBear, 2013, 2015). Commodification of heritage and bodies as property has raised many increasingly vocal and politically powerful concerns. From such tensions has emerged Kim Tall-Bear's (2017, 2019) proposal of a "relational kinship" for partnering in a decolonized world. TallBear aligns with the many scholars who recognize the power of non-Western ontologies in arguing against

the West- ern binaries of human/not human, natural/ unnatural worlds. Emphasizing an Indigenous concept of relationality, TallBear (2019, p. 37) promotes "making kin" as a 21st century solution that emphasizes reciprocal relationships of caring and trust, which extend to all people and all that surrounds us, rather than Western constructs of nation-states, sovereignty, and negotiation. Such relational, nongenetic models well illustrate the fundamental differences between Indigenous and Western notions of "kin-based" relationships and belonging.

4.5 | Intersectionality

Developed within a Black feminist activist paradigm, intersectionality holds promise for advancing bioarchaeology's analytic and transdisciplinary bio-archaeological agendas. The concept was formalized by Crenshaw (1989), although its history extends into the 19th century. Intersectionality refers to multiple identities (e.g., race, class, gender, sexuality, ethnicity, nationality, ability, and age) interacting within an individual at a given time, as sociologist Collins (2015, p. 2) states, "not as unitary, mutually exclusive entities, but as reciprocally constructing phenomena that in turn shape complex social inequalities." Discussions of intersectionality often focus on definitions of axes of marginalization, power structures, and the utility of atheoretical versus theoretical approaches (Evans, 2019; Sen & Iyer, 2012). Such discussions are highly relevant to developing intersectional studies within bioarchaeology, using a focus on power structures and inequality through time and across space to address mechanisms that stimulate migration, violence, climate change, and pandemic disease. Factors promoting resilience in the face of these challenges should also be sought. Intersectionality has become increasingly visible in bioarchaeology, emphasizing knowledge gained by conceptualizing interacting, mutually constituted identities within individuals and groups (for summaries see, e.g., DeWitte & Yaussey, 2020; Yaussy, 2022). Case studies to date include work by Yaussy (2019), Byrnes (2017), Mant et al. (2021), Torres-Rouff and Knudson (2017), and Knudson et al. (2020).

Thus, collaborative, intersectional studies of past identities, whether focused on individuals or communities, would seem poised to provide insight into the structures that initiated and reinforced inequalities in the past. Temporal depth and cross-cultural insights should emerge from these investigations in a manner significant for 21st-century interventions, as they also enlighten our perspectives upon past lives. The work of Mant et al. (2021), for example, in comparing case studies of two unclaimed individuals from different geo- graphical and temporal contexts using a cross-disciplinary, intersectional perspective highlights the importance of theoretically informed intersectional and osteobiographical approaches.

4.6 | Conclusions

The study of identities in the past is a challenging adventure in linking numerous classes of archaeologically recovered data. For the

bioarchaeologist, this means studying human remains, not only in fune ary contexts, but within the larger residues of past lives—homes, shrines, and monuments—necessitating collaborative efforts with other scholars and descendant communities. The study of identities—however challenging—is essential in exploring how and why past peoples changed their relations to others and to their environments. Intersectionality studies also hold potential for identifying the institutions that maintain structural violence (Section 7.2). Questions that emerge for further study include: (1) How to further refine methods for estimating biological sex, age-at-death, and genetic relationships? (2) How best to move from biological observations to social categories of gender, age, and kinship? (3) How to identify non-essentialized examples of variation across social categories and use this information to inform the present? (4) How to approach intersectionality in the past and use this information to identify the institutions that initiate and maintain structural violence? And (5) How to best bring this information to contemporary problems?

5 | CLIMATE CHANGE

The archaeological record reflects the impact of past climate and envi- ronmental changes that have been persistent forces framing the human condition since the emergence of *Homo sapiens sapiens* in the Pleistocene. The 21st century is already witnessing extreme climate events— floods, fires, and heat advisories—related to global warming; CO_2 levels and annual mean surface temperatures are approaching levels not seen since hominins evolved in the Pliocene (Burke et al., 2018). For the past 12,000 years, humans have benefitted from a relatively stable climatic condition, but for at least half that time, the species has directly and significantly manipulated the "natural" and increasingly contributed to the creation of an anthropogenic world (Stephens et al., 2019). The pace and the magnitude of contemporary anthropogenic climate change is arguably the most important challenge any species has ever faced.

Climate change undoubtedly has had and will continue to have substantial effects on human communities and lead to profound changes across the spectrum of life on Earth (Barnosky et al., 2011). It is difficult to predict exactly how climate change will proceed, particularly given the unprecedented magnitude and pace of recent changes (Quintero & Wiens, 2013), but a vital resource for such predictions is the historical sciences, primarily reconstructions of past environments. To plan for the future of planet Earth we also need to understand how human communities perceive and understand climate and environmental changes; the meaning of climate changes cross-culturally and over time; the role of history, culture, and society in shaping short-term responses to climate change; and the long-term consequences of adopting different strategies. Bioarchaeology has much to contribute, as evidenced by recent publica- tions on climate change (Robbins Schug, 2020; Robbins Schug et al., 2019).

5.1 | Climate change and human resilience

Discussions of resilience crosscut academic and political discourse about climate change and the future of

humankind upon this earth. As defined by Holling (1973, p. 14), resilience "is a measure of the persistence of systems and of their ability to absorb change and disturbance and still maintain the same relationships between populations or state variables." Importantly, resilience does not nec- essarily mean stability—systems can be modified. Butzer's (2012) treatment, cited in at least one policy paper (World Health Organization, 2017), focuses upon collapse but in the context of a resilience model that emphasizes the significance of cultural identity, as Burke et al. (2021) and Temple and Stojanowski (2019a) subsequently advocated. In parallel to an emphasis upon ecological diversity as an attribute associated with resilience, Burke et al. (2021) emphasize the importance of cultural diversity in promoting resilience in human systems.

Cultural resilience figures heavily in Temple and Stojanowski's (2019a) bioarchaeological treatment of hunter-gatherers. They argue that the persistence of ethnic identity is of particular significance, buffering against external stressors through the maintenance of support networks. Similarly, in human contexts, resilience should be measured using worldviews, historical contingencies, and perceptions (Temple & Stojanowski, 2019b). Thus, in approaches to human resilience in response to climate change (and other stressors) our definition of resilience should be modified to include cultural attributes. The Point Hope hunter- gatherer example (Justice & Temple, 2019) serves well to illustrate this perspective: though peoples' food acquisition strategies transformed over time, evidence of a persistent, sustaining worldview signifies significant cultural resilience in the face of climate change, including a flexible socioeconomic system. The work of Hegmon et al. (2008) and Nelson et al. (2006) have highlighted the significance of flexible responses, including mobility but not necessarily migration.

Cultural resilience is a core concept for modeling human resilience in response to external stressors such as climate change (Burke et al., 2021). Aspects of cultural identity, whether individual or group (kinship, religion, social standing, ability status), crucial in studies of resilience, are (perhaps uniquely) accessible through bioarchaeological study (see also Section 4). Similarly, as health and quality of life are persistent measures of positive, adaptive outcomes (though not all resilient systems lead to healthy populations), we again see bioarchaeology in a key role. Finally, missing in most archaeological, ecological, and socio-ecological scenarios is the role of religion and worldview, an important aspect of a people's identity (Buikstra, 2019d; Martin & Harrod, 2020; Temple & Stojanowski, 2019b). Evidence gained through the study of funerary rituals and mortuary sites is keenly important in this regard, as exemplified by Baker (1994) and Buzon et al. (2016).

One of the many attractive aspects of resilience models is their adaptability. As Holling (1973, p. 21) stated, the "resilience framework … does not require a precise capacity to predict the future, but only a qualitative capacity to devise systems that can absorb and accommodate future events in whatever unexpected form they may take." As witnessed in the 21st century, even widely expected disruptive forces, such as pandemic disease, can test cultural resilience in remarkable ways.

5.2 | Exploring the effects of climate change on migration and violence

Violence (Section 7) and migration (Section 8) are often seen as inevitable and maladaptive human responses to climate change (Robbins Schug et al., 2019). Bioarchaeology is replete with studies that contradict such generalizations. For example, Harrod and Martin (2014) examined responses to climate and environmental change among Ancestral Pueblo people of the Southwestern United States. These authors found not only evidence of migration and warfare, but also the formation of cooperative alliances with other communities, with exchange networks, and critical resource redistribution. Flexibility and diversity of possible responses appear to have been the resilience response under these circumstances. Violence precipitously increased in populations that experienced drought and had constructed socio-ecological and cultural systems more rigid than their counterparts who engaged in alternative pathways.

Robbins Schug and colleagues have conducted research on human-environmental interactions over the past 4500 years in South Asia (Robbins Schug, 2011, 2016, 2017; Robbins Schug et al., 2012, 2013; Robbins Schug & Blevins, 2016; Robbins Schug & Goldman, 2014). They found variation in the experience of climate and environmental change in urban societies versus rural, agrarian villages. Human skeletal remains from Harappa or Mohenjo Daro demonstrate the effects of environmental and political changes on human communities. Interpersonal violence and infectious diseases were rare at the height of the Indus civilization (Robbins Schug et al., 2013). However, the skeletal remains of people who stayed behind and lived in these cities during the Post-Urban period demonstrate that the prevalence of injuries and infectious diseases increased over time with the onset of climate change and resultant social instability and that the risk for interpersonal violence and disease was shaped by social inequality (Robbins Schug et al., 2012). In this case, the more resilient response indeed appears to have involved migration. Thus, flexibility facilitated resilience; as homeland and place were malleably defined, and the populations faced the challenges of climate change more successfully than the more rigid group that remained in the urban area.

Though there are examples wherein the adaptive response was indeed migration or at least enhanced mobility (Buzon et al., 2007; Buzon & Simonetti, 2013; Thompson et al., 2005), other long-term histories report that migration is only one of several alternatives in the face of external stressors. Rather than assuming that mobility and migration are inherently maladaptive, the focus should be upon the factors that make population movement a resilient response. For example, Beekman (2015) found that the archaeological evidence from the Guanajuato and Jalisco regions of Northern Mexico in the Epi-Classic period demonstrate large-scale migration events that coincided with prolonged drought in the period from AD 700–1200. Stojanowski and Knudson (2011a, 2011b, 2014) examined mobility in the context of environmental change in human populations from Niger in the Sahara region of North Africa. They found for the Middle Holocene that climate change led to aridification, and that these environmental changes were associated with higher levels of mobility but

fewer signs of growth disruption in childhood. Significantly, there is no evidence that this increase in mobility resulted in sociopolitical instability or interpersonal violence.

Bioarchaeologists working in other world areas have reported that there is a variety of historical and socio-cultural circumstances where the relationship between climate change and migration breaks down (e.g., Gregoricka, 2016; Knudson & Torres-Rouff, 2015; Robbins Schug, 2011; Tung et al., 2016). Bioarchaeologists also can identify how history and sociocultural variation shape the likelihood of climate and environmental change leading to migration, and this permits disciplinary exploration of other pathways to resilience.

5.3 | Climate and disease

Bioarchaeology has a key role to play in understanding the antiquity of modern observations of associations between climate change and infectious disease outbreaks. McMichael (2015) noted that extreme weather events, which are projected to increase with human-driven climate change, are often followed by disease outbreaks, as these disrupt social conditions and infrastructural elements relevant to public health and affect the distribution and/or demography of pathogens, vectors, and animal reservoirs. Global warming has led to an expan- sion of areas hospitable to some pathogens and vectors, altering global distributions and prevalence of diseases such as cholera (Chowdhury et al., 2017). Understanding how climate change has shaped the distribution of pathogens and facilitated the emergence and spread of new diseases, and how humans have both contributed to climate change and suffered through or exhibited resilience in the face of climate-associated disease events in the past, is important for prompting change today. Bioarchaeologists offer a vital perspective on the history of social inequality and violence in human health that is embedded in the anthropogenic transformation of ecosystems, including contemporary global food systems (Agarwal, 2022).

Bioarchaeological examination of the links between climate change and disease includes recent work on historical plague epidemics. The mid-14th century plague epidemic, often referred to as the Black Death, which inaugurated the Second Pandemic of Plague, emerged in the context of changing global climatic conditions associated with end of the Medieval Climate and the transition to the Little Ice Age (Brooke, 2014; Campbell, 2016). Bioarchaeological research in London has examined how severe famine events produced by environmental changes–in syndemic interaction with intense population pressures, increasing urbanization, and dramatic social inequality– might have exacerbated vulnerability to plague, leading to higher mortality rates than might have otherwise been the case (DeWitte, 2015b, 2018, 2021; DeWitte & Slavin, 2013; see also Section 9.1). Associations have also been suggested between climate conditions and other historical pandemics, such as the Antonine Plague in the second century CE (Elliott, 2016) and the Plague of Justinian (also referred to as the First Pandemic of Plague) that began in the sixth century CE (Harper, 2017; McCormick et al., 2012, see also Baten et al., 2019). These epidemics have not yet received

extensive bioarchaeological attention, but the availability of skeletal remains used in aDNA studies of the Plague of Justinian (Harbeck et al., 2013; Wagner et al., 2014) suggests such work might be possible.

5.4 | Diet and adaptation

Global climate change has drastic impacts on local ecosystems, which influence modes of production and resource availability and, thus, human diet. Even small changes in ambient temperature can transform ecosystems and dietary practices (Turner et al., 2020). As the planet faces the challenge of increasing temperatures, changes in precipitation patterns, and increasing intensity of storms, ecosystem turnover and precarity in human diet are increasingly likely (Brown & Funk, 2008; Hanjra & Qureshi, 2010). Food scarcity attributable to global climate change already challenges human communities and threatens communal existence (Connolly-Boutin & Smit, 2016; Gregory et al., 2005). Anthropologists recognize that diet is more than mere sustenance—it is reproduced through cultural transmission and forms the basis for symbolic modes of communication. Archaeological and bioarchaeological studies demonstrate that changes in ambient temperature, droughts, and storminess have resulted in a drastic transformation in diet that may have prompted deeper consequences such as increases in stress and disease, violence, and regional abandonment, whereas flexibility within socioecological and cultural systems have facilitated resilience in diet (Harrod & Martin, 2014; Hegmon et al., 2008; Nelson et al., 2016). Bioarchaeological studies provide a contextual and longitudinal understanding of human diet during periods of climate change. Within these studies, it is possible to understand how population adaptability provides mechanisms for survival during climate change and, specifically, the ways in which flexible behaviors help facilitate resilience in diet. Finally, many of these studies demonstrate how resilience in ideological systems may be facilitated by dietary transformations that are required for surviving climate change or, alternatively, introduce rigidities that increase precarity within socioecological systems.

A compelling example of flexibility within socioecological and cul- tural systems is associated with dietary resilience in Late/Final Jomon communities in southwestern Honshu, Japan, at around 4100 BP during a period of climatic cooling and emerging inequality (Kiriyama & Kusaka, 2017; Kusaka et al., 2008; Kusaka et al., 2015; Temple, 2019a). At this time, a dietary transition was facilitated by socioecological practices that drew upon a long-standing memory of plant cultivation, indicating resilience in Jomon diets as well as a stable, embedded worldview. Temple and Kusaka (2022) report that flexibility in dietary practices facilitated resilient occupation of Yoshigo Shell Mounds in Japan (see also Fish et al., 2013; Gamble, 2017).

Archaeological and bioarchaeological evidence underscores the fact that diet should be considered an independent variable, not necessarily inherently linked to other sociocultural attributes. For exam- ple, Stojanowski (2019a), using carious lesions, antemortem tooth loss, periapical abscesses, and dental calculus, argues for the persistence of a core diet at the Gobero site in Niger during and after climatic aridification at around 6500 BP. Despite a relatively stable diet across this period, transformed sociopolitical

structures are visible, include large-scale cemeteries, specialized disposal areas, and funerary pendants, perhaps signaling the emergence of ethnic distinctions. Berger and Wang (2017) interpret decreased rates of stress markers across the Bronze Age in the Hexi Corridor of Gansu, China in the context of fluctuating climate conditions as reflecting the resilience of the agropastoral subsistence strategies that existed at the time. On the other hand, marked changes in diet are also found independent of climatic and/or environmental change. The European Mesolithic-Neolithic transition is one example of a marked dietary change independent of climate change where transformation in patterns of migration, diet, ancestry, and ritual practices swept across a landscape (Schulting, 2019).

5.5 | No grand narratives

Governmental and nongovernmental organizations are developing plans to cope with and respond to climate change. Unfortunately, policy and planning professionals are not relying on archaeological sources to inform their decision-making (Rockman, 2012; Sabloff, 2009; Van de Noort, 2011). The most prominent sources for the public and, unfortunately, policy makers are authors like Jared Diamond and Steven Pinker, whose discourse about human adaptation and "human nature" in the face of external stressors is underinformed anthropologically (Graeber & Wengrow, 2021; Robbins Schug et al., 2019). In addition, the Human Security field has reached erroneous conclusions about human behavior in the context of climate change, specifically that resource scarcity, social inequality, and environmental migration will inevitably result in increased conflict and interpersonal violence (e.g., Adger, 1999; Alvarez, 2016; Carleton et al., 2016; Cramer, 2002; de Soysa et al., 1999; Ehrlich & Ehrlich, 2013; Gilgan, 2001; Gough, 2002; Hsiang et al., 2013; Matthew et al., 2009; Mochizuki, 2004; Nordås & Gleiditsch, 2007; Oels, 2012; Ohlsson, 2000). This perspective—that climate change always causes migration, competition, and violence— leads to narratives emphasizing US isolation and military power (Hartmann, 2013; Lane, 2010).

Broadly speaking, bioarchaeology challenges such simplistic grand narratives of human history. Small-scale societies are often resilient in the face of environmental change; mobility, and flexibility; adaptive diversity is a largely successful strategy for avoiding negative consequences (Berger & Wang, 2017; Gregoricka, 2016, 2021a; King et al., 2018; Robbins Schug, 2011; Snoddy et al., 2020; Sohler-Snoddy et al., 2017; Stojanowski & Knudson, 2011a, 2011b, 2014; Temple & Stojanowski, 2019a, but see also, Bartelink, 2006, 2009; Bartelink et al., 2014, 2019). However, complex societies are often much less flexible, often falling into the "rigidity trap" (Holling & Gunderson, 2002). They are too frequently built on structures of social inequality that can become fault lines for further marginalization when crises arise, including longstanding and rapid climatic change events (Nystrom & Robbins Schug, 2020).

Thus, bioarchaeological research on human health in the context of global climate change demonstrates that sometimes the social and cultural adaptations that people employ in the short-term may ultimately not be enough to buffer them from long-term consequences of environmental change. However, grand narratives concluding that climate change always leads to migration, competition, violence, and collapse are overly simplistic and do not account for the important historical, social, and cultural forces that shape human perceptions of climate change, decision making, and the consequences of different choices.

5.6 | Conclusions

Bioarchaeologists have denaturalized natural disasters such as climate change by recognizing that moments of crisis and chaos are often anthropogenic and are also opportunities for sociocultural change and biological adaptation (e.g., Robbins Schug, 2016). When reframed in this way, change is not viewed as inherently bad, and viewing pre-existing structures ("the past") as somehow "good" or "natural" are avoided (Moore & Baldwin, 1993). This de-essentializing is similar to that seen when the bioarchaeological evidence for alternative, humane responses to human variety, whether in shape, size, color, sexual orientation, or health is recognized (see Section 4).

One of the challenges faced by scholars interested in contributing to broader discourses about climate change is creating a narrative that captures cultural diversity without becoming so rife with details that no conclusions emerge. If, for example, flexible responses are more resilient than rigid ones, this should be emphasized without becoming lost in descriptive minutiae, however interesting these may be. To ensure that research relates to broad issues of significance begins at the level of the research design to guarantee that the questions posed are as important in understanding the past as they are of significance in the world today (see Section 11).

6 | MIGRATION

Migrations and human mobility have been prominent throughout the history of humankind, from the original dispersal of the genus *Homo* "out of Africa" to the current capacity to cross continents in a matter of hours. Many discussions at the Workshop focused on the link between the deep history that bioarchaeologists bring to the study of human variation, including aspects foundational to studies of migration and scientific racism. This article addresses several ways in which 21st-century bioarchaeologists can and should engage with migration and the way it can be studied through the embodied signatures of heritage, residence, and cultural modifications.

6.1 | Words matter

Following the lead of bioarchaeologist Stojanowski (2019b), biological anthropologist Kenneth Weiss (Weiss &

Lambert, 2011, 2014; Weiss & Long, 2009), forensic anthropologist Ann Ross (Ross & Pilloud, 2021; Ross & Williams, 2021), and molecular anthropologist Deborah Bolnick (2008), Workshop participants advocate against the use of typological language in discussions of the history of humankind and human variation, frequently found today in reference to migration. Changing the use of ingrained, typological terms will not be easy, as they reflect a way of thinking closely meshed with categorizing humankind in terms of races, either implicitly or explicitly. Racist political groups frequently use poorly chosen words from scientific reports to justify their dogma. As Stojanowski (2019b, p. 183) emphasizes, "[t]his is unacceptable, and it is time for bioarchaeologists, those who study ancient migrations with nuance and context, to speak out."

6.2 | Bioarchaeology, genomics, and migrations

While migration remains a highly visible topic in the public eye, few bioarchaeologists have engaged as public intellectuals with "big picture" questions, such as the Great Migration,[13] the Lapita-Polynesian Colonization, and the Peopling of the Americas. Bioarchaeologists have, however, written authoritative, scholarly articles about the Great Migration (de la Cova, 2011, 2014, 2019) and continental migrations (e.g., Hubbe et al., 2011; Neves & Hubbe, 2005; Powell, 2005), but seldom are they viewed as the "go to" authorities. The most notable bioarchaeological exception is the African Diaspora, writ large in professional and public statements by Blakey (2001) and Blakey and Rankin-Hill (2009). Today's broad-scale syntheses, how-ever, tend to be written by molecular geneticists (e.g., Reich, 2018), sometimes in collaboration with archaeologists or museum specialists (Lamnidis et al., 2018; Willerslev & Meltzer, 2021).

Bioarchaeologists, reeling from mid-20th century critiques of the "old physical anthropology," focused on searches for better phenotypic skeletal and dental proxies for genotytpes, such as the so-called "nonmetric traits" (e.g., Berry & Berry, 1967; Buikstra, 1972; Finnegan, 1972; Ossenberg, 1970; Spence, 1974, see also Buikstra et al., 1990, Hefner et al., 2016). These were frequently used to argue against population replacement in regional contexts where changes in material culture were de facto explained by migration. Inspired by the "new archaeology," many bioarchaeologists turned away from bio-distance studies, as they focused upon research questions more in line with the adaptationist concerns of processual archaeologists, many of which related to health and diet (Armelagos, 1969; Cook, 1979). This shift in bioarchaeological emphasis led to the immensely productive health-related studies associated with agriculture (Cohen & Armelagos, 1984). As with the radiocarbon dating "revolution" of the 20th century the 21st century has seen remarkable technological advances in genomics and bioinformatics, which facilitate new insights in the study of archaeological migrations. Approaches generally take two basic forms: the study of contemporary variation, which is projected into the past, and the study of aDNA, sometimes replicating the full genome of very ancient materials (Pickrell & Reich, 2014). The former may include quite large samples although they may reflect only relatively recent

events (Pickrell & Reich, 2014; Stojanowski, 2019b). Ancient DNA, although limited by taphonomic factors, holds potential for inferences at global-to-local scales (Calloway, 2018). The several high-quality genomes from Neanderthals, as well as their sister group, the Denisovans, are achievements unleashed through the power of genomic analysis (Mafessoni et al., 2020; Prüfer et al., 2014, 2017; Reich et al., 2010; Slatkin & Racimo, 2016). Similarly, stimulated by new methods for data collection, capture, and analysis, 21st century bio-archaeologists are exploring documented genealogies in studies of complex dental structures in a manner that should improve bio- distance models and promote renewed emphasis on bioarchaeological studies of migration (Paul et al., 2017; Paul & Stojanowski, 2015; Stojanowski, 2019b; Stojanowski et al., 2017).

Disputes have developed, however, over general genomic models for migration, such as those proposed by Haak et al. (2015) and Allentoft et al. (2015) for the Yamnaya Culture pastoralists from the Russian and Ukrainian steppes as they apparently replaced earlier Neolithic farmers in Europe (Calloway, 2018). Such models, pronounced with authority of what biological anthropologist Horsburgh (2015) terms "molecular chauvinism," may serve relatively well as maps for characterizing global or continental-scale migrations, but for people and processes, as Horsburgh (2015, p. 142) emphasized, "privileging the genetic data over all the other classes of data available impoverishes the nature of the reconstructions available to us." In the case of the Yamnaya model, archaeologist Furholt (2018, p. 164) reminds us that genetic data need to be better contextualized using archaeological theory, and that "anthropology shows us that material culture may be linked to diverse and changing layers of identities, may be actively used for different purposes by social actors, and may have a different and changing impact on social interaction," echoing issues raised by TallBear in Section 4.4. These are lost when monolithic linkages between cultural and biological units, so similar to the outdated archaeological tropes of the early 20th century, are newly attired in white coats and promoted today (Furholt, 2018, 2019a, 2019b).

To date, even if the samples from archaeological human remainsare painstakingly selected by bioarchaeologists, the migration debates have most visibly involved molecular or archaeological scientist- spokespersons. Biodistance and mobility studies are not commonly included in this work, although they are sometimes added later but not really integrated into the research design. This may be changing, however, (e.g., Furholt's, 2019a, polythetic approach, Burke et al., 2021). More anthropologically satisfying, at the other end of the scale, is an earlier study of people also associated with the third millennium BCE Corded Ware Culture (Haak et al., 2008). Biological profile information along with DNA and strontium isotope studies of mobility, lineage relationships, and sex-based residence data were combined to explore the circumstances of life and death of these 13 individuals, as well as of their deaths, apparently the result of a massacre that took place near present-day Eulau, Germany, approximately 4600 years ago (Meyer et al., 2009). This integrated, interdisciplinary effort highlights the way Early Medieval people lived, and their deaths speak compellingly to political tensions and violence

associated with regional culture change (see also, Amorim et al., 2018). Such nuanced, focused, and interdisciplinary studies are convincing and compelling snapshots that reveal much about larger historical processes.

6.3 | Bioarchaeological approaches to migration

Recent edited volumes on migration (e.g., Baker & Tsuda, 2015a; Cabana & Clark, 2011) have included bioarchaeologists, who made significant contributions to regional histories, methodologies, and theoretical issues (Frankenberg & Konigsberg, 2011; Knudson, 2011; Knudson & Torres-Rouff, 2015; Tsuda et al., 2015; Zakrzewski, 2015). In these collections, bioarchaeologists have focused on subtle but important relationships within local regions.

Further questions that warrant study include: Are religious differences introduced by immigrants typically more disruptive to social cohesion than other customs? How do religious differences affect local transformations? How do communities at the edge of distant state political control respond to the withdrawal of foreign influence? How is resilience in the face of such changes demonstrated? Certainly, these studies are regionally significant, but how may they expand to address larger issues?

An important step moving forward may be seen in Gregoricka's (2021a, 2021b) review of migration studies in bioarchaeology, which defines several topical areas wherein bio- archaeological studies have been prominent: social and ethnic identities; kinship analyses and post-marital residence; forced migration and enslavement; contact, interaction, and admixture; and climate change and disease transmission. If bioarchaeologists can report a common suite of parameters relevant to these issues, then comparative studies will be able to generalize accordingly. Gregoricka (2021a, 2021b) also urges—as endorsed by the Workshop participants—that bioarchaeologists should develop a habit of disseminating both their local and more general results on these and related issues to the public.

With its long-term perspective, bioarchaeology can reveal whether the patterns of health among present-day peoples also existed and thus shaped variation in health within and between populations in the past. Specifically, several studies of contemporary populations have revealed that individuals who successfully migrate are, at least temporarily, healthier on average than individuals in both their sending and receiving populations (the so-called “healthy migrant effect” or “migrant selectivity") (e.g., Chen, 2011; Lu, 2008; see also Groves et al.'s, 2013 mobility study of an Anglo-Saxon site in northeast England wherein migrant individuals appeared to have had a better overall state of health than the local population). The long- term perspective of bioarchaeology is also ideal for addressing social theories about migrations, including, for example, Manning's (2006) hypothesis that cross-community migration, “in which human individuals and groups move to join an existing community and learn its language and customs” is the most transformative of all forms of migration (Manning, 2006, p. 28). Manning's (2006) perspective emphasizes process in a behavioral model, which focuses

on human motivations and impacts, rather than an ecological emphasis on locations of origin and destination.

Individual and group identities associated with migration have been investigated by bioarchaeologists in a variety of contexts, frequently facilitated by biodistance and bone chemistry studies of mobility, such as those reported in Knudson and Stojanowski (2009a, 2020). Perhaps studying identities, as they change across migrating and recipient communities, would be a way to characterize the human experience of immigration effectively. Stojanowski's (2010) pioneering study of Seminole ethnogenesis is a useful model in this regard, as is Zakrzewski's (2015) study of Islamic Iberia during the Medieval Period. Migration studies would thus seem ideal venues for bio- archaeology to play a central role. After all, the human body in motion is the core of migration, wherein new identities may be embodied in association with new materials and language forms. For example, Bentley et al. (2009) assessed identity, kinship, and mobility through the comparison of strontium, carbon, and oxygen isotopes in human teeth with burial artifacts at a Bronze Age site in northeast Thailand. Among the females at the site, different groups were identified through isotopic signatures; these groups also had distinctive types of pottery. Their social identity was therefore arguably drawn from place of origin (in this case different villages) and was represented by material culture in the mortuary context.

In contrast to the extensive study of migrations in Europe, the Pacific has seen relatively little bioarchaeological research. This largely reflects the small number of archaeological sites that have yielded well-preserved human remains. However, there has been the extensive bioarchaeological study of the few sites with intact burials, particularly over the past 15 years. Research questions have explicitly included human colonization and adaptation, many focusing on Lapita population movement (Buckley et al., 2010; Clark et al., 2017; Kinaston et al., 2013; Walter et al., 2017). Recent aDNA studies, including genomic research, are expanding knowledge of the complexities of migration into the Pacific including the early settlement by Lapita people as well as the settlement of distant islands, including Aotearoa New Zealand (Knapp et al., 2012; Lipson et al., 2018; Skoglund et al., 2016). However, because of the political and cultural complexities of working with human remains in the Pacific, some of the previous biological anthropological research on migration focused on aDNA and DNA analysis of commensal animals as proxies for human colonization (Matisoo-Smith, 2015).

Thus, migration and mobility studies are ideal contexts for bio- archaeologists to contribute to scientific advancement of knowledge and also to shape public awareness of past human group and individual transformations in the course of migrations. Changes in the human landscape—whether biological or cultural—can be invigorating, as they are inevitable. Bioarchaeologists have contributed to the study of migrations at multiple scales, ranging from the individual experience of enslaved people (Blakey & Rankin-Hill, 2009) to an economic underclass (Beaumont et al., 2013; Harrod et al., 2012). The motivations for migration, as well as defining who migrates, are important questions, amenable to bioarchaeological study and relevant today (Baker & Tsuda, 2015a; Tsuda & Baker, 2015).

6.4 | Conclusions

In sum, our discussions of migrations lead to several significant conclusions, some related to the fraught history of bioarchaeology in the study of human migration and mobility. While bioarchaeologists should be encouraged to engage in migrations studies, it is imperative that terminology eschew typological language and focus instead on the people whose bodies moved across the landscape. Words indeed matter in studies of the human past. In migration models, ground truthing with bioarchaeological, archaeological, and historical evidence is essential for knowledge to truly advance. By exploring detailed cases, we can establish those attributes that are of more general significance, thus addressing important theoretical questions, such as, under what conditions do individuals and groups move? These conditions may be environmental, political, economic, religious, social, or, most likely, a combination. Ethnic groups are fluid, and ethnogenesis is an important, vital process in human history, including the impact of human mobility. Finally, the public should be partners in this endeavor, especially when they comprise a descendant community, but also when the response to the research is presented in public venues, as is our responsibility.

7 | VIOLENCE

The Bioarchaeology Workshop's discussion of violence addressed both direct evidence of physical violence in trauma analyses and Galtung's (1969) and Farmer's (2004) notion of structural violence, especially how bioarchaeologists can employ this powerful construct. Workshop participants concluded that the subtle yet impactful forces of structural violence stemming from long-standing power inequalities could indeed be critically examined—at least partially—with a bioarchaeological lens. To achieve deep insights into direct physical violence and structural violence, our group emphasized the need for nuanced analyses of temporal trends. Regional examples were likewise emphasized, as were prospective partnerships with colleagues in both violence and peace studies. Participants cautioned against monocausal explanations for violence, emphasizing relationships with other variables, such as climate change, migration, social and gender norms, and inequality as well as the context-dependent reasons for and repercussions of violence. Due to their distinctive osteological signatures, inter- personal and structural violence will be considered separately here.

7.1 | Trauma and interpersonal violence

Through the study of antemortem bone trauma, bioarchaeology contributes to the understanding of physical violence across the human past. Bioarchaeologists also explore the intricate, complex relationships between the factors that predispose to interpersonal and group violence, and they infer day-to-day activities that increase the risk of broken bones. For example, antemortem and perimortem[14] fractures, frequently exciting public interest and also stimulating controversies, have been identified in ancestral hominins (e.g., Berger & Trinkaus, 1995; Kappleman

et al., 2016; L'Abbé et al., 2015; Weidenreich, 1939, 1943). Counterarguments have focused on probable postmortem causation and the lim- ited nature of monocausal arguments (Binford et al., 1985; Binford et al., 1986; White, cited in Hersher, 2016[15]; Trinkaus, 2012). In response to critiques, interpretations of fractures in Neanderthal remains have moved from proposing monocausal, global explanations to recommending context-specific arguments (Trinkaus, 2012). The search for causation also reverberates through studies of more recent, Holocene human communities, with researchers generally agreeing with Trinkaus about multiple causes. Many bioarchaeologists argue that key interacting, predisposing variables may indeed be identified through careful contextual studies. The public is often drawn to reports of violence, especially in early hominines. These can usefully anchor broader discussions, if bioarchaeologists are careful to recognize current unmet challenges, (e.g, distinguishing peri-mortem blunt force trauma from taphonomic alterations).

Projectile and sharp force trauma to the bony skeleton are readily recognized by bioarchaeologists, as are distinctions between antemor- tem, perimortem, and postmortem breakage (cf. Knüsel, 2005). Less obvious are the effects of blunt force trauma, with distinctions between perimortem, and postmortem changes due to taphonomic factors, esp cially soil pressure, subject to dispute (e.g., Lahr et al., 2016; Stojanowski et al., 2016). As some of the more visible, attention-getting examples of trauma require distinctions between perimortem blunt force trauma and post-depositional changes (Ingvarsson & Bäckström, 2019; Kappleman et al., 2016; Lahr et al., 2016), developing accurate stan-dards for distinguishing perimortem trauma from alterations based upon forensic and funerary archaeological excavation expertise is essential. The methods created and applied by Sala (Sala, Arsuaga, Pantoja-Pérez, et al., 2015; Sala, Arsuaga, Martínez, and Gracia-Téllez, 2015; Sala et al., 2016) for remains from the Middle Pleistocene site of Sima de los Huesos (Atapuerca, Spain) appear promising for resolving this significant problem. Knowledge drawn from forensic anthropology about fracture biomechanics, fracture healing rates, and the role of taphonomy in altering bone to mimic antemortem and perimortem processes is essential in bioarchaeological studies of trauma (Berryman et al., 2018; L'Abbé et al., 2021; Pokines et al., 2021; Wedel & Galloway, 2014).

Other important methodological concerns require researchers to distinguish bony reflections of nonviolent, frequently occupation- related accidents from those truly reflecting interpersonal violence. Arkush and Tung (2013), for example, present an extensive compil tion of expected skeletal correlates for certain forms of violent behav- iors. Other recent reviews of bone fracture and causation appear in Wedel and Galloway (2014) and Lovell and Grauer (2019). An abundance of bioarchaeological treatments of violence includes Anderson et al. (2018), Domett et al. (2011), Harrod and Martin (2014), Klaus and Toyne (2016); Knüsel and Smith (2014): Martin and Frayer (1997), Martin and Anderson (2014), Martin et al. (2012), Redfern (2016), Redfern and Fibiger (2019) and Walker (2001). Attention to data recording systems is also important so that comparisons can be made between studies and etiologies assigned (e.g., Magalh˜aes et al., 2020).

For much of the 20th century, archaeological interpretations of the past largely ignored evidence of violence in small-scale societies, ultimately reconsidering this stance due to evidence provided by Keeley (1996), among others, illustrating the potential deadly demographic effect of conflict in small-scale societies. Bioarchaeologists

have a long history of addressing inter-personal violence in groups of small size, including topics such as cannibalism (Turner II & Turner, 1999; White, 1992), torture (Osterholtz, 2012), massacre (Meyer et al., 2015), suspected sacrifice (Lefranc et al., 2018) and mutilation (Chenal et al., 2015). Even so, the popular and frequently cited treatments of temporal trends in violence are commonly published outside the field, though some use bioarchaeological data (e.g., Pinker, 2011). As Milner (1999, 2007, 2019) and others have emphasized, generalizations about the apparent violent tendencies of humankind require regional sequences and detailed analyses of specific communities, rather than samples collected from across the globe with little regard for archaeological, historical, and cultural contexts.

Comparisons of temporal sequences across vastly different regions have underscored the lack of directionality implied by popular writers such as Pinker (2011). For example, a detailed study of cranial trauma and fortifications among pre-contact Andean groups from 8000 BCE to 1532 CE revealed considerable evidence of violence during the late Early Horizon (400 BCE–100 CE) and then again during the Late Intermediate Period (1000–1400 CE) with an apparent lull in between (Arkush & Tung, 2013; see also, Baten & Steckel, 2019; Pilloud & Schwitalla, 2020; Redfern, 2020; Robbins Schug, 2020; Torres-Rouff, 2020). Bio- archaeological critiques, however, are largely limited to academic language and scholarly publications. The ultimate goal should be to reach broader nonprofessional audiences in a professionally responsible manner.

As Robbins Schug (2020), in a nontechnical treatment of her larger compendium, emphasizes, "the deterministic view that climate change invariably causes migration, competition, violence, and collapse is overly simplistic. Bioarchaeology shows us that human responses are far more complex and diverse.[16]" Resilient reactions that involve flexibility in the face of difficult alternatives are amply documented across the archaeological record, as is the human cost of failing to plan for managing both short- and long-term challenges to contemporary lifestyles. The lessons from bioarchaeology suggest that even resilient responses may involve difficult choices among varied alternatives, such as dietary and subsistence shifts or, more drastically, migration and violent confrontation. Nonlethal violence as conflict management appeared in cultures as diverse as the those living in the San Pedro de Atacama oases (Torres-Rouff, 2020; Torres-Rouff & Costa Junqueira, 2006; the Chumash of southern California Walker, 1989), and Anatolian Neolithic Çatalhöyük (Knüsel et al., 2021).

7.2 | Structural violence

Although physical violence is treated separately from structural violence in this discussion, they are inextricably linked; the forces of structural violence greatly influence the frequency, pattern, and effect of physical violence and also contribute to other forms of bodily and psychological harm (Tung, 2021). Briefly, Galtung's (1969) definition of structural violence includes the institutional, societal, and political

limitations of an individual's ability to achieve their potential. This con- struct is useful for bioarchaeologists, as the impact of structural violence may be recorded in a variety of acute and chronic stressors, such as dietary inadequacy, disease, trauma, and pathogen load (Zuckermann et al., 2021) (Section 7.2.1). A second aspect of structural violence, as applied bioarchaeologically, relates to postmortem treatment of the body, especially autopsies and recovery for reference "documented collections" of human remains (Section 7.2.2).

Various other theoretical approaches to the expression of power differentials, such as biopolitics/biopower (Foucault, 1976), dead body politics (Verdery, 1999), necropolitics/necropower (Mbembé, 2003; 2019), biosoveereignty (Bargu, 2014), and the poetics of violence (Whitehead, 2002, 2004) are being adopted today in bioarchaeological examples. Some, such as biopolitics and necropolitics, focus upon the violence experienced by individuals and groups under conditions of power differentials. The poetics of violence is more broadly based, as it references the performative aspects of violence, as well as its generative potential and functions within cultural contexts (Osterholtz, 2020). Political functions and the experience of violence by those participating as actors and observers are embedded in these many approaches, which tend to be applied by bioarchaeologists in detailed contexts.

Bioarchaeological studies of embodied structural violence emphasize the significance of a broad definition of violence that extends beyond bodily trauma to the creation of socio-political power structures that create and reinforce inequalities, ultimately leading to violence, poor health and inadequate nutrition for the disadvantaged living, while also predisposing to destructive, sometimes illegal, and disrespectful treatment of the dead body. Identifying the dynamics that create and reinforce such inequalities underscores the conclusion that these are not "natural" states.

7.2.1 | Structural violence embodied in the living

In bioarchaeology, structural violence has been invoked most frequently to explain evidence of trauma and poor health in historical situations. This research has focused largely on remains recovered from three types of contexts: cemeteries associated with almshouses, asylums, and sanatoria, anatomical ("documented") collections representing those whose bodies were autopsied, sometimes illegally, or macerated and thus retained (Atwell & de la Cova, 2018; Blakely & Harrington, 1997; Crist et al., 2017; de la Cova, 2010, 2011, 2012, 2014), and lastly burial grounds for other economically disadvantaged individuals and those previously enslaved or incarcerated (Blakey & Rankin-Hill, 2009; Bright, 2020; Geber, 2016; Tremblay & Reedy, 2020).

Studies of embodied structural violence have revealed gendered and racialized experience of violence in the 19th and early 20th centuries. For example, in a comparative study of Euro-American and African American males from the Cobb, Hamann-Todd, and Terry anatomical collections, de la Cova (2010) hypothesized that African American males would present more evidence of trauma due to conditions associated with enslavement. In fact, the Euro-American males presented significantly more post-cranial trauma and a trend toward

more cranial trauma. Partitioning her sample of males by birth date, de la Cova (2011) discovered that African Americans, especially during the reconstruction period suffered disproportionately from tuberculo- sis (TB) and syphilis. By contextualizing the study in historical sources, de la Cova (2011, p. 526) attributed such differences to "environmental conditions related to enslavement, postliberation migration to the industrialized North, crowded urban living conditions, and poor sanitation." A subsequent comparative study of African American and Euro-American females (de la Cova, 2012) from the Terry Collection used the term "structural violence" for the first time in exploring the rea-sons for patterned differences in fracture patterning across the two groups of females. In studying structural violence, de la Cova 2020a, pp. 155–156) recommends a four-step, rigorous research approach that includes hypothesis-testing and interpretation only after the scientific protocol is complete. This work stands as a model for interdisciplinary rigor in exploring the embodiment of structural violence.

Structural violence can be much more difficult to investigate in the archaeological record when there are no ethnohistoric or archival sources. Martin and Harrod (2015, p. 134) provide a model for examining data sets within a data-rich context drawing on the archaeological record, adapted here as Figure 1. Qualitative and quantitative data from skeletal remains are the beginning point, while other data provided by archaeological and ethnohistoric sources add layers of data to empirically explore the presence of social structures within which violence is embedded.

One of the issues that emerge in the interpretation of health-related impacts as a measure of structural violence is the lack of comparative data from those who were known via independent measures not to have been disadvantaged. Further, as Klaus (2012) points out, given the historically contingent nature of structural violence, there

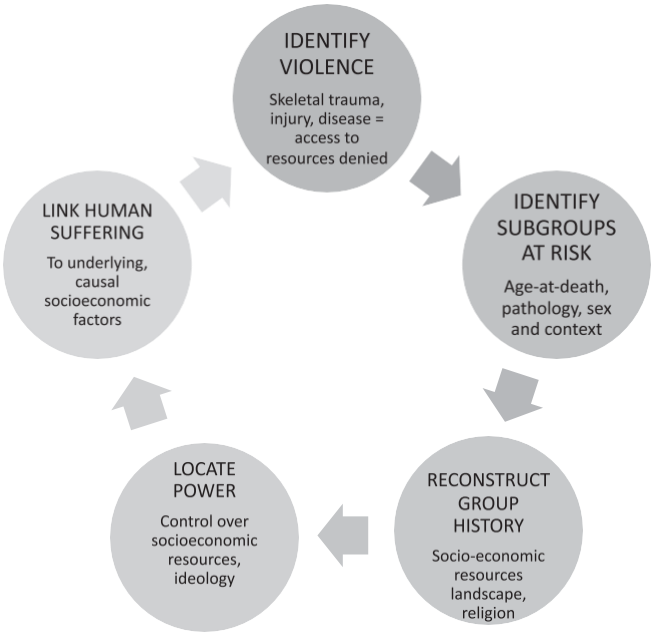


FIGURE 1 Chart illustrating possible pathways for linking bioarchaeological remains and contexts to structural violence (after Martin & Harrod, 2015, p. 134)

are several concerns in bioarchaeological applications to contexts without archival records. These include the problematic nature of extending the concept to non-Western premodern settings, and the potential that structural violence is only achievable in a rigidly hierarchical society. These are important issues, and as Klaus (2012, p. 44) also emphasizes, comparisons with "members of archaeologically defined supra- and subordinate social formations" are the ideal way to examine health indicators for evidence of structural violence. Barring that, a "contextualized diachronic sequence of health outcomes" is appropriate, leading Klaus to compare the lives of temporally sequential pre-colonial and colonial Muchik people from the Lambayeque Valley from the north coast of Perú. Klaus's results are ren- dered robust by this comparative approach.

7.2.2 | Structural violence and the dead body

Human cadaveric dissection has a long history, extending back in time at least to third century BCE Greece (Ghosh, 2015). Over the intervening centuries, legal, social, and religious perspectives have shaped anatomical use of cadavers, which is especially contentious in regard to those selected for dissection. Obtaining cadavers for such purposes, with the rise of formal medical education during the 19th and 20th centuries in Europe and North America, frequently led to bodies being obtained either clandestinely from recent graves or disproportionately from criminals or those dying in disadvantaged circumstances. While earlier bioarchaeological reports of surgical interventions, with special interest in trepanation had appeared, Blakely and Harrington's (1997) volume on the remains recovered from the basement of the original building of the Medical College of Georgia building in Augusta, Georgia, set a new standard for contextualizing dissected remains and the people whom they represent. This volume was followed by several 21st-century efforts to explore social status through the body's postmortem treatment.

Firmly focused on the marginalized histories of the people represented in the documented collections, de la Cova (2020a, 2020b) has further emphasized the structural violence represented in such contexts. The association of dissection/anatomization and marginalization has also been emphasized by Nystrom (Hodge & Nystrom, 2020; Nystrom, 2011, 2014, 2017a, 2017b) and Watkins (Watkins, 2018; Watkins & Muller, 2015). Nystrom's edited volume (Nystrom, 2017b) makes the important distinction between anatomization/dissection and autopsy, both methodologically and socially (see also Dittmar & Mitchell, 2015). The socially marginalized have been subjected to anatomization and dissection, with their identities all too frequently subjugated to the educational needs of the white elite (Watkins & Muller, 2015). In contrast, elite bodies have been opened to identify the cause of death; identity is thus retained during autopsy and in final interment.

7.3 | Combining physical and structural violence

Learning about construction and maintenance of violence in the past holds powerful lessons for the world today. Male violence (lethal and nonlethal) is expressed cross-culturally in diverse and complex ways because it is

associated with social spheres of power and influence, embedded within culturally specific ideologies, histories, and collective memories (Martin, 2021) and socialization processes (Knüsel, 2011). Bioarchaeologists such as Tung (2021) and Harrod (2017) have explored the ways that violence can be seen as both a chaotic and transgressive force as well as a generative and transformational social process. These works demonstrate how violence plays a key role in creating, maintaining, and transforming social processes. Using an interpretive approach that focuses on the ritualized aspects of male violence provides rich insights into the social processes that help to normalize and institutionalize violence.

One compelling example is Tung's (2021) discussion of masculinity and violence during late Andean prehistory and the early colonial period. Combining bioarchaeological, art historical, and archival sources, Tung (2021, p. S125) emphasizes that "naturally violent man" is in truth the product of social, political, and other culturally mediated processes that "make and mark" gender. She argues that this "bio- archaeology of embodiment," with the body at its core, provides key markers of structural violence, such as malnutrition, meanwhile also recording the physical impact of interpersonal aggression. Tung (2021) also addresses broader issues, including the degree to which the link between masculinity and power are essentialized in various cultures, thus naturalizing the link between men and violence today. This is an important example wherein received wisdom is interrogated through a critical reading of long-term histories. In her detailed and wide- ranging study, she critically reviews other commonly held beliefs, such as a "natural" link between meat-eating and masculinity, which is decoupled in the Andes as maize consumption assumes prominence, presumably through *chicha* as a "power drink" that reinforces masculinity in social displays.

7.4 | Conclusions

Richly contextualized studies compared across time and space argue compellingly against notions of "natural" violence and essentialized time trends. Causes of violence in societies of any scale are invariably so complex that identifying factors for deterring violence will similarly be a complex task, requiring time depth and both pre-and post-violence pulse samples. Climate change, for example, is indeed correlated with violence on some occasions, but other risk factors in the face of climate change are also important. Mitigations today should address all factors, not assume mono- causality. Regarding histories of violence, bioarchaeologists should also argue for nuanced perspectives on both the conquered and the conquerors. A mosaic landscape of Indigenous cultural differences in social, political, and economic structures should be appreciated in terms of agency as they encountered the colonizing other. Finally, members of the Bioarchaeology Workshop envisioned future, temporally controlled studies of archaeological conflict situations wherein a detailed pre-conflict baseline is created, affording a fundamental, crucial point of comparison from which to view the impact of large-scale aggression on smaller scale interpersonal violence.

8 | EPIDEMICS AND PANDEMICS

In the months following the Workshop as the COVID-19 pandemic intensified, many participants observed a growing recognition by journalists and the general public of the relevance of bioarchaeology for understanding the origins, contexts, behavior, and consequences of epidemic and pandemic diseases in human history. In particular, numerous parallels have been drawn between COVID-19 and the Second Plague Pandemic, the 1889–1891 pandemic (commonly called the Russian flu, but which might have been caused by a coronavirus, Brüssow & Brüssow, 2021), and the 1918 influenza pandemic. Correspondingly, however, it is important to avoid making false analogies between the COVID-19 pandemic and the Black Death or the 1918 flu, as there are many important differences between the pathogens that caused these pandemics and their pathophysiologies, potential for long- term sequelae, and social, political, public health, and medical contexts. However, there are parallels that can and should be drawn in order to contribute to positive changes that benefit people in the future; these include the xenophobia and racism that is revealed or amplified by these crises (Cohn, 2012; Hoppe, 2018; Rambaran-Olm, 2020), challenges in slowing or stopping the spread of disease, and the role that social inequality can play in worsening the outcomes of a pandemic (Abrams & Szefler, 2020; Nelson, 2021; Roberts, 2020c).

8.1 | Social determinants of infectious disease morbidity and mortality outcomes

The last 2 years have witnessed the effects of social inequality on outcomes of COVID-19 infections. Greater income inequality within countries is positively associated with numbers of COVID-19 deaths (Davies, 2021), and higher poverty rates are associated with faster spread of the disease (Bargain & Aminjonov, 2021). Lower-income people face higher risks of exposure to the disease because of their disproportionate representation among frontline workers (Blau et al., 2021), greater reliance on mass transportation, and more crowded living conditions (Almagro et al., 2021; Truong & Asare, 2021). Lower-income people are also more likely to live in multigenerational households, which elevate risks of exposing vulnerable elderly people to the virus (Nafilyan et al., 2021). They are also more likely to experience reduced access to good health care services and generally seek health care at more advanced stages of illnesses, increasing risks of poor outcomes (Patel et al., 2020). Several health conditions have been identified as increasing the risk of severe illness or death from COVID-19, all of which disproportionately affect people with low incomes for a variety of reasons, such as poor nutritional status because of food deserts, reduced access to health care and education, or the inability to take time away from work to seek health care (Miranda et al., 2019; Truong & Asare, 2021). Poor communities are more likely to be exposed to higher concentrations of indoor and outdoor air pollution too (Hajat et al., 2015; Perlin et al., 2001), which is associated with elevated risks of infection and death from COVID- 19 (Conticini et al., 2020; Travaglio et al., 2021; Wu et al., 2020).

This general pattern of disproportionate negative effects for impoverished people during epidemics is not new. Analyses of human skeletal remains from medieval London cemeteries have revealed evidence of worsening health, in general, prior to the 14th-century Black Death (DeWitte, 2015b, 2018), which might have exacerbated mortality outcomes during the Black Death. These changes in health occurred in the context of increasing social inequalities in England and recurrent, often severe famines, that would have disproportionately affected poorer households (Campbell, 2016). Evidence gathered from the remains of people who died during the Black Death in London suggests variation in risk of mortality by health status (DeWitte & Hughes-Morey, 2012; DeWitte & Wood, 2008; Godde et al., 2020), which might have been shaped by social status or wealth inequality. Documentary evidence indicates that in some cases medieval and early modern plague in England and other locations disproportionately affected lower status and poor people (e.g., Alfani & Bonetti, 2019; Carmichael, 1986; Cummins et al., 2016; DeWitte & Kowaleski, 2017; Galanaud et al., 2020).

In addition to, and likely interacting in a syndemic fashion with, the clear negative effects of economic inequality during the pandemic, there have been striking racial disparities in exposure to and morbidity and mortality from COVID-19. Numerous studies have highlighted the disproportionate infection and mortality rates for citizens of Native Nations and Black, Hispanic, Latinx, and Asian people in the United States and the United Kingdom (Abedi et al., 2021; Chen & Krieger, 2021; Lopez et al., 2021; Mackey et al., 2021; Nazroo & Bécares, 2020). Similarly, globally, some migrants have experienced disproportionate rates of COVID-19 disease and mortality and adverse economic effects of the pandemic (Greenaway et al., 2020; Guadagno, 2020; Guijarro et al., 2021; Mukumbang, 2021), as have people with specific health conditions (e.g., leprosy: Mahato et al., 2020). To date, there have been no published bioarchaeological studies of the possible effects of racism and xenophobia on outcomes of past bubonic plague pandemics (though work has been done on leprosy and stigma in the past; see, e.g., Robbins Schug, 2016). However, given the increasing application of biogeochemical analyses to historic plague burials, there is certainly the potential for bio- archaeologists to integrate demographic, aDNA, isotopic, and morphometric data to examine whether disparities across population affinities or migrant statuses existed during past plague epidemics.

Many of the mechanisms linking wealth or racial inequality and health and disease have been well established in the medical anthropological, public health, and epidemiological literature, but the COVID-19 pandemic dramatically highlights the implications—not just for those directly affected by poverty and racism—but also for the population at large, that is, interfering with measures to control the spread of the disease within and between populations. Importantly, because the social and economic factors affecting morbidity and mortality at the time of the Black Death and currently in the context of COVID-19 are exogenous to the individual body (at some point during the lifetime of an individual or their ancestors), it is theoretically possible to prevent or change them. Some of the biocultural outcomes of social inequality are not immediately reversible, given the effects of

economic disparities and psychosocial stress on long-term immune function and risk of chronic disease, and the possible intergenerational effects of poverty via epigenetic mechanisms (McEwen & McEwen, 2017). Nonetheless, it is imperative to do whatever is possible to reduce the negative consequences of inequality for the well- being of the entire population.

Bioarchaeological research can promote these efforts, given its potential to reveal the deep history of structural conditions that shape human health and that continue to be reproduced today, such as racism, xenophobia, economic inequality, and other forms of structural inequality and marginalization. Clear, contextualized documentation of this deep history can undermine the idea that health, disease, and risks of death are all a matter of individual biology or responsibility, that is, that people are inherently at higher risk because of their genetic makeup or that they put themselves at elevated risk of disease and death because of deliberate choices they make or have made (see de la Cova, 2011, 2014, 2019). It is all too easy to blame individuals, particularly those viewed as "other," for their poor health rather than to recognize and rectify the structures that are ultimately responsible for creating the embodied conditions that put people at risk; bio- archaeological research can help to counter this tendency. A huge body of literature exists on the social determinants of health, which emphasizes the conditions in which people are embedded (e.g., income level, educational opportunities, food insecurity, racial segregation, access to housing) rather than individual biology and behavior (Marmot, 2005). For example, with respect to the COVID-19 pandemic, Tan et al. (2021) provide evidence that higher levels of measured structural racism are associated with higher rates of disease and death, even after adjusting for relative access to healthcare, population density, and other factors that contribute to exposure, morbidity, and mortality. Scholars who engage with intersectionality to promote health equality and social justice have long pushed against "blaming the victim" (see, e.g., Lo,pez & Gadsden, 2017), while syndemic perspectives, rooted in anthropology but more widely influential, highlight the role of adverse social conditions in determining poor health outcomes (e.g., Singer & Clair, 2003). Bioarchaeology can contribute to this discussion and to efforts to promote health equality by providing a wider view of how the social conditions operating within populations today produce health inequality that also operated in the past. These structures are not a historical anomaly, but instead embody the negative effects of deeply entrenched systems of oppression and privilege. As such, evidence of their production through deliberate actions, can be documented bioarchaeologically (DeWitte & Wissler, 2022; Zuckerman et al., 2022). This deep perspective provides a compelling counter-argument to complacency by those in positions of privilege in the face of inequalities today.

8.2 | Ancient DNA and bioarchaeology: A symbiosis

Bioarchaeological research, when integrated with ancient biomolecular (e.g., aDNA) analyses, also promises to improve the ability to detect

undocumented past pandemics and transform understanding of their microevolutionary consequences and the emergence and evolution of pathogens. The global rise in temperature and human population growth will lead to unprecedented risks of zoonotic disease. Since most human infectious diseases have resulted from zoonotic infections, there is much insight to be gleaned from tracking these zoonotic transmissions through time. In what contexts did zoonotic disease lead to infectious and virulent human-adapted pathogens, and vice versa? For how long did major human infectious diseases exist as isolated spillover infections before adapting to human-human transmissibility? Hundreds of ancient pathogen genomes have been recovered (Duchêne et al., 2020), and improvements to aDNA methods and accessibility to researchers will ensure this successful recovery rate increases. These ever-growing time-series datasets present an invaluable opportunity for bioarchaeologists to engage fully with the origins and impact of zoonotic infections. For example, the earliest *Yersinia pestis* genome, the causative agent of plague, was recently recovered from a 5000 year-old skeleton from Rin¸n¸ukalns Latvia (Susat et al., 2021). This genome represents a lineage that diverged recently after *Y. pestis* shared a last common ancestor with *Yersinia pseudotuberculosis*. *Y. pestis* was only identified in a single individual from a burial of four that, combined with the observation that most Bronze Age *Y. pestis* genomes have been recovered from single burials, led the authors to suggest that these early Neolithic and Bronze Age strains caused terminal or low transmissibility zoonotic infections in humans (Susat et al., 2021). Identifying archaeological sites with early zoonotic spillovers is instrumental for bioarchaeology to integrate the One Health concept, which views human health as directly linked to animal health and the environment writ large (Littleton et al., 2022; Mackenzie & Jeggo, 2019; Zinsstag et al., 2011). Zooarchaeology (archaeological animal remains) also has an important role in informing about the impact of animals on human health in the past (e.g., Thomas et al., 2019).

Extraction of DNA, including from more recent burials of known epidemic victims, has enabled positive identification of causative pathogens, exploration of genetic differences between historic and currently circulating strains of pathogens, and characterization of microbiomes and microorganism ecologies (e.g., Bos et al., 2011, 2016; Devault et al., 2014; Spyrou et al., 2019; Tito et al., 2012; Warinner et al., 2014). Such burials also allow for examination of changes in human genetic variation in response to past epidemics (Barquera & Krause, 2020). For example, Kerner et al. (2021) found evidence of negative selection against the P1104A polymorphism of *TYK2* that increases risk for clinical forms of TB in homozygotes starting ~2000 years ago, suggesting a significant role for the disease in shaping European health since that time. Recent work focused on 16th-century burials in Germany has begun to explore the possible selective effect of catastrophic mortality caused by epidemics during the Second Pandemic of Plague on human immune loci (Immel et al., 2021).

Human genetic data may also reveal the effects of past pandemics on patterns of migration, permitting testing of hypotheses regarding whether and how pandemics produced push or pull factors

driving migration. In England, for example, there is historical evidence that rates of migration increased following the Black Death and that, in general, females predominated among rural-to-urban migrants during the medieval period (Dyer, 2005; Kowaleski, 2013). However, genetic data from well-dated bioarchaeological assemblages is crucial for examining the actual extent and demographic patterns of that migration, as well as what effects it might have had on human genetic variation and disease ecologies. Work along these lines has begun with respect to the Black Death. Recently, Klunk et al. (2019) analyzed temporal trends in mitochondrial DNA (mtDNA) from human skeletal remains from medieval London and cities in medieval Denmark and found high mtDNA diversity in these contexts before, during, and after the Black Death. These findings might reflect consistent, high levels of female migration into these particular cities before and after the epidemic.

8.3 | Conclusions

Well-dated, contextualized bioarchaeological data can contribute substantially to reconstructions of pathogen phylogeographies, including clarifying the role of human economic, demographic, and social behav-or in the spread and maintenance of diseases at regional and global scales (Bos et al., 2014; Bravo Lopez et al., 2020; Mühlemann et al., 2020; Spyrou et al., 2019). Contextually rich bioarchaeological datasets with temporal control also have much to offer evolutionary biology and population genetics. Time series datasets spanning hundreds to thousands of years present an unparalleled way for tracking evolution over the long-term. Securely dated pathogen genomes can be used to calibrate molecular clocks, and datasets of ancient human genomes enable evolution to be tracked directly though time via allele frequency changes.

In summary, Workshop participants viewed bioarchaeology as having made important contributions to understanding of disease epidemics and pandemics, with a tremendous potential to contribute even more, particularly as efforts improve integration of multiple lines of evidence. As emphasized elsewhere in this article, greater responsibility for more effective dissemination of findings to scholars in other fields, policy makers, and the general public is required, so that the lessons acquired from study of past pandemics generate positive changes in living populations.

9 | HUMAN ADAPTATION AND PLASTICITY

9.1 | Adaptation

Bioarchaeology can make substantial contributions to the study of human adaptation, referred to here as changes in form and function that reflect natural selection acting on heritable variation. For example, bioarchaeology can explore the morphological substructures of physiological adaptations to altitude and climate that have long been

studied by human biologists (Baker, 1984; Stinson et al., 2012). Thermoregulatory adaptations conforming to Bergmann's and Allen's rules regarding surface area relative to volume (Allen, 1877; Bergmann, 1847; Katzmarzyk & Leonard, 1998; Roberts, 1953) can be accessed via brachial and crural indices (as scale-free measures of surface area) and biiliac breadth (as a hard-tissue constant representing volume) (Ruff, 1994). Brachial and crural indices as well as limb shape have been key to understanding migration and adaptation during the Holocene in the Western Hemisphere (Auerbach, 2012; Holliday & Hilton, 2010), Japan (Temple et al., 2008a; Temple & Matsumura, 2011; Yamaguchi, 1989), Siberia (Stock et al., 2010), Africa (Bleuze et al., 2014; Migliano et al., 2007; Ruff & Walker, 1993; Shea & Bailey, 1996), and Europe (Holliday, 1999; von Cramon Taubadel et al., 2013). Bioarchaeological studies have also explored the morphological scaffolding of physiological adaptations to high altitude (and thus hypoxia) in terms of blood-oxygen transport and lung surface area, which according to studies by anthropological geneticists and human biologists appear to vary between regions (Bigham, 2016; Brutsaert et al., 2019; Frisancho, 2013; Yang et al., 2017). For example, studies of thoracic morphology in pre-Hispanic Peru (Weinstein, 2007) demonstrate the value of the contextual approach of bioarchaeology for understanding deviations from ecogeographic predictions.

The jaws and bony structures supporting the face provide some of the best examples of phenotypic plasticity in relation to human behavior. Faces are at the center of expression, behavior, social position and relationships, and there is a growing psychological literature (Foo et al., 2017; Hu et al., 2017; Kachur et al., 2020; Nakamura & Watanabe, 2019; Zebrowitz et al., 2015) on their social significance. While in most mammals a functioning dentition is essential for survival, this adaptive constraint is modified in humans with tool use and social organization. A bioarchaeologist would argue that consideration of artifactual evidence for behavior is incomplete without a consideration of the teeth and jaws.

Today more than half of children and adolescents around the world are diagnosed with malocclusion (Lombardo et al., 2020). The rarity of occlusal anomalies in many archaeological assemblages and in fossil hominins has led to discussions regarding what factors of modern life, diet, childrearing, and behavior have led to the current high prevalence (Boyd et al., 2021; Peres et al., 2018). Corruccini (1984, 1990, 1999) has proposed that soft modern diets require less forceful chewing and therefore place less load on the masticatory apparatus, which in turn leads to the development of a smaller muscle mass, reduced dimensions of the jaws and less robust bony supporting structures. In this interpretation, there is a genetic potential for devel-oping an alveolar process that will accommodate a given size of teeth, but phenotypic plasticity in response to the forces applied creates a jaw that is too small and thus tooth crowding. Clear evidence exists of a relationship between masticatory muscle mass and jaw size and robusticity (Sella-Tunis et al., 2018) and the hardness of the diet and jaw size (Anderson et al., 2014; Lieberman et al., 2004; Ravosa et al., 2008). Archaeological assemblages of human crania show differences in shape between people whose diets were based mostly on meat or fish and those based on plant foods (Holmes & Ruff, 2011; Noback & Harvati, 2015), and between hunter-foragers and agriculturalists (Katz et al., 2017; von Cramon-Taubadel, 2011). An alternative, older (Begg, 1954) interpretation of malocclusion focused instead on the heavy tooth wear seen in archaeological dentitions, which rapidly reduced the

size of teeth over the life course. It was suggested that tooth and jaw size are adapted to heavy wear and, that is, teeth are initially larger than needed in order to fall into proper occlusion when worn (Kaifu et al., 2003). There is little doubt that the remains of many young adults in archaeological contexts display teeth that have been reduced in size by wear and the jaw has been remodeled around them to adapt to the shorter tooth row. Living people wear their teeth to a much lesser extent, through diet, behavior, and habits, which creates a mismatch between tooth size and the potential of the jaws to adapt. These two explanations of the current malocclusion epidemic are not mutually exclusive. Thus, the plasticity of the jaws, skull, and face lies at the center of this debate, which is relevant far beyond bioarchaeology.

Evolution, and in particular natural selection, has substantially affected human bodies over the past 10,000 years, with important and interesting contingencies in these processes attributable to local behavior. The application of increasingly sophisticated population genetic models to evaluate pleiotropic effects and deeper explorations of archaeological context to explore dietary behavior and migration portend enormous potential for the continued role of bioarchaeology in the study of human adaptation.

9.2 | Phenotypic plasticity

Phenotypic plasticity refers to the range of phenotypes (behavioral, morphological, or physiological) that may arise in response to environmental stimuli (West-Eberhard, 2003, 2008). Plasticity in skeletal phenotypes is crucial to understanding behavior, ecology, and biology in the past (Armelagos et al., 1982; Goodman et al., 1984; Larsen, 2015). For example, bioarchaeologists evaluate changes in long bone diaphy- eal morphology to better understand changes in behavior implicated in the transition to agriculture (Bridges et al., 2000; Larsen, 1982; Ruff et al., 1984), to resist the monolithic conceptualization of hunter- gatherer subsistence economies, and instead point toward highly adaptive behavioral practices that reflect long-standing environmentally directed beliefs, knowledge, and skill sets (Holt, 2003; Ruff & Holt, 2018; Stock & MacIntosh, 2016; Stock & Pfeiffer, 2001, 2004; Temple et al., 2021). In addition, adaptive plasticity is inferred from patterns observed during European colonization of the Americas. This acts both as an embodied signal of the extractive and exploitive eco nomic structures imposed on Indigenous North American populations and as a testament to the adaptive capacity of these populations to survive under circumstances of disease, dispossession, and death (Larsen et al., 1996; Ruff & Larsen, 1990).

Studies of skeletal adaptive plasticity can also contribute to broader discussions of developmental stability (the capacity for a genotype to produce near-similar phenotypes under consistent environmental conditions) as well as the limits to variation imposed by functional constraints, which limit morphological variation in association with the function of the structure in question (Futuyma, 1998) and canalization (the capacity for a genotype to withstand enviro mental perturbations) (Waddington, 1953). Research consistently demonstrates higher levels of asymmetry and variance in diaphyseal breadths compared to lengths and articular surface dimensions (Auerbach & Ruff, 2006; Buck et al., 2010; Reeves et al., 2016; Ruff et al., 1991) are consistent with the responsiveness of diaphyseal morphology to habitual activity, and greater developmental

stability in articular surface and length dimensions (Lieberman et al., 2001; Ruff et al., 2006). Taken as a whole, plasticity in diaphyseal morphology is directly observable in bioarchaeological contexts and provides important information on the habits, dispositions, and practices of past populations.

Stress has been defined in bioarchaeology, following Selye (1936), as a nonspecific physiological response to any external perturbation that threatens homeostasis (Goodman et al., 1988). In general, stress is considered a "shadow image" of adaptation, reflecting circumstances where populations fail to thrive (Goodman et al., 1988), and skeletal and dental indicators of stress are assumed to reflect this failure (specifically, e.g., dietary deficiency and disease, Goodman, 1994). However, the hypothesis that the presence of skeletal markers may act as a barometer for people experiencing stress in the past has been critiqued in light of the Osteological Paradox (Wood et al., 1992) (Section 10). In response to this critique, some bioarchaeologists now use stress markers in bones and teeth in association with quantitative demography to explore the relationship between stress and selective mortality in past populations (e.g., Temple, 2014).

The incorporation of life course perspectives and evolutionary life history combined with social and environmental context into studies of stress has provided new perspectives (Agarwal, 2016; Gowland, 2015; Temple, 2019b; Temple & Goodman, 2014), moving away from viewing skeletal markers as binary indicators of health and focusing on trade-offs related to short-term survival and physiological constraints. Further, when the human skeleton is viewed as forged by biocultural factors over the entire life course, adaptive responses in bone morphology emphasize a range of trajectories. For example, contextualized data on bone maintenance and aging in the archaeological record show that patterns of bone loss and functional adaptation do not always constitute predictable or normative patterns of aging or biological sex (Agarwal, 2021).

A process may be considered adaptive if the invocation of the stress response (via the hypothalamic–pituitary–adrenal [HPA] axis) promotes short-term survival through alteration of the phenotype (Cannon, 1915; Crespi et al., 2013; Crespi & Denver, 2005; Selye, 1936; Worthmann & Kuzara, 2005; see also Edes & Crews, 2017, regarding additional systems that also require consideration). If phenotypic alteration promotes short-term survival in response to stress, this suggests the response may be tethered to adaptive plasticity. However, natural selection is balanced by evolutionary trade-offs—negative correlations between traits that prevent simultaneous optimization (Futuyma, 1998). Physiological constraints are one type of evolutionary trade-off that

occur in association with limits placed on energetic investment (Charnov, 1993; Stearns, 1992). Thus, investment in short-term survival of stress events may be met with exhaustion when energetic resources are spent (e.g., Selye, 1936), or alternately, result in reduced investment in future growth and maintenance in organisms with limited energetic allocation (Worthmann & Kuzara, 2005). This relationship is well documented in individuals who survive early life stress but experience reduced growth in body size, reproductive energy, immunosuppression, and early mortality (Kuzawa, 2007). In the United States, the experience of systemic racism provides a stark example of plasticity in the capacity to survive stress carried over multiple generations, while simultaneously producing substantial inequalities in long-term health and well-being (Gravlee et al., 2009; Kuzawa & Sweet, 2009), all ideas alluded to more than a century ago when scholars of color argued for the detrimental, long-term consequences of racism on individual development (Cobb, 1936; Du Bois, 1914). Taken as a whole, the exploration of stress has moved from a linear, comparative process toward one focused on individual lifespans where tremendous transformative potential exists when applied to contexts including inequality, marginali- zation, and racism.

The study of stress is, however, an intensely debated topic in psychology, clinical medicine, and biology, as well as bioarchaeology (DeWitte & Stojanowski, 2015; Goodman, 1994; Wood et al., 1992). Hillson (2014) argues that the physiological conditions related to infection and dietary insufficiency may not trigger the stress response and that there exists scant evidence for a direct relationship between the dental or skeletal indicators used in bioarchaeology and the physiological changes associated with stress, either as originally defined by Selye or with more recent, broader definitions. Thus, bioarchaeologists should carefully consider the physiological pathways that follow stress and the way in which these might influence plasticity during development and adulthood (Agarwal & Beauchesne, 2011; Gosman, 2012; Klaus, 2014). While many of the biomarkers associated with the stress experience do not have direct influence over bone, dentin or enamel formation, there are potential downstream cellular consequences that might influence skeletal and dental tissue (Chyun et al., 1984; Guder et al., 2020; Martinelli & Moreira, 1994; Parsons, 1992; Riesenfeld, 1973; Sasaki et al., 2007; Seow et al., 1989; Stockman & Fandrey, 2006; Tsukasaki & Takayanagi, 2019). In addition, recent work in biology (Schulte, 2014) considers a wide range of responses to environmental stressors, such as climate change, or interruptions to food and water supply, which parallel issues addressed in bioarchaeology. To take part in this wider development of the stress concept, bioarchaeologists must better develop evidence for the physiological basis of variation and features observed in archaeological human remains.

Bioarchaeologists can explore relationships between adaptive plasticity and physiological constraint through contextual information (Temple, 2019b). Skeletal indicators of stress (particularly compromised growth of bones and teeth, including dental enamel and vertebral neural canals, and reduced adult body size) represent instances of survival and thus evidence for adaptive plasticity. Factors such as the presence of chronic infection, relative adult body size, and mortality may act as evidence for physiological constraint, or negatively

correlate with the capacity to survive stress events at earlier stages in the life course. Bioarchaeologists first referenced plasticity in the context of biological compromise during the transition to agriculture in prehistoric Illinois (Buikstra, 1988), and have begun to apply the co cept of adaptive plasticity as the capacity to alter phenotypes toward an optimal value (Agarwal, 2016; Gowland, 2015; Temple, 2014, 2019b) and define it in intergenerational contexts, where maternal stress experiences may be transmitted to offspring, most especially when the nexus of dependence between mother and infant is accentuated (Gowland, 2015; Gowland & Halcrow, 2020). Bioarchaeologists can address intergenerational challenges of maternal stress (Section 4.2) using isotopes that target periods of nutritional insufficiency in the early life environment in the dental enamel of non- surviving subadults and compare these values to early life and adult diet in individuals who survived to adulthood (Beaumont et al., 2015). Concepts such as developmental sensitivity have been incorporated into bioarchaeological research using incremental microstructures of: (1) enamel that demonstrate relationships between earlier stress events, development of later growth disturbances, and risk of death (Gamble, 2017; Garland, 2020; Lorentz et al., 2019; Temple, 2014), and (2) dentin that permits high-resolution examination of the timing of early life nutritional stressors (Beaumont & Montgomery, 2016; Brickley et al., 2020).

9.3 | Epigenetics

Epigenetics is a promising avenue for exploring human adaptation and developmental plasticity. Epigenetic modifications of DNA, via mechanisms such as methylation, post-translational alterations of histones, and binding of noncoding RNA, can occur in response to physiological and psychosocial stressors (Mulligan, 2016). In turn, they can modify gene expression and thus individual phenotypes. Epigenetic changes can be passed on to offspring, transforming individual experiences into intergenerational phenotypic alterations.

Epigenetic analyses have the potential to clarify the mechanisms that link early life stressors to health outcomes later in life and may provide better understanding of what skeletal markers of stress truly indicate about health and frailty (cf. Section 10). Bioarchaeologists are well positioned, for example, to explore the intergenerational effects of structural violence (Section 7.2) in terms of maternal-fetal health, as recently explored by Gowland and Halcrow (2020) (see Section 4.2). Epigenetic research has surged recently, but it remains an almost totally untapped source of evidence for bioarchaeologists. However, the work of Gokhman et al. (2017, 2020) has demonstrated the feasibility of bioarchaeological applications of epigenetics. However, there are currently limitations for bioarchaeological research that aims to explore the effects that can be inferred from bone, as epigenetics is often tissue specific, with most anthropological epigenetics studies focused on blood (for a review of epigenetics of bone disease, see Michou, 2018). Nonetheless, as with other technological advance- ments mentioned in this article, interdisciplinary research relying on epigenetic data from archaeological contexts not only clarifies patterns of stress and disease in the past but also puts the field in bet- ter conversation with human biologists and other scholars with a longer history of engagement with epigenetics.

9.4 | Conclusions

As scholars working at the crossroads of human biology, evolution, and culture, bioarchaeologists can contribute substantively to our understanding of their interplay and the relevance of past events and behaviors for living populations today. We are at an advantage, compared to other fields, in having both a deep temporal perspective that is crucial for clarifying human evolutionary trends as well as contextual details (from experiences embodied in the skeleton, archaeological data, and historical documents) that enrich our understanding of the cultural causes and consequences of changes to human anatomy, physiology, and our genome. As is true of other topics of interest in the field, advances in this area will benefit from increased integration of emerging technologies, advances in evolutionary theory, and increasing diversity of scholars.

10 | OSTEOLOGICAL PARADOX, DOHAD, AND HEALTH

10.1 | Osteological paradox

Several Workshop participants expressed concern that the osteological paradox has been insufficiently addressed in bioarchaeological studies despite the impact of the original paper by Wood et al. (1992), having been cited over 1700 times since its publication [similarly, subsequent review papers of the osteological paradox by Wright & Yoder, 2003 and DeWitte & Stojanowski, 2015 have each been cited hundreds of times]. Briefly, the osteological paradox describes fundamental issues affecting studies of human skeletal remains that interfere with reconstructing health in the once-living populations from which they derive. Wood and colleagues focused primarily on heterogeneous frailty and selective mortality. Heterogenous frailty refers to variation in individual age- standardized relative risk of death, and selective mortality acts on that variation such that individuals who die at each age are disproportionately those with the highest frailty (Vaupel et al., 1979; Wood et al., 1992). Of particular concern is the fact that most sources and expressions of variation in frailty are undetectable in human skeletal remains (what Wood et al. call "hidden heterogeneity in frailty"), making it difficult to infer individual or sub-population patterns of health from aggregate cemetery data. One of the arguments put forth by Wood and colleagues (and, indeed, what is from the perspective of many people synonymous with the osteological paradox), is that it is possible that pathological conditions or skel- etal indicators of stress observable in human skeletal remains might, in some cases, indicate relatively good health or low frailty, contrary to the more common interpretation that skeletal lesions reflect poor health.

Workshop participants noted that while some scholars have engaged productively with the osteological paradox (Hughes-Morey, 2016; Marklein & Crews, 2017; Milner & Boldsen, 2017; Usher, 2000; Wilson, 2014), most citations of the original Wood et al. (1992) article passively mention that it might have some effect on their findings, but they fail to actively address its implications during research design, analysis, or discussions of results. The consensus of participants was that many scholars do not engage with the osteological paradox because they are unsure how to do so, particularly in cases where they face limitations such as

fragmentary skeletal remains, poor age estimates, or lack of a good chronological control. There is thus a need to promote engagement with the osteological paradox such that the concept can be incorporated into research from the design stage, rather than via post-hoc lip service. Authors should address the implications of the osteological paradox explicitly.

In general, age-structured data can facilitate the study of selective mortality, including evaluating the association between skeletal stress markers and risks of death or survivorship (e.g., Boldsen, 2007; Boldsen et al., 2015; DeWitte & Wood, 2008; Temple, 2014; Watts, 2015; Wilson, 2014) and the integration of data from incremental dentin analyses of dietary isotopes to examine the outcomes of nutritional stressors during key developmental periods (Beaumont & Montgomery, 2016; Miller et al., 2020). Information about variation in frailty is potentially present in lesion "activity" data, in which distinctions in data analysis are made between people who died before healing of lesions occurred and those who survived beyond the commencement or completion of lesion healing (e.g., DeWitte, 2014a; Mays et al., 2006; O'Donnell, 2019). The use of age-structured data, of course, hinges on accurate age-at-death estimates. Emerging approaches for improved age estimation include the third version of transition analysis (Milner et al., 2021), which includes dozens of skeletal indicators, most of which are infracranial, and can be applied to incomplete and fragmentary remains. This version might better allow people working with fragmentary and otherwise poorly preserved skeletal remains to link age (on an individual basis) to other variables of interest. Lastly, clarity regarding the mechanisms that lead to the formation of skeletal lesions and their association with heterogeneous frailty, and of expressions of comorbid conditions (e.g., van Schaik et al., 2014), can be improved through further, ethically driven use of documented collections and dissemination of information about such collections available around the world (Campanacho et al., 2021).

10.2 | Developmental origins of health and disease

Workshop participants also expressed enthusiasm for bioarchaeological studies of the DOHaD. Parallel concerns arose from an increase in the number of papers that mention it, including superficial rather than substantive analysis using the DOHaD framework (for exceptions, see, e.g., Armelagos et al., 2009; Garland, 2020; Ham et al., 2021; Lorentz et al., 2019; Reitsema et al., 2016; Temple, 2014; Weisensee, 2013). The DOHaD framework (also referred to as the Barker, fetal origins, and fetal programming hypotheses) has been a topic of study in other fields such as human biology and medicine, and addresses the later life health outcomes of early life stress events, such as the long-term effects of malnutrition in utero or during infancy on risks of disease and mortality later in life (for more detailed overviews of DOHaD and bioarchaeology see: Agarwal & Beauchesne, 2011; Gowland, 2015; Temple, 2019b).

Participants argued that more bioarchaeological research should be directed toward linking indicators of early life stress to specific di eases that occur later in life. Such efforts are facilitated by studies in living populations that integrate demographic, medical history, psychosocial, epigenetic, and/or cause of death data. Much of the

research in living populations on DOHaD focuses on non-communicable diseases such as cardiovascular disease and diabetes (e.g., Barker, 1990; Gomez-Verjan et al., 2020), but developmental insults also have the potential to alter immune functioning over the lifespan (MacGillivray & Kollmann, 2014; Palmer, 2011) and to affect mortality risk from infectious disease (Moore et al., 1999). A recent study by Cheng et al. (2020) found that prenatal and early life exposure to nutritional stress during the Great Chinese Famine increased the risk of tuberculosis in adulthood across two generations, more clearly indicating a way for bioarchaeologists to examine within- individual and intergenerational effects of diet and specific, skeletally diagnosable, diseases in the past.

To use skeletal stress markers to examine DOHaD in the past, more scholarship should focus upon defining tissue formation processes, the timing of insults, and the mechanisms linking physiological insults and stress indicators. Emerging work on osteoimmunology (Crespo, 2020; Crespo et al., 2017), for example, provides a promising avenue for improved and better defined conceptualizations of stressors, physiological and immunological responses, and skeletal markers that can fill existing lacunae between conditions of growth and what is ultimately seen in the skeletal record. Furthermore, adaptive plasticity and constraints, as described in Section 9.2, need to be acknowledged and dealt with more carefully in studies that aim to address DOHaD; understanding the expression of these trade-offs requires careful attention to cultural and ecological contexts (Temple, 2019b). As is true for other areas of interest in the field, use of standardized data collection can facilitate DOHaD research. Specifically, variables that might best capture critical periods of development and reflect stressors of both bioarchaeological interest and that have parallels with those studied in human biology to bolster argu- ments about mechanisms within bioarchaeological contexts and to engage in cross-disciplinary research should be investigated. Standardization would ideally facilitate metanalyses, which might over- come some of the limitations of small and incomplete datasets. As mentioned in the context of the osteological paradox, participants suggested targeted training and published guidelines/models for those interested in addressing DOHaD would be beneficial, such as dissemination of what types of data are needed and what types of analyses are ideally suited to address DOHaD.

10.3 | Measuring health

Discussions of health at the Workshop raised a critical question about whether it is possible for all bioarchaeologists to agree on terminology regarding “health” and what is ideally desirable to measure versus what can be measured using skeletal data. As noted by Gage and DeWitte (2009), among others, it is difficult to define health for living people, for whom a variety of biological, genetic, social, and mental variables can be assessed, and there has been debate in bio-archaeology about how to define and measure “health” in the past (Temple & Goodman, 2014). Workshop participants discussed the advantage of using terms such as “skeletal health,” “stress,” “health/disease,” or “disruptions of homeostasis” rather than “health,” or explicitly applying

demographic measures (i.e., mortality or survival) as proxies for health. Given the lack of consensus in defining "health" among members of the targeted Workshop breakout session, all bio-archaeologists should be encouraged to be explicit about definitions of the terms they use and how they are using them.

10.4 | Conclusions

Given obvious interest in the osteological paradox and DOHaD, having clear examples for relevant data collection, research design, and analysis might encourage more bioarchaeologists to engage actively and fruitfully with both concepts. There may not be a one-size-fits-all approach, but scholars would benefit from the availability of more models of approaches, explicitly framed to engage with the osteological paradox and/or DOHaD, which they can apply, adapt, or extend. Ultimately, successful engagement with the osteological paradox provides the means to better understand intra- and interpopulation variation in well-being, health, and disease in the past. In turn, this information provides insights into larger issues of anthropological concern, such as resilience, the effects of social hierarchies, and how access to resources or exposure to disease varies with biosocial factors. The natural experiments afforded by bioarchaeological data mean that studies generate or contribute to models for use in modern clinical settings, such as providing resolution on the optimal timing of, and outcomes for, early life interventions. Lastly, given the capability to engage in the study of human adaptation and plasticity (Section 9), combined with a widespread interest in health, bioarchaeologists have significant potential for contributing to topics relevant to evolutionary medicine, such as coevolution of humans and pathogens, the interaction of disease with developmental plasticity and life history tradeoffs, and the effects of cultural context on disease experiences and out- comes (see e.g., Plomp et al., 2022; Trevathan et al., 2008).

11 | RESEARCH DESIGN AND QUANTITATIVE METHODS

11.1 | Problem-Oriented research designs

As detailed in Section 1, the initial motivation for organizing the Bio- archaeology Workshop was to examine the reasons for relatively low funding rates for bioarchaeological projects within the Biological Anthropology Panel of the NSF and other homologous organizationsworldwide.[17] One potential contributing factor for United States-based scholars is that bioarchaeology proposals are often co-reviewed by the Biological Anthropology and Archaeology programs of the NSF, which have different priorities that may be difficult to balance in a single pro- posal. Responses to the preliminary questionnaire and discussions at the Workshop highlighted concerns about the lack of a problem-oriented research design apparent in bioarchaeology grant proposals and manuscripts submitted for peer review. Participants noted that grant proposals that are ranked as noncompetitive are predominately based on an exclusive focus on subjects or culture areas at the expense of describing how the projects will address specific questions of broader relevance and explicitly identifying hypotheses to be tested. For example, proposed studies

of un(der)studied skeletons from specific regions are made without clearly explaining the broader significance of the research. Similarly, many noncompetitive proposals describe opportunistic research on skeletal remains seemingly for the singular reason that they are available for study, which reviewers do not find to be sufficiently compelling and worthy of grant support. Several Workshop participants summarized their impressions of such proposals as invoking

reviewer reactions of "so what?" In some cases, these perceived shortcomings are the result of a prospective Principal Investigator failing to prioritize and express research questions according to reviewers' expectations. This issue can be addressed by scholars reading successful grant applications to learn how to frame proposals in ways that align with agency- and subfield-specific expectations. Several participants noted the potential utility of an open- access centralized archive of submitted proposals (perhaps hosted by funding agencies or professional organizations), and many would be willing to share their own (successful and unsuccessful) proposals to serve as models. However, problems with research design are, in some cases, deeper than simply framing and description in the text of the grant proposal. Some investigators fail to identify clear, relevant, and compelling questions at the initial stages of research design or the theoretical frameworks they are applying (for a recent analysis of use of theory in the field, see Cheverko et al., 2020). Specific, clear hypotheses are not always articulated and testing procedures are clouded by unscientific terminology. Addressing such deeper issues over the long-term will require deliberate instruction in creating problem-oriented research designs and hypothesis testing, beginning with undergraduate researchers and continuing through graduate education (as detailed below).

Discussions of research design also emphasized the need to make clear, from the beginning of a research project, the linkages between the data that will be generated by the project and the research questions that they are expected to address. Further, investigators should produce clear, testable hypotheses and select analytical approaches appropriate to those hypotheses and relevant data. This process contrasts with an unfortunate, all-too-common, tactic criticized at the Workshop of pursuing data collection and analysis without a stated research question, followed by an explanatory scenario seemingly generated without rigorous consideration of alternatives (i.e., finding the hypothesis within the results). Lastly, as is explicitly required by NSF, scholars should focus more clearly on the broader impacts of and the generalizable knowledge that can be produced by their research and highlight mechanisms to implement those broader impacts. This forum is ideal for articulating how bioarchaeological research is relevant to living people.

11.2 | Hypotheses and levels of analysis

Levels of analysis may vary from a focus on the individual, as noted below, to community-based, regional, continental, or global studies. An example of the latter would be the issue of the impact of the "Neolithic Revolution" discussed in the Introduction (Section 1). Most investigations center on one of the intermediate levels, discussing matters ranging from migration histories (frequently continental, see Section 6) to the development and maintenance of identities such as masculinity (regional, see Section 7). In each case, the

questions chosen for interrogation should be anchored by a set of hypotheses, most commonly focused on how the study sample may be considered representative of the living individuals or groups who are the focus of inquiry. These hypotheses are important as a device to assure both the researcher and any prospective reviewer that the study is rigoous. Are there other samples or individuals who should be included in the study? Are the hypotheses about context met (e.g., how does one know that the group subsisted on or otherwise came into contact with infected zoonotic species, and why is this important)? A careful and explicit statement of hypotheses and how they are justified is an important basis for any ensuing study.

11.3 | Interdisciplinarity and collaboration

A common theme throughout the Workshop was the inherent inter- disciplinarity of bioarchaeology. One of the sessions explored ways to improve interdisciplinary approaches so that they are truly substantive and mutually beneficial to bioarchaeologists and scholars in other fields, such as public health, archaeology, medical anthropology, history, pathophysiology, and clinical medicine. Now that bioarchaeology is a well-established field, there has generally been a "siloing" effect such that bioarchaeologists primarily write for and collaborate with each other (as evidenced by, for example, the common use of "The Bioarchaeology of …" in the titles of our publications, rendering them less likely to attract external readership). Further, participants reported that most interdisciplinary projects were initiated by bio- archaeologists rather than scholars outside the field. Disrupting this insular trend requires writing essays that people in other fields want to read, and being proactive about enabling others to see the value of bioarchaeological research.

Interdisciplinary elements need to be built into projects from the very start of research design, and collaboration should include relevant individuals recruited during these initial steps rather than as an afterthought. There have been remarkable advances in the tools and technology that can be used at both the data collection and analytical stages to address a variety of bioarchaeological topics, including but not limited to dietary reconstruction (via stable isotope analysis), mobility patterns (via the application of engineering principles to bone), and identification of infectious pathogens (via aDNA analyses and paleoparasitology). While some bioarchaeologists certainly can obtain training in these and other advanced techniques, realizing these advantages (particularly in combination) often requires collaboration with experts from other fields. This process includes careful consideration of both the benefits that can be obtained from interdisciplinary collaborations and the complexities that might arise because of variations in terminology across fields and different disciplinary expectations about co-authorship, data-sharing, analytical approaches, appropriate publication venues, and relevant background literature, among other things (e.g., Snoddy, Beaumont, et al., 2020; Snoddy, King, et al., 2020). Another potential issue is in obtaining funding for interdisciplinary projects, as program officers and reviewers familiar with one field might not appreciate the value of approaches and questions from another. Despite these potential hurdles, interdisciplinary research has the potential to improve reconstructions of life in the past (see Sections 3 and 9), and to yield information of significant benefit to living people. For example, Larsen et al. (2019)

summarize find- ings from their collaboration involving bioarchaeologists and archaeologists, focusing on questions of broad anthropological interest regarding health, migration, and mobility (informed primarily by biomechanics and stable isotope analysis) at Neolithic Çatalhöyük. Other recent successful examples of interdisciplinary work involving bioarchaeologists includes that of Baker et al. (2020), Han et al. (2017), Pomeroy et al. (2019), Seetah et al. (2020), Smith-Oka et al. (2020), and Wells et al. (2016).

Interdisciplinary, collaborative work benefits from widespread, consistent use of standardized bioarchaeological data collection methods (e.g., Buikstra & Ubelaker, 1994; Steckel et al., 2019) and the creation and maintenance of large datasets. There is an emerging conversation in biological anthropology regarding best practices for data storage and sharing that will help guide future project planning (e.g., Boyer et al., 2020).

11.4 | Small datasets

Bioarchaeologists are often faced with relatively small sample sizes that preclude (or, in some cases, are mistakenly perceived to preclude) the use of analytical approaches more commonly used in other fields, such as those in epidemiology and demography. There are examples in which sample sizes truly are too small to be compatible with rigorous analytical approaches, and it is not the goal here to undermine the potential value of these data. Further, there are cases in which it is appropriate to eschew statistical analyses altogether (e.g., an osteobiography of one individual or a case study of a rare disease evidenced in human remains that can have significant value in the absence of rigorous statistical analyses; see examples in the 2019 spe- al issue of *Bioarchaeology International* on osteobiography and the 2021 special issue of *International Journal of Paleopathology* on rare diseases). However, to promote bioarchaeological work that is aligned with the goals of the other subfields within biological anthropology, that is, to move beyond cataloging and description and to addressing issues of broader anthropological and evolutionary significance, it is essential to promote the careful consideration of all feasible statistical analyses relevant to the questions being asked in bioarchaeological studies. Identification of appropriate statistical methods requires initial consideration of all possible relationships that may exist among the variables under study, with respect to the broader cultural, demographic, environmental, biological, or evolutionary phenomena of interest. Then the researcher should make explicit predictions from a plausible scenario (or, where appropriate, several alternative scena ios) regarding those relationships that are firmly grounded in pre- existing information about the relevant context. For a recent effective deployment of this strategy, see Rathmann et al.'s (2019) study of ancient Greek colonization of southern Italy, in which they used den- tal metric and nonmetric trait data to test several competing models.

It is not feasible to describe all possible analytical approaches relevant to bioarchaeological research, both because of space constraints and because there is no single method or set of methods that are universally applicable. In the interest of furthering rigorous bio-archaeological research, despite apparent assumptions to

the contrary, there are suitable methods for the statistical treatment of ordinal/categorical variables and for simultaneously examining multi- ple types of variables (e.g., categorical and continuous). Examples of these applications can be found in work by Temple (2014), Yaussy (2019), Godde et al. (2020), and Obertová et al. (2020), among others. Informed consideration of feasible and suitable options relies on effective training in the application of quantitative methods, as detailed further below, or collaboration with colleagues with relevant expertise.

One strategy that is commonly used in bioarchaeology for dealing with the limitations of small samples sizes is to pool data within a site (by age-at-death, sex, or other variables) or pool samples across sites spatially or temporally to produce a working dataset sufficiently large to generate acceptable levels of statistical power, fulfill the criteria of specific statistical approaches, and yield interpretable results. While pooling samples is justified when the assumptions made for the gene ation of questions/hypotheses are not violated, the issue of assumptions is very important (see above). The strategy of pooling data thus introduces the problem of potentially (and to an unknowable degree) masking heterogeneity that might exist within the meta-sample. Putting aside the fact that heterogeneity itself is often of great interest to bioarchaeologists, this inevitably raises questions about whether the findings reflect experiences of just some subset(s) of the population and how generalizable they are to other contexts.

Another tactic for dealing with small sample sizes (and which is often used in combination with data pooling) is to use methods that are expressly compatible with small sample sizes (such as χ^2-square tests or Fisher's exact tests) and for which there are many examples in the bio- archaeological literature. Such methods, though they can and do pro- duce interesting results, do not, in isolation, permit evaluations of higher order interactions, nor do they enable one to effectively control for confounding variables. This makes it difficult, if not impossible, to draw clear inferences from the results. For example, a comparison of frequencies of skeletal lesions between two groups of interest may yield findings suggesting a difference between those groups. Taken alone, this result cannot indicate what effect, if any, is the result of variation between those groups with respect to age-at-death distributions, sex ratios, social status, temporal period, or other factors. The inability to analyze the associations of multiple variables efficiently and simultaneously is a concern given evidence from numerous studies that stress markers and other data of interest to bioarchaeologists vary according to variables such as age-at-death, sex, and social status (see, e.g., DeWitte, 2012; Garland, 2020; Grauer, 1993; Nakayama, 2016; Pilloud & Schwitalla, 2020; Yaussy, 2019).

11.5 | Missing data

A further issue that is not limited to small sample sizes, but that might disproportionately skew findings, is missing data. Following Rubin (1976, p. 19) and Little and Rubin's (2019) formalization, Stojanowski and Johnson (2015) provide an overview of the ways in which data (in their case, of dental traits) can be missing and offer a case study of the impli-

cations of "missingness." Data can be categorized as missing completely at random (MCAR), missing at random (MAR), or missing not at random (MNAR), and all mechanisms of missingness can potentially affect a single dataset. Data that are MCAR are missing for reasons that are unrelated to the value of the variable of interest or to any other variables included in analysis, and there is no pattern to the values of the missing data; data that are MCAR produce no systematic differences between individuals in the samples with and without missing data (Mack et al., 2018), and observed data can be viewed as a random subsample of the hypothetically complete data (Baraldi & Enders, 2010). Data that are MAR are missing for reasons that *are* related to some other variable in the dataset but not related to the value of the variable of interest itself; as with data that are MCAR, there is no pattern to the values of the missing data. Data are MNAR if they are missing for reasons that are related to the variable of interest's values, and the values of missing data are not random; for example, incisor shoveling data are MNAR if the probability that they are missing is related to the severity of shoveling (Stojanowski & Johnson, 2015).

Unfortunately, it is possible to test empirically only for the MCAR mechanism, as the MAR and MNAR mechanisms depend on the unobserved data (Baraldi & Enders, 2010). According to Rubin (1976), missing data are a common problem, and often analyses proceed under the (implicit or explicit) assumption that the processes that produce missing data can be ignored. However, while MCAR and MAR are considered ignorable missingness (e.g., they both yield unbiased parameter estimates), MNAR is considered non-ignorable missingness (Graham, 2009). Stojanowski and Johnson (2015) highlight the potential for data that are MNAR to introduce considerable bias to bio- archaeological analyses and urge bioarchaeologists to consider the potential for missing data at the research design stage and to select sampling strategies that account for anticipated missingness. Wissler (2021) recently assessed methods for data imputation as a way to deal with missing data that are feasible and useful for bio- archaeological research.

Bayesian approaches

Several participants in the Workshop highlighted the potential value of Bayesian approaches to bioarchaeological research. A comprehensive overview of Bayes' theorem, with examples of its applicability to biological anthropology, is provided by Konigsberg and Frankenberg (2013). Though these authors argue that biological anthropologists think in probabilistic terms and that our perspectives and research rely on prior knowledge (i.e., aspects that are inherent to Bayesian approaches), statistical approaches that are unrelated to these research questions are used. Konigsberg and Frankenberg (2013, p. 153) promote consideration of Bayesian approaches (where appropriate) because they offer such advantages as "creating estimates and uncertainties about those estimates without asymptotic approximation" and of explicitly incorporating prior information with data "to generate problem-specific distributions in a systematic and logical way." Bayesian approaches produce "interpretable answers in terms of a probability distribution," which makes them potentially more intu- itively useful than the confidence intervals produced by frequentist approaches, which are often misinterpreted (see Konigsberg & Frankenberg, 2013, p. 156). Importantly for bioarchaeological data, Bayesian approaches accommodate missing data and complex parametric models, and permit comparisons between models. Given that

Bayesian approaches require making explicit the subjective information within or associated with the study sample (inherent to but often unacknowledged by many frequentist approaches), they also permit better evaluations of the inferences scholars make from their results and can potentially enhance the reproducibility of findings (Konigsberg & Frankenberg, 2013, p. 175).

There are numerous examples of Bayesian methods and inference in bioarchaeological research, including for the purposes of estimation of individual skeletal ages and paleodemographic analyses (Boldsen et al., 2002; Coqueugniot et al., 2010; DiGangi et al., 2009; Godde & Hens, 2012, 2021; Godde et al., 2020; Gowland & Chamberlain, 2002; Konigsberg & Frankenberg, 1992; Łukasik et al., 2021; Müller et al., 2002; Nagaoka & Hirata, 2007; Sasaki & Kondo, 2016; Séguy et al., 2013); estimation of sex (Konigsberg & Hens, 1998), ancestry (Rathmann et al., 2019), and stature (Konigsberg et al., 1998); paleopathological diagnosis (Boldsen, 2007; Byers & Roberts, 2003); evaluation of antemortem tooth loss (Gilmore, 2013); and dietary reconstruction (Arcini et al., 2014; Chinique de Armas et al., 2017; Stantis et al., 2020). Although many scholars may recognize the value of the analytical rigor that Bayesian approaches represent and their advantages over frequentist approaches and classical hypothesis testing, some Workshop participants suggested that a greater number of bioarchaeologists (particularly in US contexts, as Bayesian approaches are used more commonly elsewhere) may be more strongly compelled to adopt them if more bioarchaeological studies were published that explicitly demonstrate their practical utility with respect to the questions addressed (similar to Konigsberg & Frankenberg, 2013). That is, compared to those statistical approaches used most often in bioarchaeology, what difference does a Bayesian approach actually make with respect to the inferences drawn from bioarchaeological data?

Several bioarchaeologists interested in paleodemography or age- structured analyses of pathological or other data have relied upon the advantages of hazards analysis (Godde et al., 2020; Godde & Hens, 2012, 2021; Hughes-Morey, 2016; Konigsberg & Frankenberg, 1994; McCool et al., 2021; Redfern et al., 2019; Redfern & DeWitte, 2011; Watts, 2015; Wood et al., 2002). Hazard models specify the time until a certain event, such as death, occurs. Hazards analysis is a potentially powerful way to extract information from relatively small and biased samples of human skeletal remains, and it has been promoted as an alternative approach to paleodemographic life-table estimation (Konigsberg & Frankenberg, 2013; Wood et al., 2002). Hazards analysis in bioarchaeology often involves fitting a fully parametric mortality function, survivorship function, or age-at-death distribution (all of which are related) to skeletal age-at-death estimates and other data representing covariates of interest (e.g., to examine differences in hazards by sex, social status, or time period). Gage (1989) and Wood et al. (2002) have detailed several relevant parametric models, including their biological rationale, for bioarchaeological applications. The flexibility of these models, which permits application to even conventional age estimates with broad terminal age intervals, makes them appealing to some scholars while the field grapples with the issues of accuracy and preci- sion of skeletal age estimation. In addition to these fully parametric models, bioarchaeologists have also applied the semi-parametric Cox proportional hazards model, which permits the estimation of the risk of death and potential variation in that risk across variables of interest (Betsinger & DeWitte, 2017; Hughes-Morey, 2016;

Temple, 2014; Walter & DeWitte, 2016; Watts, 2015). Because hazard functions do not require the specification of a baseline hazard of mortality, parameters are not estimated, which makes it suitable to relatively small sample sizes. Patterns of survivorship can also be assessed non-parametrically using approaches such as Kaplan–Meier survival analysis (Boldsen, 2005; Gamble et al., 2017; Ham et al., 2021; Wilson, 2014).

Many workshop participants emphasized a need for improved training in quantitative methods for bioarchaeologists (see Section 12). Until such training is widely available and a routinely required compo- nent of graduate programs (and given that there are programs in which effective and required quantitative methods training may continue to be unfeasible), a potentially useful mechanism would be for qualified bioarchaeologists to organize

regular quantitative methods workshops at annual conferences (e.g., AABA, PPA, and SAA), or to adopt emerging trends for publicly available virtual seminars, highlighting appropriate statistical approaches suited to bioarchaeological data.

11.6 | R programming language

Broader adoption of rigorous, informative, and suitable quantitative methods may also be enhanced by the increased use of R by bio- archaeologists. R is a programming language and environment that is valued for its flexibility, transparency (e.g., details of R algorithms are publicly available), availability of a large number of methods, and the level of control it gives to the user (Marwick, 2018; Mascaro, et al., 2014). In contrast to commercial software such as IBM-SPSS and SAS, R users are not limited to built-in functions or reliant on slug-gish rates of additions of new methods (which can be particularly problematic for relatively narrow markets), but can use code produced by others or create their own (Carlson, 2017; Marwick, 2018). R code can be shared easily, including via searchable online repositories such as Comprehensive R Archive Network (CRAN), Bioconductor, and GitHub, and the code can be published with (or as supplementary material to) articles that report findings produced using the code. There is a large community of R users, who are continuously producing new packages for R (Li, 2018), and the online R community is notably friendly to novices (Marwick, 2018). According to Lynch and Stephan (2018, p. 236), "more than half of currently available computer analytic tools in forensic anthropology use R," and, according to Marwick (2018, p. 1), R is the "most widely used scientific programming language in archaeology." Many R users inside and outside the field generously share their code online, providing a potential source of guid-ance for bioarchaeologists adopting R for their own purposes. R users can also share the scripts they are produced during data analysis, which report each step in the analysis, further increasing transparency and furthering the reproducibility of findings in the field. Another major advantage of R is that it is an open-source software program and accessible to all scholars regardless of institutional affiliation or financial circumstances. R has a reputation for having a steep learning curve (Li, 2018); however, the clear advantages of R and the friendly community of users can undermine existing hesitation to adopt it.

11.7 | Conclusions

As highlighted throughout this article, the ability and potential of bio- archaeology to produce meaningful understandings about life in the past is vast. However, fully achieving that potential requires problem- oriented research designs (and in many cases, hypothesis-testing), use of appropriate and maximally informative statistical methods (and relevant software), substantive and well-planned interdisciplinary work, collaboration with colleagues with complementary skillsets (e.g., for accessing advantages of technological advances), and recognition of and accounting for missing data. How these surmountable hurdles can be addressed via targeted training in graduate programs is addressed below.

12 | GRADUATE TRAINING

12.1 | PhD production and job placement

Because of the initial motivations for organizing the Workshop, most of the participants work at institutions in the United States. As a result, the following is focused primarily on graduate training in the United States. From 1985 to 2014, ~13,000 PhDs in anthropology were awarded in the United States, and, as of 2014–2015, approximately 21% of those individuals were in tenure-track positions in anthropology departments (Speakman et al., 2018). Transparency with students about the reality of obtaining permanent, full-time employment opportunities in academia in the United States must be encouraged and faculty members should be proactive in helping students seek and apply for postdoctoral positions and fellowship opportunities as these can improve the odds of securing a tenure-track or other position. Several Workshop participants have seen increasing numbers of their own PhD students secure post-doctoral positions, as has been common in the physical and biological sciences, including through the NSF, NIH, the European Commission (e.g., the Marie Skłodowska-Curie fellowships), and other agencies (e.g., the British Academy, NERC, AHRC, Leverhukme Trust in the United Kingdom). It is vital that departments provide knowledge and skills training that can transfer to careers outside of academia, such as in cultural resource management, as NAGPRA coordinators, data analysts in industry settings, education specialists at museums, employment with the Defense POW/MIA Accounting Agency, grant or science writers, and in user experience design (UXD).

Given evidence that production of graduates with PhDs in anthropology annually outpaces the availability of academic jobs (Speakman et al., 2018), institutions and individual faculty need to address explicitly the ethical issues associated with admittance practices to graduate programs that provide training related to bio- archaeology, beginning at the undergraduate level. Students often rely on the advice and recommendations of their undergraduate faculty advisors when deciding whether to pursue graduate study. Ideally, opportunities to engage in research should begin at the undergraduate level with a thesis or a course that involves independent research. Students can use these experiences as one mechanism for evaluating whether graduate school, with its major focus on cultivating independent research skills, is a good fit. This experience-based

self-reflection can relieve the burden of "gatekeeping" by faculty and help shift that decision-making authority into the hands of students.

Prospective graduate students might also reflect upon which type of graduate program is the best fit for them (e.g., MA or PhD, applied or pure research focus). Some students will self-select out, while others who might otherwise not have considered graduate school as a viable or desirable option will decide to apply, resulting in applicants who will be more fully prepared to undertake graduate studies. Additionally, with respect to US graduate programs (the structures and finan-cial restrictions with which most participants were familiar), it is strongly recommended that programs fully fund their students (i.e., provide tuition abatements for full-time enrollment and stipends) for the typical or ideal duration of the relevant graduate program (e.g., 2 years for MA programs and 4–5 years for PhD programs). Exceptions include, for example, students who have secured other sources of funding or

those pursuing professional MA programs for which funding is not typical. While acknowledging that the availability of graduate funding packages is not uniformly known at the time of admission and that university administrations or granting agencies are ultimately the arbiters of graduate funding packages, transformation of these practices to ensure funding packages at the time of admission becomes standard. Funding decisions are a gatekeeping mechanism that can be biased against BIPOC and ethnic minority students. Addressing this structural bias will depend upon success in efforts to increase inclusion and diversity within academia. Recommendations for non-US contexts, with different traditions of funding, may well differ.

Section 2 of this article addressed the need for departments and faculty to address systemic issues plaguing academia, particularly regarding equity and racial justice; it is fundamental to ensure that bioarchaeology graduate programs are likewise proactive in addressing these issues. Just as individuals from marginalized groups working as academic staff, faculty, and administrators face additional barriers in their careers (Muhs et al., 2012), graduate students from underrepresented groups also experience substantial obstacles to their professional development. Several steps may be taken to ensure that graduate programs and admissions processes are more inclusive, and to improve trends in recruitment and retention of, and support for, students from racially marginalized groups, students with disabilities, and students from low socioeconomic backgrounds. First, departments can improve equity in admissions, starting by removing Graduate Record Examination (GRE, United States) score requirements from applications, as has been done already by many programs (including but not limited to Anthropology). Recent reporting and research demonstrates that the GRE suffers from many of the same limitations as other forms of standardized testing, including cultural and socioeconomic bias (Clayton, 2016; Kent & McCarthy, 2016; Miller & Stassun, 2014), and it has low predictive value for graduate student success (Petersen et al., 2018). Programs may also contemplate contextualized admissions decisions that consider individual backgrounds and obstacles. Additionally, Heath-Stout and Hannigan (2020) described how fieldwork experiences are often cost-prohibitive for many students and limit participation (and consequently, career advancement) of minoritized and economically disadvantaged students. Until free and low-

cost field schools are more common, program admissions need to reconsider the weight given to prior fieldwork experience when evaluating applications. After admittance, requirements, or informal expectations regarding fieldwork, especially field excavation, are often designed around the presumption of the participation of able-bodied individuals and are therefore not inclusive. Further, consideration should be given to harassment and assault based on perceived gender or sexual orientation and against archaeologists of color and those with disabilities in field settings and how these limit fieldwork opportunities (Clancy et al., 2014; Nelson et al., 2017; Voss, 2021). Considering the numbers of previously excavated skeletal collections in museums, universities, and other institutions, local, nonresidential options for experiential, on-the-ground training are increasingly available to many graduate students. Thus, while in some cases important contextual information may be missing from existing datasets and that a lack of standardization of data collection methods may limit metanalyses, expectations regarding students' training in field and lab methods should ultimately be tailored to their program of study and appropriate to their career goals. This increased flexibility benefits students of all ability statuses, as well as nontraditional students and students who are caregivers (Healey et al., 2002).

Finally, the climate of graduate programs should become more inclusive and supportive of all students. Anthropology graduate students of color have reported receiving fewer opportunities for career advancement than their white peers (Brodkin et al., 2011). Addressing this problem requires systemic change, wherein departments develop a reflexive attitude toward their own racial discourse and actively work to hire more faculty of color, diversify theoretical perspectives and curricula, develop or make partnerships with mentorship programs designed specifically to support minoritized groups, and hold white faculty accountable for increasing racial justice (Brodkin et al., 2011). Inclusive universities should also support student mental health, given that mental health concerns are increasingly common among graduate students (Evans et al., 2018), and ideally ensure diverse student counselors who specialize in racial trauma and mental health stress faced by minoritized groups. Although access to health services largely depends on resources provided at the institutional level, it is unwise for faculty to take on additional burdens for which they are not trained, even if they can aptly play supportive roles both as faculty advocates (to administrators) and faculty mentors (to students).

12.2 | Preparing for career diversity through training for careers in academia

Institutions and faculty must recognize that most PhD students will ultimately have careers outside of academia; training and advising should reflect this. This does not require a major restructuring of (most) graduate curricula, but an explicit recognition that much of the knowledge and skills that students acquire in a bioarchaeology PhD program are transferable to a variety of settings. For example, skilled research design and grant-writing is not only the core of academic research, but it is also broadly applicable to a variety of careers. Graduate programs should provide sufficient support, guidance, and flexibility to enhance student capacities as independent learners. However, it is impossible for institutions and faculty to plan for (or find the time and opportunity to teach) all the skills and knowledge needed for particular tasks or careers. Programs can encourage students to

identify and develop new skills and collaborations particular to their interests and plan of study, which will serve students in a variety of academic, professional, and personal situations.

Bioarchaeology graduate programs should also rely on the sevices provided by university career centers. While these centers often lack specific disciplinary knowledge or are primarily struc- tured to serve the needs of undergraduate students, they can give broadly applicable advice on issues such as: transforming CVs to resumes, articulating how research in other countries and deep knowledge of various cultural groups is translatable into cultural competencies, and viewing grant writing as a skill in persuasive writing. Programs should also coordinate with the Graduate School/Graduate College to find internships or professionalization workshops/seminars for graduate students and encourage students to take charge of their education and articulate how skills are translatable to a variety of careers.

12.3 | Graduate training

Curricula for graduate training need to parallel academic professional work (e.g., writing papers that resemble published articles; reading/ reviewing grant proposals; intensive reading to develop deep knowl- edge). This training needs to start early and persist throughout the entirety of the program. Not only will this training improve bio- archaeological research projects, but it will also ensure that these skills are translatable to nonacademic jobs. To develop recommended curri ular requirements for programs that train bioarchaeologists, existing curricula were assessed. Data were collected on graduate program curricula from graduate degree-conferring institutions with bio- archaeologists on staff, identified using the online AAA *AnthroGuide*. Additionally, graduate degree-conferring institutions not in the *AnthroGuide* but represented in the 2020 Bioarchaeology Workshop were also included, resulting in a total sample of $n = 84$, predominately US institutions but also including some from the United Kingdom ($n = 3$), Canada ($n = 6$), Portugal ($n = 2$), and Mexico ($n = 1$). Data were collected on degree types, tracks, and course requirements from the webpages and graduate handbooks for each institution sampled (Table 1). Seven key categories of curriculum requirements were identi- fied: Professionalism/Ethics, Research Design/Proposal Writing, Theory, Breadth, General Methods, Quantitative Methods, and Proficiency in a Research Tool and a foreign Language (described in Table 2).

Several graduate programs had requirements that varied by degree concentration and/or included requirements that could be fulfilled by taking courses or pursuing training in multiple curriculum categories. Each curriculum category was recorded as Required, Optional to Fulfill Requirement, or Required Only for Certain Degree Tracks, as shown in Figure 2. Figure 3 illustrates those curriculum categories that are required for all degree tracks by degree type (Terminal Master's, PhD only, Master's/PhD combined). These figures and data will be discussed in the following sections, which will describe recommendations for improving curricula in bio- archaeology training programs.

	United States	United Kingdom	CAN	PT	MX	Total
Terminal Master's	26	0	2	0	0	28
PhD only	15	0	0	1	1	17
Master's/PhD	31	3	4	1	0	38
Total	72	3	6	2	1	84

TABLE 1 Institutions sampled country and degree type

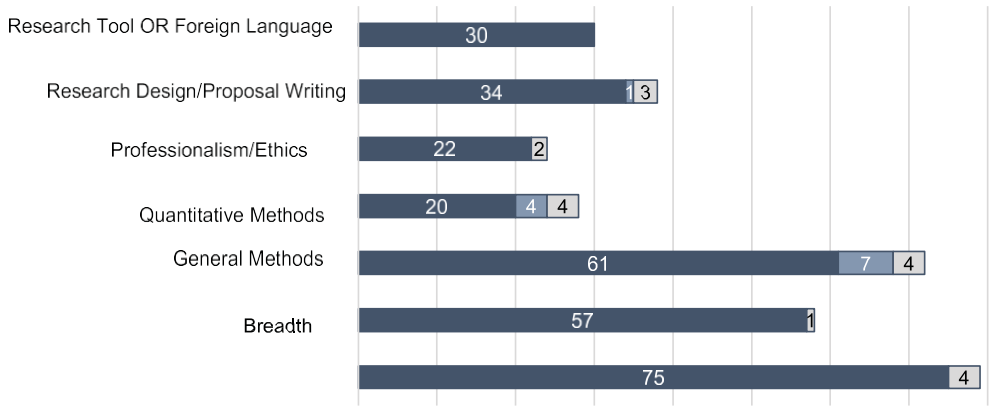
12.3.1 | Professionalism/ethics

TABLE 2 Categories of curriculum requirements

Category	Description
Professionalism/ethics	Course(s) in professionalism/ professional development, introduction to graduate studies, ethics in anthropology
Research Design/ proposal writing	Course(s) in research design, research strategies, proposal writing, writing for anthropology/archaeology
Theory	Course(s) in anthropological theory, history and theory of anthropology, and theory and methods courses of each subdiscipline
Breadth	Course(s) outside of subdiscipline/ department; alternatively, multiple "general anthropological theory" courses
General methods	Laboratory/analytical training, general methods training in method/theory courses, field method training, quantitative method training, internship/practicum requirements
Quantitative methods	Quantitative methods requirement, typically either a course in quantitative methods in anthropology or other statistics course(s)
Proficiency in either a research tool (e.g., GIS, statistics, an advanced field method, etc.) OR a foreign language	

Professionalism and ethics are inextricably linked and should be integrated into graduate training, ideally including a standalone course. Currently, only about 26% of the bioarchaeology graduate programs evaluated (n = 22) appear to require a course in professionalism and ethics. While some of this training occurs through apprenticeship (e.g., co-teaching, collaborating on field projects, and co-leading community outreach projects, lunches with advisers and their colleaguesat conferences, etc.), these processes should be formalized by mentors within a professional framework, more explicitly acknowledged, and more equitably made available to graduate students. Ethics should be meaningfully addressed in all appropriate courses/modules; an additional option would be to develop workshops with the explicit goal of discussing ethics.

Students need to be aware of how to be ethically responsible anthropologists who embrace the concept of "do no harm," within home institutions and field research settings. Social identity does not end at death, and students need to be aware that social identities of the deceased still resonate in descendant communities (in all the var- ied locations around the globe) and among the public. Students require knowledge and experience of how to engage with descendant communities and form collaborative relationships with them, from the initial steps of research design (rather than engaging them as *post facto* consultants). Key issues to address include bioarchaeological ethics (Lambert & Walker, 2019; Mays et al., 2013; Scarre & Scarre, 2006; Squires et al., 2020; Vitelli and Colwell-Chanthaphonh, 2006; Zimmerman et al., 2003); collaborating with descendant communities and other stakeholder groups (Boutin et al., 2017; Mihesuah, 2000); deep knowledge of NAGPRA and repatriation in general (Beisaw, 2010; Blau, 2011; Bruning, 2006; Chari & Lavallee, 2013; Kakaliouras, 2012; McEvoy & Conway, 2004; Meloche et al., 2021; Mihesuah, 2000; Rose et al., 1996; Schillaci & Bustard, 2010; TallBear, 2003; Threedy, 2007; Welch, 2010); collabo-ating with colleagues (academic faculty, students, and other professionals), including co-development of projects, co-directing projects, joint publishing, and data sharing (Ledford, 2008); networking; plagiarism (what constitutes plagiarism and what to do if someone plagiarizes work); discussion of Title IX (civil rights law in the United States that prohibits sex-based discrimination in federally funded schools and education programs) (Clancy et al., 2014; Colaninno et al., 2020; Nelson et al., 2017); Institutional Review Board and ethics approvals from universities, communities, and tribes; explicit discussion of Proficiency in research tool OR foreign language



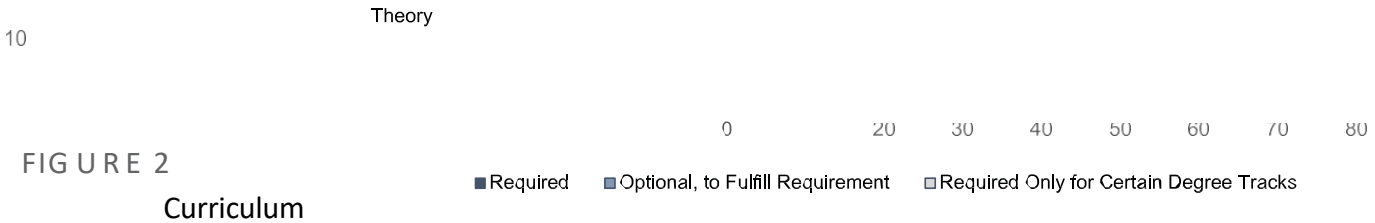
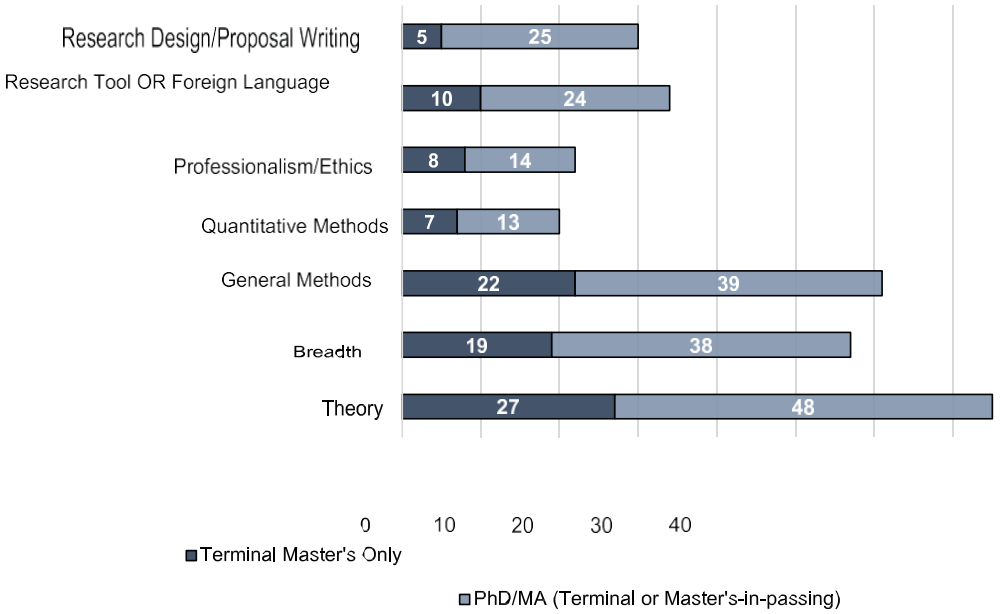


FIGURE 2 Curriculum categories by type of requirement

FIGURE 3 Program requirements by degree type



12.3.2 | Research design

Graduate students in bioarchaeology should have the opportunity to take a course in research design/grant proposal writing. Currently, less than half (*n* = 34) of the bioarchaeology graduate programs evaluated require such a course. Core components of such a course should include segments on grant proposal preparation and writing, reviewing successful and unsuccessful grant proposals, and writing multiple drafts of grants with peer-review by other students. This course should encourage students to think about what is novel in their research and how it extends existing boundaries; what are the past, current, and future trends in bio- archaeological research and publishing (Buikstra, 1991; Buikstra & Roberts, 2012; Cheverko et al., 2020; Stojanowski & Buikstra, 2005); what compelling problems research addresses and how to formulate testable hypotheses to address those problems. Students should be encouraged to start any project by first identifying a problem to address and then selecting appropriate analytical and methodological approaches (rather than starting from an interest in tools and methods and looking for a context in which to apply them). Students should also learn to identify the broader impacts of their research and how to make those impacts an integral component of their projects rather than viewing them as an appended task included simply to satisfy granting agency requirements. Given the need to improve interdisciplinary approaches and the many technological advances relevant to bioarchaeological data collection and analysis (Section

11.2), students should begin the process of recognizing opportunities for interdisciplinary training and pursuing collaboration with scholars in other fields early to enhance their potential for engaging in substantive interdisciplinary work over the long term. This process will require students, with support of mentors, to develop realistic expectations and confidence in what they can accomplish independently as opposed to areas that are best served through interdisciplinary collaboration.

With the call more broadly for bioarchaeologists to discuss how their research speaks to contemporary issues, students require advice on how to incorporate outreach into their research design (and include into broader impacts of grant proposals). A research design course may assist students in identifying outlets for disseminating their work to a larger and more diverse audience (e.g., journalistic articles like those published in *The Conversation* and *Sapiens*, project web sites, blog posts, and podcasts). Additionally, students should learn about resources and opportunities to aid more deep engagement with various publics (e.g., PAGE Fellowships for public scholarship; Wenner Gren Engaged Anthropology Grant). This work contributes to career progression and increasingly counts in considerations for academic promotion.

12.3.3 | Theory

Figures 2 and 3 show that overwhelmingly, bioarchaeology graduate programs (regardless of degree type) require that students take at least one course in theory, and most require that students take courses outside of their subdiscipline/concentration (breadth requirements). These requirements are seldom optional and are almost always required for all degree tracks. This is an excellent start, but theory, like ethics, should be fully integrated into curricula beyond explicitly dedicated courses. Embedding social and evolutionary theory in thematic/topical and methods/applied courses is a very effective way to demystify these topics, demonstrating how various theories can be applied to interpretations of data. Integrating theory into methods courses disabuses students of the notion that any given method leads to one "correct," unambiguous answer.

Theory courses provide an opportunity for students to developand refine skills in critical thinking, reading, and writing. Rather than focusing too narrowly on methods/techniques, students trained in social and evolutionary theory learn to conduct problem-oriented research in the service of answering "big picture" research questions. A strong foundation in theory enhances participation in experiential learning (e.g., internships, service learning, and public outreach) by illustrating the application of theory to practice (praxis). This is especially effective at a local/regional scale, which promotes disciplinary relevance to the public, and can help students apply data from the past to the solution of current social problems.

All standalone or theory-oriented courses should also include discussions of ethics as well as ethical considerations for current practices, regardless of whether standalone ethics courses are offered and/or required. These courses should be part of a more broadly decolonized curriculum, which enhances critical thinking skills, interrogates the production of knowledge, and promotes a more inclusive academy.

12.3.4 | Methods

While ~73% (*n* = 61) of the bioarchaeology graduate programs evaluated require coursework in anthropological/archaeological methods, only 24% (*n* = 20) of graduate programs specifically require coursework or training in quantitative methods (see Figure 2). Additionally, only 11% (*n* = 9) require proficiency in a foreign language or research tool; in some cases, statistics proficiency is listed as an option to satisfy the research tool proficiency requirement, while others emphasize GIS or advanced field excavation methods.

It is clear from these requirements that general methods training is a cornerstone in bioarchaeology graduate training, while quantitative methods receive less emphasis. To make specific recommendations about the nature of that training, data was collected from published information on grantees from the NSF, the Wenner-Gren Foundation, and the Social Sciences and Humanities Research Council (SSHRC) (Canada) between 2010 and 2020 and was analyzed regarding the methods described in the abstracts and/or keywords for funded doctoral and postdoctoral bioarchaeological research (*n* = 232 projects). Over this period, NSF funded 53% of these bioarchaeology research projects, followed by Wenner-Gren with 27%, and SSHRC with 20%. Bioarchaeological projects were coded based on the methods described in the abstracts and/or keywords. Only methods that were explicitly stated or could be reasonably inferred were included. Fourteen major method categories emerged from this content analysis, described in detail in Table 3 below. All projects had at least one methodological code. Most had more than one, and several methods commonly appeared together (as noted in the table).

Overwhelmingly, these bioarchaeology research projects relied on osteological data, paleopathological analyses, and isotopic data. However, these data show that mortuary analysis, molecular analysis, osteological and dental morphometrics, and biodistance analyses are

TABLE 3 Method categories

Category	Description
Bioarchaeology (unspecified)	

[70]Studies that applies a range of methods to archaeological human remains, described as "bioarchaeological" in nature but not specified beyond that.

Biodistance	Studies of relatedness between and within populations, typically assessed through skeletal metric and nonmetric traits, and geometric morphometrics (see Osteo/Dental Morphology category). Often used in conjunction with DNA and/or Isotope analysis.
Biomechanics	Studies of movement-related skeletal variation. Includes studies of skeletal morphology/geometric morphometrics/ robusticity (see Osteo/Dental Morphology category), studies of internal trabecular and cortical structure (see CT/Radiography category), and other studies of activity-related change (specific methods unspecified).
CT/radiography	Studies that use CT, microCT, and/or other radiographic methods. Typically used in service of either biomechanical analysis (see Biomechanics) or paleopathological analyses (see Paleopathology).
DNA	Studies that use DNA analysis. These vary widely to include studies of population genetics, migration (see Isotopes), and pathogens (see Paleopathology).
Isotopes	Studies that use stable and/or radiogenic isotope analysis (e.g., for diet and mobility). Commonly used alongside Osteology, Paleopathology, and Mortuary Analysis methods (see respective categories).
Microscopy/histology	Studies that rely on microscopic evaluations of skeletal/dental morphology. Typically used in Paleopathology.
Mortuary analysis	Studies that include analyses of archaeological data such as burial practices (treatment of the body, body positioning), grave furniture, etc.
Osteo/dental morphology	Studies that include analyses of skeletal/dental morphology, morphometrics, geometric morphometrics, robusticity. These methods were often used in the service of biomechanical analysis or biodistance analysis.
Osteology	Studies that explicitly rely on osteological examination beyond any other methods listed in this table. These are studies of bones for creating biological profiles of skeletons (or components of the biological profile) or studies that otherwise rely on unspecified "osteological data." For example, studies of paleopathology and/or paleodemography are almost always also included here, as they begin with analyzing bones and teeth.
Paleodemography	Studies that evaluate human population dynamics using skeletal samples. Commonly used with Osteology and Paleopathology methods.
Paleopathology	Studies that evaluate skeletal and dental health and/or the emergence of pathogens in the past. These studies almost always also use Osteological methods.
Spatial analysis	Studies that evaluate geographic distribution patterns using GIS.
Statistics	Studies that are significantly based in statistics. Data aggregation, model development, or model testing is an explicit aim.

also common. Due to their centrality in current bioarchaeological research, it is vital that students in bioarchaeology are trained in these methods. Of course, the extent of this training is largely institution- dependent, particularly regarding laboratory methods like biogeo-chemical and molecular analyses, but at a minimum, students should be familiar with interpreting and evaluating data produced from these methods.

It is necessary to emphasize the importance of training in quantitative methods. Although statistical model development/testing is less common in bioarchaeological research (see Figure 4), it is undeniable that identifying appropriate quantitative methods for a given research question and interpreting them is vital in addressing current limitations and challenges in bioarchaeology. As previously noted, approximately one quarter of the graduate programs evalu- ated explicitly require at least one quantitative methods course. That said, fluency in quantitative methods comes from exposure to different statistical methods and practice using them. Bioarchaeology graduate courses should routinely discuss quantitative methods and encourage students to use datasets for course-based research projects when relevant. Additionally, ecology, biology, epidemiology, and biostatistics departments often offer courses in bioarchaeologically-relevant statistical methods like Bayesian sta- tistics (as opposed to psychology, computer science, or statistics departments, which tend to rely on frequentist statistics). While Bayesian statistics are beneficial in contexts with large amounts of missing data and small datasets, taking machine-learning courses will also strengthen foundational skills and broaden the quantitative methods toolkit.

12.4 Best practices for graduate training

As noted above, the focus here is primarily on graduate training in the United States, so the following is designed for United States-based education systems and thus might not be fully applicable in other locations. Overall, most of the graduate programs evaluated for this study currently train bioarchaeology students in theory and methods and require some degree of breadth in student coursework. Training in quantitative methods, research design, and professional ethics are much more variably required. These data offer a limited perspective on graduate training; they only reflect formal degree requirements and cannot, alone, characterize students' training from any of these institutions. Fewer requirements typically permit more flexibility, and students may ultimately be trained in many of the above categories (and potentially, more), even though they are not explicitly required by the degree program. Nonetheless, these requirements indicate a general heuristic of what graduate programs consider core values.

Given the constraints of time, funding, and faculty composition of most graduate programs, graduate training cannot be comprehensive, but it must be foundational. The ideal education for a broadly trained bioarchaeologist includes both archaeology and biological anthropology. Students should emerge from graduate school with the core skills and knowledge necessary to be competent bioarchaeology professionals, including understanding basic skeletal and dental biology, archaeological contextualization, and generally how the social and biological conditions

people experience influence growth and development and are otherwise embodied in the skeleton. Here and elsewhere in this article the emphasis is on how 21st-century

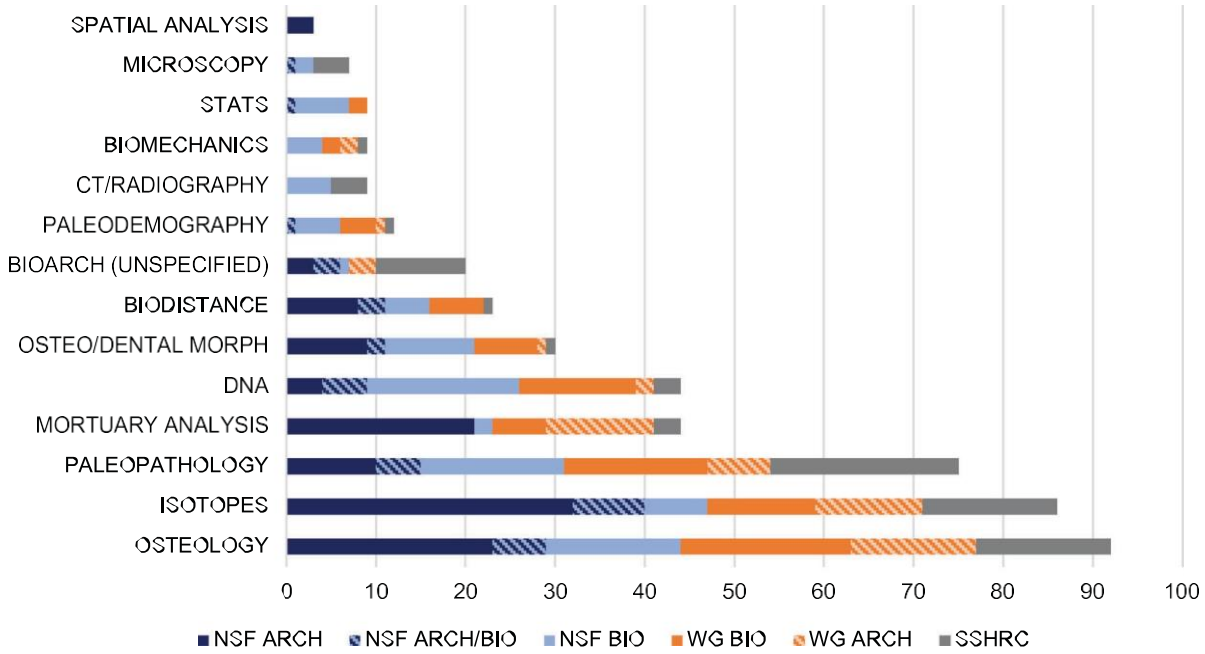


FIGURE 4 Methods in bioarchaeology research funded by NSF, Wenner-Gren, and SSHRC, 2010–2020. Methods used in osteology, isotopes, and paleopathology are by far the most common, followed by DNA and mortuary analysis, Osteo/dental morphology, then biodistance. The remaining methods each appear in less than 10% of funded projects

bioarchaeology will require the practice of strong professional ethics, extensive public outreach, and broad interdisciplinary collaborations. To address the big picture questions and challenges facing the field, scholars should continue to draw on social and evolutionary theory and improved quantitative methods. Graduate students developing plans of study and faculty tasked with improving curricula and revising program requirements should bear in mind these points and endeavor to incorporate them, formally or informally, into graduate training.

A possible framework (i.e., curriculum, loosely defined) for graduate training in bioarchaeology follows the knowledge needed for writing each section of a standard, peer-reviewed research article (see Table 4). This model provides a clear justification and explanation of why students are being trained. For example, writing the introduction to an article often requires that the work addresses a larger theme or theoretical issue in the social or natural sciences; courses in anthropo- logical or evolutionary theory provide knowledge that will contribute to the formulation of a compelling introduction. Similarly, the methods section requires knowledge and skills that demonstrate how bio- archaeological research will be conducted and why those particular methods chosen are suitable (Aufderheide and Rodríguez-Martin, 2003; Buikstra, 2019c; Buikstra & Beck, 2006; Buikstra & Ubelaker, 1994); methods courses provide that training and context. Although Table 4 summarizes the article sections and associated substantive topics and coursework, a key goal of graduate education is that students become critically thinking, independent learners and researchers, engaging in honest self-reflection about existing lacunae in their knowledge and skill sets and proactively seek to learn what is necessary. Faculty cannot foresee every possible methodological advancement, theoretical trend, or software development, but faculty and graduate students can collaborate to ensure that students acquire the knowledge and abilities to continue advancing after they have earned a graduate degree.

TABLE 4 Outline of a "typical" bioarchaeology research article, suggesting how those sections connect to substantive ideas, graduate coursework, and broad training applicable to a variety of careers

Outline of a research article	Substance	Related courses	Application in diverse careers
Introduction and theoretical framework	Big ideas in anthropology/social sciences	Courses in social theory and biological/evolutionary theory	Ability to process and integrate diverse sources of knowledge. Critical thinking.
Background: Culture and history	Deep content knowledge	Courses in the population, geography, history, and language of communities being studied	Deep content knowledge and ability to generate deep knowledge in new fields (learning how to learn)
Methods	Lab and related skills and deep knowledge of the appropriateness	Methods courses: osteology and lab specializations (isotope,	Lab and related skills applicable in industry and the wider world of

	of certain methods	pathology, DNA, histology, GIS, etc.). These courses should include both the applied (skills) components and the theoretical/ historical background on the methods.	work; ethical considerations
Research questions/ hypotheses	Research Design	Research Design and grant writing course	Grant writing/ persuasive writing; clear thinking and organizing ideas; awareness of previous relevant work
Results	Generating and organizing new data/knowledge	Course in statistical methods and data presentation & data visualization	Analytical (statistical) skills and communicating data (e.g., data description and visualization) are widely applicable.
Discussion and conclusion	Bridging big ideas with deep content knowledge and new data; use of relevant published literature; noting limitations of data/study	Content specific courses; Independent Studies	Synthesizing large and diverse sets of information, often from several different disciplines; Learning how to learn
Acknowledgements	Professionalization; Collaboration, Ethics	Course on Professionalization, Academic & Community Collaborations, and Ethics	Professionalization; Ethics, Networking
Literature cited	Deep scholarship	All classes + self-directed readings	Deep knowledge; Learning how to learn
		Total number of courses	

13 | CONCLUSIONS

Over the past half-century, bioarchaeology has made important contributions to understanding life in the past, including clarifying the individual- and population-level experiences and impacts of infectious diseases, variation in health across biosocial variables, patterns and consequences of migration, and trends in interpersonal violence. In multi-scalar fashion, the field has illuminated the histories of individuals, regions, and continents. It has also explored general phenomena of significance to our global past, present, and future. As illustrated in this article, bioarchaeology is poised to make further, potentially transformative, contributions. Here we offer comments designed to strengthen all such initiatives, including research design, training programs, topics of special significance, and ethical considerations that should guide the profession during the coming decades of the 21st century. A further profound need, which will require substantial proactive efforts, is decolonizing and transforming the field to one that is more inclusive, representative, and sensitive to the desires of descendant populations.

Multiple approaches to bioarchaeological research are clearly desirable, though we strongly encourage rigorous methods that address significant questions about human life in the past and that, where possible, are applicable and relevant to living people. One over- all challenge is how to contextualize our data when focusing upon issues of broad significance, such as resilient responses to climate change, the context of the emergence of infectious diseases, and par- cipation in various forms of violence. Do we begin with exquisitely detailed regional studies from which we extract common themes, or do we start with "big data," multi-regional approaches? In both cases, we must address issues of data comparability and strive to strike a
balance between contextual richness and general trends. Our field's most publicly recognized achievement, the impactful conclusions developed from the initiative to examine health at the origins of agriculture (Cohen, 1989; Cohen & Armelagos, 1984; Cohen & Crane- Kramer, 2007), involved comparisons across regionally contextualized datasets. The visibility and significance of these findings urges us to consider whether this is the best way to proceed further with other major questions, such as the impact of climate change.

Bioarchaeologists recognize that "natural disasters" are frequently episodes of crisis and chaos ultimately of anthropogenic origin. Such calamities are also recurring tests of human resilience, requiring socio-cultural change and biological adaptation. When framed in this manner, we remove the tendency to think of change as bad and to inadvertently reify pre-existing structures as somehow "good" or "natural" for that time and place. For example, bio- archaeological perspectives on violence and social institutions converge on a few simple ideas: inter-personal violence is in no way a natural outcome of climate and environmental change; violence is not necessarily abated by strong social institutions, particular forms of government, or tighter social control—phenomena that can also represent forms of violence; and there is no single meaning of, nor a single trajectory for violent behavior in human history. Other related, yet unasked questions that merit attention include the response of peoples during the immediacy of change, the "transformational periods." We may

hypothesize that change/transformation is not necessarily deleterious, but if we drill down into major transformations, such as those in food production, industrialization, and urbanization, should we consider the process of change itself or the final result as the negative or positive health and wellbeing outcome? Perhaps managing change is one of the greatest human behavioral problems in the 21st century.

In exploring the issues raised here, including those of resilience modeling and social transformations, we find that social identities, including intersectional identities that reflect and maintain structures of violence are crucial attributes that require our attention, first to the accuracy of our biological observations and then to the contextual details that facilitate a discourse attuned to social identities of gender, age, and kinship. Further developments in the field also hinge on improving our willingness and ability to work effectively with multiple lines of evidence and to embrace and proactively pursue interdisciplinarity (within and beyond anthropology). Such breadth should be featured in our research and especially in our training programs. We also recognize that some bioarchaeological research is limited by a failure to use relevant statistical analyses. Addressing this problem will require advanced training in quantitative methods. Similarly, achieving a rate of funding of bioarchaeological research that matches the potential our field represents and the massive interest in it by students and scholars necessitates improved training in research design and proposal writing.

Several colleagues have already produced impressive articles, books, and edited volumes on topics such as climate change, migration, violence, and social inequality (e.g., Baker & Tsuda, 2015a; Blakey & Rankin-Hill, 2009; de la Cova, 2012, 2020a, 2020b; Gregoricka, 2021b; Harrod & Martin, 2014; Nystrom, 2014; Robbins Schug, 2020). These achievements in reconstructing the lives of past peoples are to be celebrated and, as appropriate, their conclusions should be directed toward resolving contemporary issues (Buikstra, 2019a). Nonetheless, we recognize that while important bioarchaeological research is and should be used to illuminate the past in ways that engage varied audiences; the ability to tell the stories of past individuals carries with it a responsibility to living descendants. These results should proactively also be made available to living descendants and nonspecialist audiences, in accessible language. As we generate and disseminate research conclusions with contemporary significance, how do we most effectively communicate our results beyond the profession? How best do we get past the scholar's recourse to "it depends" followed by polysyllabic swamps and descent into details, however interesting we find them? Challenges abound!

The need to decolonize the field and make it more inclusive in general, and the substantial proactive effort this will require, permeated many discussions at the Workshop, as is occurring within the field of biological anthropology more generally. As has been noted by Fuentes (2021) for biological anthropology, our intimate understanding of and focus on the outcomes of stress and marginalization makes ina tion toward resolving a lack of diversity and inclusion in bioarchaeology inexcusable. For example, bioarchaeological studies of adaptation during early life hold significant potential to push current knowledge further by documenting survival of early life stress and consequences at later stages of the life course in relation to systemic racism and other structures of inequality and power imbalances. However, a substantial lack

of diversity in bioarchaeology suggests that such studies will result in subjectification until marginalized voices are included in the exploration of these and other questions (Watkins, 2018). Framing questions about plasticity, constraint, resilience, and context in bio- archaeology requires inclusion of marginalized voices in research design as well as training a diverse generation of scholars for future research. Similarly, discussions of the ethical use of skeletal remains–particularly those of Indigenous peoples, enslaved individuals, or socially marginalized people–for pedagogical or research purposes will fall far short of their potential to promote social justice if they fail to include a diversity of perspectives and privilege the desires of descendant populations.

It is such transformation we seek, for ourselves and for the discipline, to prepare future generations to meet the challenges of a rapidly changing world. The field of bioarchaeology must change, decolonize, and embrace diversity in a manner previously unknown. As responsible educators and researchers, we should use our exper- tise and pedagogic skills to bring our knowledge of deep time to contemporary and future challenges that face humankind, not the least of these being epidemic disease, violence, inequality, and other trials that tax our resilience as individuals and in collectivities. Changing reward structures in universities to include communicat- ing with nonspecialist audiences is requisite and necessitates train- ing students in ethics, in transdisciplinary thinking, and in the collaborations that are necessary to provide the contextualized interpretations that inform general issues. These are significant challenges, ones that we must face to help frame our world and our global future.

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CONFLICT OF INTEREST

The authors declare no potential conflict of interest.

ENDNOTES

[1] In this contribution, we reference human bioarchaeology, the study of human remains from Holocene archaeological and historical contexts, recognizing that bioarchaeology has also been applied to zoo- archaeology (Clark, 1972) and may be used more generally to reference the study of any organic remains recovered from archaeological sites. The more general definition is used more commonly in Europe and the

United Kingdom than in the United States. Because of the explicit goals of this Workshop and the primary funding source, this article focused on bioarchaeology in the United States. For this reason, bioarchaeology is considered to include paleopathology (the study of ancient health and disease), a distinctive field of study in some countries.

[2] "Transdisciplinary," as used here, refers to bioarchaeological research that explicitly addresses contemporary issues that threaten well-being, such as inequality, violence, and epidemic disease. "Bioarchaeology," by its very nature, is interdisciplinary.

[3] Prior to January 2022, *The American Journal of Physical Anthropol- ogy (AJPA)*.

[4] https://anthrosource.onlinelibrary.wiley.com/hub/journal/15481395/ about/author-guidelines.

[5] https://www.babao.org.uk/assets/Uploads/BABAO-EDI-Report-Arday- and-Craig-Atkins-May-2021-v2-3.pdf.

[6] https://www.saa.org/publications/saa-contributions-on-race.

[7] Black, Indigenous, People of Color.

[8] https://histanthro.org/news/observations/ignoble-trophies/.

[9] https://histanthro.org/news/observations/enclosures-and-extraction/.

[10] http://restitutionreport2018.com/sarr_savoy_en.pdf.

[11] https://www.artnews.com/art-news/news/germany-returns-benin- bronzes-2022-declaration-1,234,591,348/.

[12] https://news.yale.edu/2015/06/04/peru-yale-partnership-future- machu-picchu-artifacts.

[13] Movement of 6 million African Americans from rural southern United States to the urban North between 1916 and 1970. https://en. wikipedia.org/wiki/Great_Migration_(African_American).

[14] Defined as occurring at or around the time of death.

[15] https://www.npr.org/sections/thetwo-way/2016/08/29/491841003/ scientists-divided-over-how-lucy-died.

[16] https://www.anthropology-news.org/articles/the-long-view-of- climate-change-and-human-health/.

[17] For a recent analysis of relatively low rates of applications to NSF, Wenner-Gren, and the National Geographic Society by women in archaeology in general, see Goldstein et al. (2018).

DATA AVAILABILITY STATEMENT

Data on graduate curricula and methods in funded research, as described in Section 12, are available upon request.

REFERENCES

Abedi, V., Olulana, O., Avula, V., Chaudhary, D., Khan, A., Shahjouei, S., Li, J., & Zand, R. (2021). Racial, economic, and health inequality and COVID-19 infection in the United States. *Journal of Racial and Ethnic Health Disparities*, *8*(3), 732–742. https://doi.org/10.1007/s40615-020-00833-4

Abrams, E. M., & Szefler, S. J. (2020). COVID-19 and the impact of social determinants of health. *The Lancet Respiratory Medicine*, *8*(7), 659– 661. https://doi.org/10.1016/S2213-2600(20)30234-4

Adams, B. J., & Byrd, J. E. (Eds.). (2008). *Recovery, analysis, and identifica- tion of commingled human remains*. Humana. https://doi.org/10.1007/ 978-1-59745-316-5

Adger, W. N. (1999). Social vulnerability to climate change and extremes in coastal Vietnam. *World Development*, *27*(2), 249–269. https://doi. org/10.1016/S0305-750X(98)00136-3

Agarwal, S. C. (2012). The past of sex, gender, and health: Bioarchaeology of the aging skeleton. *American Anthropologist*, *114*(2), 322–335. https://doi.org/10.1111/j.1548-1433.2012.01428.x

Agarwal, S. C. (2016). Bone morphologies and life histories: Life course approaches in bioarchaeology. *Yearbook of Physical Anthropology*, *159*(S61), 130–149. https://doi.org/10.1002/ajpa.22905

Agarwal, S. C. (2021). What is normal bone health? A bioarchaeological perspective on meaningful measures and interpretations of bone strength, loss, and aging. *American Journal of Human Biology*, *23*, 33: e23647. https://doi.org/10.1002/ajhb.23647

Agarwal, S. C. (2022). What does a pandemic response and recovery look like through the lens of anthropogenic violence and inequality? *Eco- nomic Anthropology*, *9*(1), 158–162.

Agarwal, S. C., & Beauchesne, P. (2011). In S. C. Agarwal & B. Glencross (Eds.), *It is not carved in bone: Development and plasticity of the aged skeleton* (pp. 312–332). Social Bioarchaeology, Wiley-Blackwell.

Agarwal, S. C., & Wesp, J. (Eds.). (2017). *Exploring sex and gender in bio- archaeology*. University of New Mexico Press.

Alfani, G., & Bonetti, M. (2019). A survival analysis of the last great European plagues: The case of Nonantola (northern Italy) in 1630. *Population Studies*, *73*(1), 101–118. https://doi.org/10.1080/ 00324728.2018.1457794

Allen, J. A. (1877). The influence of physical conditions on the genesis of species. *Radical Review*, *1*, 108–140.

Allen, J. S., & Jobson, R. C. (2016). The decolonizing generation: (race and) theory in anthropology since the eighties. *Current Anthropology*, *57*(2), 129–148. https://doi.org/10.1086/685502

Allentoft, M., Sikora, M., Sjögren, K.-G., Rasmussen, S., Rasmussen, M., Stenderup, J., Damgaard, P. B., Schroeder, H., Ahlström, T., Vinner, L., Malaspinas, A.-S., Margaryan, A., Higham, T., Chivall, D., Lynnerup, N., Harvig, L., Baron, J., Casa, P. D., Dąbrowski, P., … Willerslev, E. (2015). Population genomics of bronze age Eurasia. *Nature*, *522*, 167–172. https://doi.org/10.1038/nature14507

Almagro, M., Coven, J., Gupta, A., & Orane-Hutchinson, A. (2021). Dis- parities in COVID-19 risk exposure: Evidence from geolocation data. *Social science research network* (paper ID 3695249). NYU Stern School of Business Forthcoming, https://doi.org/10.2139/ssrn. 3695249

Alt, K. W., Pichler, S., Vach, W., Klíma, B., Vlček, E., & Sedlmeier, J. (1997). Twenty-five thousand-year-old triple burial from Dolní Věstonice: An ice-age family? *American Journal of Physical Anthropology*, *102*(1), 123–131. https://doi.org/10.1002/(SICI)1096-8644(199701)102:1%3C123::AID-AJPA10%3E3.0.CO;2-2

Alt, K. W., & Vach, W. (1992). Non-spatial analysis of "genetic kinship" in skeletal remains. In M. Schader (Ed.), *Analysing and modeling data and knowledge* (pp. 247–256). Springer.

Alt, K. W., & Vach, W. (1995). Odontologic kinship analysis in skeletal remains: -concepts, methods, and results. *Forensic Science International*, *74*(1–2), 99–113. https://doi.org/10.1016/0379-0738(95)01740-A

Alvarez, A. (2016). *Unstable ground: Climate change, conflict, and genocide*. Rowman & Littlefield Publishers.

Amorim, C. E. G., Vai, S., Posth, C., Modi, A., Koncz, I., Hakenbeck, S., La Rocca, M. C., Mende, B., Bobo, D., Pohl, W., Baricco, L. P., Bedini, E., Francalacci, P., Giostra, C., Vida, T., Winger, D., von Freeden, U., Ghirotto, S., Lari, M., … Veeramah, K. R. (2018). Understanding 6th- century

barbarian social organization and migration through pal- eogenomics. *Nature Communications*, *9*(1), 1–11. https://doi.org/10. 1038/s41467-018-06024-4

Anderson, C. P., Martin, D. L., & Larsen, C. S. (Eds.). (2018). *Massacres: Bio- archaeology and forensic anthropology approaches*. University Press of Florida.

Anderson, J., & Hevenor, H. (1987). *Burning down the house: MOVE and the tragedy of Philadelphia*. W.W. Norton & Co.

Anderson, P. S. L., Renaud, S., & Rayfield, E. J. (2014). Adaptive plasticity in the mouse mandible. *BMC Evolutionary Biology*, *14*(85). https://doi. org/10.1186/1471-2148-14-85

Ansell, D. A. (2017). *The death gap: How inequality kills*. The University of Chicago Press.

Arcini, C., Ahlström, T., & Tagesson, G. (2014). Variations in diet and stat- ure: Are they linked? Bioarchaeology and paleodietary Bayesian mixing models from Linköping, Sweden. *International Journal of Osteoarchaeology*, *24*(4), 543–556. https://doi.org/10.1002/oa.2247

Arday, J., & Mirza, H. S. (Eds.). (2018). *Dismantling race in higher education: Racism, whiteness and Decolonising the academy*. Palgrave McMillan.

Arkush, E., & Tung, T. A. (2013). Patterns of war in the Andes from the archaic to the late horizon: Insights from settlement patterns and cra- nial trauma. *Journal of Archaeological Research*, *21*, 307–369. https:// doi.org/10.1007/s10814-013-9065-1

Armelagos, G. J. (1969). Disease in ancient Nubia. *Science*, *163*(3864), 255–259.

Armelagos, G. J., Carlson, D. S., & Van Gerven, D. P. (1982). The theoretical foundations and development of skeletal biology. In F. Spencer (Ed.), *A history of American physical anthropology: 1930–1980* (pp. 305–328). Academic Press.

Armelagos, G. J., Goodman, A. H., Harper, K. N., & Blakey, M. L. (2009). Enamel hypoplasia and early mortality: Bioarcheological support for the Barker hypothesis. *Evolutionary Anthropology: Issues, News, and Reviews*, *18*(6), 261–271. https://doi.org/10.1002/evan.20239

Arponen, V. P. J., Müller, J., Hofmann, R., Furholt, M., Ribeiro, A., Horn, C., & Hinz, M. (2016). Using the capability approach to concep- tualise inequality in archaeology: The case of the late Neolithic Bosnian site Okolište c. 5200-4600 BCE. *Journal of Archaeological Method & Theory*, *23*, 541–560. https://doi.org/10.1007/s10816-015-
9252-0

Atalay, S., Clauss, L. R., McGuire, R. H., & Welch, J. R. (Eds.). (2014). *Trans- forming archaeology: Activist practices and prospects*. Routledge.

Atwell, M., & de la Cova, C. (2018, November). The violence of abandon- ment and neglect: Bioarchaeological implications from Missouri asy- lums. Paper presented at the 117th annual meeting of the American Anthropological Association, San Jose, CA.

Auerbach, B. M. (2012). Skeletal variation among early Holocene north American humans: Implications for origins and diversity in the Ame- ricas. *American Journal of Physical Anthropology*, *149*(4), 525–536. https://doi.org/10.1002/ajpa.22154

Auerbach, B. M., & Ruff, C. B. (2006). Limb bone bilateral asymmetry: Variabil- ity and commonality among modern humans. *Journal of Human Evolution*, *50*(2), 203–218. https://doi.org/10.1016/j.jhevol.2005.09.004

Aufderheide, A. C., & Rodríguez-Martin, C. (2003). *The Cambridge encyclo- pedia of human paleopathology*. Cambridge University Press.

Baker, B. J. (1994). Pilgrim's progress and praying Indians: The biocultural consequences of contact in southern New England. In C. S. Larsen &

G. R. Milner (Eds.), *In the wake of contact: Biological responses to con- quest* (pp. 35–45). Wiley-Liss.

Baker, B. J., Crane-Kramer, G., Dee, M. W., Gregoricka, L. A., Henneberg, M., Lee, C., Lukehart, S. A., Mabey, D. C., Roberts, C. A., Stodder, A. L. W., Stone, A. C., & Winingear, S. (2020). Advancing the understanding of treponemal disease in the past and present. *Yearbook of Physical Anthropology*, *171*(Suppl. 70), 5–41. https://doi.org/10. 1002/ajpa.23988

Baker, B. J., & Tsuda, T. (Eds.). (2015a). *Migration & disruptions: Toward a unifying theory of ancient and contemporary migrations*. University Press of Florida.

Baker, B. J., & Tsuda, T. (2015b). Introduction: Bridging the past and pre- sent in assessing migration. In B. J. Baker & T. Tsuda (Eds.), *Migration and disruptions: Toward a unifying theory of ancient and contemporary migrations* (pp. 3–13). University Press of Florida.

Baker, B. J., Varney, T. L., Wilkinson, R. G., Anderson, L. M., & Liston, M. A. (2001). Repatriation and the study of human remains. In T. Bray (Ed.), *The future of the past: Archaeologists, native Americans, and repatriation* (pp. 69–89). Garland.

Baker, P. T. (1984). The adaptive limits of human populations. *Man*, *19*, 1–14.

Baraldi, A. N., & Enders, C. K. (2010). An introduction to modern missing data analyses. *Journal of School Psychology*, *48*(1), 5–37. https://doi. org/10.1016/j.jsp.2009.10.001

Bargain, O., & Aminjonov, U. (2021). Poverty and COVID-19 in Africa and Latin America. *World Development*, *142*, 105422. https://doi.org/10. 1016/j.worlddev.2021.105422

Bargu, B. (2014). *Starve and immolate: The politics of human weapons*. Columbia University Press.

Barker, D. J. (1990). The fetal and infant origins of adult disease. *BMJ (Clinical Research Ed.)*, *301*(6761), 1111.

Barker, D. J. P. (2003). Editorial: The developmental origins of adult dis- ease. *European Journal of Epidemiology*, *18*(8), 733–736. https://doi. org/10.1023/A:1025388901248

Barnosky, A. D., Matzke, N., Tomiya, S., Wogan, G. O. U., Swartz, B., Quental, T. B., Marshall, C., McGuire, J. L., Lindsey, E. L., Maguire, K. C., Mersey, B., & Ferrer, E. A. (2011). Has the Earth's sixth mass extinction already arrived? *Nature*, *471*, 51–57. https://doi.org/ 10.1038/nature09678

Barquera, R., & Krause, J. (2020). An ancient view on host pathogen inter- action across time and space. *Current Opinion in Immunology*, *65*, 65–69. https://doi.org/10.1016/j.coi.2020.05.004

Bartelink, E. (2006). *Resource intensification in pre-contact Central California: A bioarchaeological perspective on diet and health patterns among hunter-gatherers from the lower Sacramento Valley and San Francisco Bay* [PhD Dissertation]. College Station, Texas: Texas A & M.

Bartelink, E. J. (2009). Late Holocene dietary change in the San Francisco Bay Area: Stable isotope evidence for an expansion in diet breadth. *California Archaeology*, *1*(2), 227–251. https://doi.org/10.1179/cal.2009.1.2.227

Bartelink, E. J., Andrushko, V., Bellifemine, V., Nechayev, I., & Jurmain, R. J. (2014). Violence and warfare in the prehistoric San Francisco Bay area: Regional and temporal variations in conflict. In C. Knüsel & M. J. Smith (Eds.), *The Routledge handbook of the bioarchaeology of human conflict* (pp. 285–307). Routledge.

Bartelink, E. J., Bellifemine, V. I., Nechayev, I., Andrushko, V. A., Leventhal, A., & Jurmain, R. (2019). Biocultural perspective on inter- personal violence in the prehistoric San Francisco Bay area. In D. H. Temple & C. M. Stojanowski (Eds.), *Hunter-gatherer adaptation and resilience: A bioarchaeological perspective* (pp. 274–301). Cambridge University Press.

Baten, J., & Steckel, R. H. (2019). The history of violence in Europe: Evi- dence from cranial and postcranial bone trauma. In R. H. Steckel, C. S. Larsen, C. A. Roberts, & J. Baten (Eds.), *The backbone of Europe: Health, diet, work and violence over two millennia* (pp. 300–324). Cambridge University Press.

Baten, J., Steckel, R. H., Larsen, C. S., & Roberts, C. A. (2019). Multi- dimensional patterns of European health, work, and violence over the past two millennia. In R. H. Steckel, C. S. Larsen, C. A. Roberts, & J. Baten (Eds.), *The backbone of Europe: Health, diet, work and violence over two millennia* (pp. 381–396). Cambridge University Press.

Beaumont, J., Geber, J., Powers, N., Wilson, A., Lee-Thorp, J., & Montgomery, J. (2013). Victims and survivors: Stable isotopes used to identify migrants from the great Irish famine to 19th century London. *American Journal of Physical Anthropology*, *150*(1), 87–98. https://doi. org/10.1002/ajpa.22179

Beaumont, J., & Montgomery, J. (2016). The great Irish famine: Identifying starvation in the tissues of victims using stable isotope analysis of bone and incremental dentine collagen. *PLoS One*, *11*(8), e0160065. https://doi.org/10.1371/journal.pone.0160065

Beaumont, J., Montgomery, J., Buckberry, J., & Jay, M. (2015). Infant mor- tality and isotopic complexity: New approaches to stress, maternal health, and weaning. *American Journal of Physical Anthropology*, *157*(3), 441–557. https://doi.org/10.1002/ajpa.22736

Beekman, C. S. (2015). Causes and consequences of migration in Epiclassic northern Mesoamerica. In B. J. Baker & T. Tsuda (Eds.), *Migrations and disruptions: Toward a unifying theory of ancient and contemporary migra- tions* (pp. 73–96). University Press of Florida.

Begg, P. R. (1954). Stone age man's dentition: With reference to anatomi- cally correct occlusion, the etiology of malocclusion, and a technique for its treatment. *American Journal of Orthodontics*, *40*(4, 5, 6, 7), 298–312, 373–382, 462–475, 517–531.

Beisaw, A. M. (2010). Memory, identity, and NAGPRA in the northeastern United States. *American Anthropologist*, *112*(2), 244–256. https://doi. org/10.1111/j.1548-1433.2010.01223.x

Bentley, R. A., Cox, K., Tayles, N., Higham, C., Macpherson, C., Nowell, G., Cooper, M., & Hayes, T. E. (2009). Community diversity at ban Lum Khao, Thailand: Isotopic evidence from the skeletons. *Asian Perspec- tive*, *48*(1), 79–97. https://doi.org/10.1353/asi.0.0017

Berger, E., & Wang, H. (2017). Bioarchaeology of adaptation to a marginal environment in bronze age Western China. *American Journal of Human Biology*, *29*(4), e22956. https://doi.org/10.1002/ajhb.22956

Berger, T. D., & Trinkaus, E. (1995). Patterns of trauma among the Nean- dertals. *Journal of Archaeological Science*, *22*(6), 841–852. https://doi. org/10.1016/0305-4403(95)90013-6

Bergmann, C. (1847). Uber die Verhaltniesse der Wärmeökonomie der Thiere zu ihrer Grösse. *Göttingen Studien*, *1*, 595–708.

Berry, A., & Berry, R. (1967). Epigenetic variation in the human cranium. *Journal of Anatomy*, *101*(2), 361–379.

Berryman, H. E., Berryman, J. F., Saul, T. B., Boyd, C. C., & Boyd, D. C. (2018). Bone trauma analysis in a forensic setting: Theoretical basis and a practical approach for evaluation. In C. C. Boyd & D. C. Boyd (Eds.), *Forensic anthropology: Theoretical framework and scientific basis* (pp. 213–234). John Wiley & Co.

Betsinger, T. K., & DeWitte, S. (2017). Trends in mortality and biological stress in a medieval polish urban population. *International Journal of Paleopathology*, *19*, 24–36. https://doi.org/10.1016/j.ijpp.2017.08.008

Bhattacharya, K. (2015). The vulnerable academic: Personal narratives and strategic De/colonizing of academic structures. *Qualitative Inquiry*, *22*(5), 309–321. https://doi.org/10.1177/1077800415615619

Bigham, A. W. (2016). Genetics of human origin and evolution: High- altitude adaptations. *Current Opinion in Genetics & Development*, *41*, 8–13. https://doi.org/10.1016/j.gde.2016.06.018

Binford, L. R., Ho, C. K., Aigner, J. S., Alimen, M.-H., Borrero, L. A., Te-K'un, C., Chung, T., Goldberg, P., Ikawa-Smith, F., Lanata, J. L., Zune, L., Luchterhand, K., Lyman, R. L., Goñalons, G. M., Pei, G., Straus, L. G., Yacobaccio, H. D., & Yi, S. (1985). Taphonomy at a distance: Zhoukoudian, "the cave home of beijing man"? [and Comments and Reply]. *Current Anthropology*, *26*(4), 413–442.

Binford, L. R., Stone, N. M., Aigner, J. S., Behrensmeyer, A. K., Haynes, G., Olsen, J. W., Todd, L. C., & Yu-Zhu, Y. (1986). Zhoukoudian: A closer look [and comments and reply]. *Current Anthropology*, *27*(5), 453–475.

Blakely, R. L., & Harrington, J. M. (Eds.). (1997). *Bones in the basement: Postmortem racism in nineteenth-century medical training*. Smithsonian Institution Press.

Blakey, M. L. (2001). Bioarchaeology of the African diaspora in the Ame- ricas: Its origins and scope. *Annual Review of Anthropology*, *30*, 387– 422. https://doi.org/10.1146/annurev.anthro.30.1.387

Blakey, M. L. (2010). African burial ground project: Paradigm for coopera- tion? *Museum International*, *62*(1-2), 61–68. https://doi.org/10.1111/j. 1468-0033.2010.01716.x

Blakey, M. L. (2021). Understanding racism in physical (biological) anthro- pology. *American Journal of Physical Anthropology*, *175*(2), 316–325. https://doi.org/10.1002/ajpa.24208

Blakey, M. L., & Rankin-Hill, L. M. (Eds.) (2009). The New York African burial ground: Unearthing the African presence in colonial New York. In *Skeletal biology of the New York African burial ground* (Vol. 1). How- ard University in association with the General Services Administration.

Blau, F. D., Koebe, J., & Meyerhofer, P. A. (2021). Who are the essential and frontline workers? *Business Economics*, *56*, 168–178. https://doi. org/10.1057/s11369-021-00230-7

Blau, S. (2011). Reburying the past: The effects of repatriation and reburial on scientific inquiry. *Journal of Archaeological Science*, *38*(2), 482–483. https://doi.org/10.1016/j.jas.2010.09.025

Bleuze, M. M., Wheeler, S. M., Dupra, T. L., Williams, L., & Molto, E. (2014). An exploration of adult body shape and limb proportions at Kellis 2, Dakhleh oasis, Egypt. *American Journal of Physical Anthropol- ogy*, *153*(3), 496–505. https://doi.org/10.1002/ajpa.22450

Bocquet-Appel, J.-P., & Masset, C. (1982). Farewell to paleodemography. *Journal of Human Evolution*, *11*(4), 321–333. https://doi.org/10.1016/ S0047-2484(82)80023-7

Boldsen, J. L. (2005). Leprosy and mortality in the medieval Danish village of Tirup. *American Journal of Physical Anthropology*, *126*(2), 159–168. https://doi.org/10.1002/ajpa.20085

Boldsen, J. L. (2007). Early childhood stress and adult age mortality: A study of dental enamel hypoplasia in the medieval Danish village of Tirup. *American Journal of Physical Anthropology*, *132*(1), 59–66. https://doi.org/10.1002/ajpa.20467

Boldsen, J. L., Milner, G. R., & Weise, S. (2015). Cranial vault trauma and selective mortality in medieval to early modern Denmark. *Proceedings of the National Academy of Sciences*, *112*(6), 1721–1726. https://doi. org/10.1073/pnas.1412511112

Bolger, D., & Wright, R. P. (2012). Gender in southwest Asian prehistory. In D. Bolger (Ed.), *A companion to gender prehistory* (pp. 372–394). John Wiley & Sons. https://doi.org/10.1002/9781118294291.ch18

Bolnick, D. A. (2008). Individual ancestry inference and the reification of race as a biological phenomenon. In B. A. Koenig, S. S.-J. Lee, & S. S. Richardson (Eds.), *Revisiting race in a genomic age* (pp. 70–85). Rutgers University Press.

Bolnick, D. A., Raff, J. A., Springs, L. C., Reynolds, A. W., & Miro,-
Herrans, A. T. (2016). Native American genomics and population histo- ries. *Annual Review of Anthropology*, *45*(1), 3129–3340. https://doi. org/10.1146/annurev-anthro-102215-100036

Bolnick, D. A., Smith, R. W. A., & Fuentes, A. (2019). Vital topics forum: How academic diversity is transforming scientific knowledge in biolog- ical anthropology. *American Anthropologist*, *121*(2), 464–496. https:// doi.org/10.1111/aman.13212

Bos, K., Schuenemann, V. J., Golding, G. B., Burbano, H. A., Waglechner, N., Coombes, B. K., McPhee, J. B., DeWitte, S. N., Meyer, M., Schmedes, S., Wood, J., Earn, D. J. D., Herring, D. A., Bauer, P., Poinar, H. N., & Krause, J. (2011). A draft genome of *Yersinia pestis* from victims of the black death. *Nature*, *478*, 506–510. https:// doi.org/10.1038/nature10549

Bos, K. I., Harkins, K. M., Herbig, A., Coscolla, M., Weber, N., Comas, I., Forrest, S. A., Bryant, J. M., Harris, S. R., Schuenemann, V. J., Campbell, T. J., Majander, K., Wilbur, A. K., Guichon, R. A., Wolfe Steadman, D. L., Cook, D. C., Niemann, S., Behr, M. A., Zumarraga, M.,

… Krause, J. (2014). Pre-Columbian mycobacterial genomes reveal seals as a source of New World human tuberculosis. *Nature*, *514*, 494–497. https://doi.org/10.1038/nature13591

Bos, K. I., Herbig, A., Sahl, J., Waglechner, N., Fourment, M., Forrest, S. A., Klunk, J., Schuenemann, V. J., Poinar, D., Kuch, M., Golding, G. B., Dutour, O., Keim, P., Wagner, D. M., Holmes, E. C., Krause, J., & Poinar, H. N. (2016). Eighteenth century *Yersinia pestis* genomes reveal the long-term persistence of an historical plague focus. *eLife*, *5*, e12994. https://doi.org/10.7554/eLife.12994

Boutin, A. T. (2019). Writing bioarchaeological stories to right past wrongs. In J. E. Buikstra (Ed.), *Bioarchaeologists speak out: Deep time perspec- tives on contemporary issues* (pp. 283–303). Springer. https://doi.org/ 10.1007/978-3-319-93012-1_13

Boutin, A. T., & Callahan, M. P. (2019). Increasing empathy and reducing preju- dice: An argument for fictive osteobiographical narrative. *Bioarchaeology International*, *3*(1), 78–87. https://doi.org/10.5744/bi.2019.1001

Boutin, A. T., Long, M., Dinarte, R. A., & Thompson, E. R. (2017). Building a better bioarchaeology through community collaboration. *Bio- archaeology International*, *1*(3–4), 191–204. https://doi.org/10.5744/ bi.2017.1011

Boutin, A. T., & Porter, B. W. (2019). The Elders of early Dilmun: A bio- archaeological analysis of age and masculinity from the Peter
B. Cornwall collection. In K. D. Williams & L. A. Gregoricka (Eds.), *Mor- tuary and bioarchaeological perspectives on bronze age Arabia* (pp. 220– 239). University Press of Florida.

Boyd, K., Saccomanno, S., Lewis, C., Paskay, L. C., Quinzi, V., & Marzo, G. (2021). Culture, industrialisation and the shrinking human face: Why is it important? *European Journal of Paediatric Dentistry*, *22*(1), 80–82. https://doi.org/10.23804/ejpd.2021.22.01.15

Boyer, D. M., Jahnke, L. M., Mulligan, C. J., & Turner, T. (2020). Response to letters to the editor concerning AJPA commentary on "data sharing in biological anthropology: Guiding principles and best practices.". *American Journal of Physical Anthropology*, *172*(3), 344–346. https:// doi.org/10.1002/ajpa.24065

Bravo-Lopez, M., Villa-Islas, V., Rocha Arriaga, C., Villaseñor- Altamirano, A. B., Guzmán-Solís, A., Sandoval-Velasco, M., Wesp, J. K., Alcantara, K., Lo,pez-Corral, A., Go,mez-Valdés, J., Mejía, E., Herrera, A.,
Meraz-Moreno, A., de la Luz Moreno-Cabrera, M., Moreno-Estrada, A., Nieves-Colo,n, M. A., Olvera, J., Pérez-Pérez, J., Iversen, K. H., … Avila-Arcos, M. C. (2020). Paleogenomic insights into the red complex bacte- ria *Tannerella forsythia* in pre-Hispanic and colonial individuals from Mexico. *Philosophical Transactions of the Royal Society B, Biological Sci- ences*, *375*(1812), 20190580. https://doi.org/10.1098/rstb.2019.0580 Brickley, M. B., Kahlon, B., & D'Ortenzio, L. (2020). Using teeth as tools: Investigating the mother–infant dyad and developmental origins of health and disease hypothesis using vitamin D deficiency. *American Journal of Physical Anthropology*, *171*(2), 342–353. https://doi.org/10.
1002/ajpa.23947

Bridges, P. S., Blitz, J. H., & Solano, M. C. (2000). Changes in long bone diaphyseal strength with horticultural intensification in West-Central Illinois. *American Journal of Physical Anthropology*, *112*(2), 217–238. https://doi.org/10.1002/(SICI)1096-8644(2000)112:2%3C217::AID- AJPA8%3E3.0.CO;2-E

Bright, L. N. (2020). Structural violence: Epistemological considerations for bioarchaeology. In C. M. Cheverko, J. R. Prince-Buitenhuys, & M. Hubbe (Eds.), *Theoretical approaches in bioarchaeology* (pp. 131–149). Routledge.

Brodkin, K., Morgen, S., & Hutchinson, J. (2011). Anthropology as White public space? *American Anthropologist*, *113*(4), 545–556. https://doi. org/10.1111/j.1548-1433.2011.01368.x

Brooke, J. L. (2014). *Climate change and the course of global history: A rough journey*. Cambridge University Press.Brown, M. E., & Funk, C. C. (2008). Food security under climate change. *Science*, *319*(5863), 580–581. https://doi.org/10.1126/science.

1154102

Bruning, S. B. (2006). Complex legal legacies: The native American graves protection and repatriation act, scientific study, and Kennewick man. *American Antiquity*, *71*(3), 501–521. https://doi.org/10.1017/S0002731600039780

Brüssow, H., & Brüssow, L. (2021). Clinical evidence that the pandemic from 1889 to 1891 commonly called the Russian flu might have been

an earlier coronavirus pandemic. *Microbial Biotechnology*. 1860–1870. https://doi.org/10.1111/1751-7915.13889

Brutsaert, T. D., Kiyamu, M., Revollendo, G. E., Isherwood, J. L., Lee, F. S., Rivera-Ch, M., Leon-Velarde, F., Ghosh, S., & Bigham, A. W. (2019). Association of *EGLN1* gene with high aerobic capacity of Peruvian Quechua at high altitude. *Proceedings of the National Academy of Sci- ences of the United States of America*, *116*(48), 24006–24011. https:// doi.org/10.1073/pnas.1906171116

Buck, L. T., Stock, J. T., & Foley, R. A. (2010). Levels of intraspecific varia- tion within the catarrhine skeleton. *International Journal of Primatology*, *31*, 779–795. https://doi.org/10.1007/s10764-010-9428-0

Buckley, H. R., Tayles, N., Halcrow, S. E., Robb, K., & Fyfe, R. (2010). The people of Wairau Bar: A re-examination. *Journal of Pacific Archaeology*, *1*(1), 1–20.

Buikstra, J. E. (1972). Hopewell in the lower Illinois River valley: A regional approach to the study of biological variability and mortuary activity. [Doctoral Dissertation], The University of Chicago.

Buikstra, J. E. (1988). *The mound-builders of eastern North America: A regional perspective*. The University of Amsterdam.

Buikstra, J. E. (1991). Out of the appendix and into the dirt: Comments on thirteen years of bioarchaeological research. In M. L. Powell, P. S. Brid- ges, & A. M. W. Mires (Eds.), *What mean these bones? Studies in south-eastern Bioarchaeology* (pp. 172–188). The University of Alabama Press.

Buikstra, J. E. (2006). Repatriation: Challenges and opportunities. In J. E. Buikstra & L. A. Beck (Eds.), *Bioarchaeology: The contextual study of human remains* (pp. 401–433). Routledge.

Buikstra, J. E. (Ed.). (2019a). *Bioarchaeologists speak out: Deep time perspec- tives on contemporary issues*. Springer.

Buikstra, J. E. (2019b). Knowing your audience: Reactions to the human body, dead and undead. In J. E. Buikstra (Ed.), *Bioarchaeologists speak out: Deep time perspectives on contemporary issues* (pp. 19–57). Springer.

Buikstra, J. E. (Ed.). (2019c). *Ortner's identification of pathological conditions in human skeletal remains*. Academic Press.

Buikstra, J. E. (2019d). Models, metaphors, and measures. In D. H. Tem- ple & C. M. Stojanowski (Eds.), *Bioarchaeological context: Adaptability, transformability, and resilience of hunter-gatherers in the past* (pp. 354–383). Cambridge University Press.

Buikstra, J. E., & Beck, L. A. (Eds.). (2006). *Bioarchaeology: The contextual analysis of human remains*. Left Coast Press.

Buikstra, J. E., Frankenberg, S. R., & Konigsberg, L. W. (1990). Skeletal bio- logical distance studies in American physical anthropology: Recent trends. *American Journal of Physical Anthropology*, *82*(1), 1–7. https:// doi.org/10.1002/ajpa.1330820102

Buikstra, J. E., Price, T. D., Wright, L.,. E., & Burton, J. H. (2004). Tombs from Copan's acropolis: A life history approach. In E. E. Bell, M. A. Can- uto, & R. J. Sharer (Eds.), *Understanding early classic Copan* (pp. 191– 212). University of Pennsylvania Museum of Archaeology and Anthropology.

Buikstra, J. E., & Roberts, C. A. (Eds.). (2012). *The global history of paleopa- thology: Pioneers and prospects*. Oxford University Press.

Buikstra, J. E., & Ubelaker, D. H. (1994). *Standards for data collection from human skeletal remains*. Arkansas Archaeological Survey.

Buonasera, T., Eerkens, J. W., de Flamingh, A., Engbring, L., Yip, J., Li, H., Haas, R., DiGiuseppe, D., Grant, D., Salemi, M., Nijmeh, C., Arellano, M., Leventhal, A., Phinney, B., Byrd, B. F., Malhi, R. S., & Parker, G. (2020). A comparison of proteomic, genomic, and osteologi- cal methods of archaeological sex estimation.

Scientific Reports, *10*, 11897. https://doi.org/10.1038/s41598-020-68550-w

Burke, A., Peros, M. C., Wren, C. D., Pausata, F. S. R., Riel-Salvatore, J., Moine, O., de Vernal, A., Kageyama, M., & Boisard, S. (2021). The archaeology of climate change: The case for cultural diversity. *Proceed- ings of the National Academy of Sciences*, *118*(30), e2108537118. https://doi.org/10.1073/pnas.2108537118

Burke, K. D., Williams, J. W., Chandler, M. A., Haywood, A. M., Lunt, D. J., & Otto-Bliesner, B. L. (2018). Pliocene and Eocene provide best analogs for near-future climates. *Proceedings of the National Acad- emy of Sciences*, *115*(52), 13288–13293.

Burton, J., & Katzenberg, M. A. (2019). Strontium isotopes and the chemis- try of bones and teeth. In M. A. Katzenberg & A. L. Grauer (Eds.), *Bio- logical anthropology of the human skeleton* (3rd ed., pp. 505–514). John Wiley & Sons.

Butzer, K. W. (2012). Collapse, environment, and society. *Proceedings of the National Academy of Sciences*, *109*(10), 3632–3639. https://doi. org/10.1073/pnas.1114845109

Buzon, M. R., & Simonetti, A. (2013). Strontium isotope ($^{87}Sr/^{86}Sr$) variabil- ity in the Nile Valley: Identifying residential mobility during ancient Egyptian and Nubian sociopolitical changes in the New Kingdom and Napatan periods. *American Journal of Physical Anthropology*, *151*(1), 1–9. https://doi.org/10.1002/ajpa.22235

Buzon, M. R., Simonetti, A., & Creaser, R. A. (2007). Migration in the Nile Valley during the New Kingdom period: A preliminary strontium iso- tope study. *Journal of Archaeological Science*, *34*(9), 1391–1401. https://doi.org/10.1016/j.jas.2006.10.029

Buzon, M. R., Smith, S. T., & Simonetti, A. (2016). Entanglement and the formation of the ancient Nubian Napatan state. *American Anthropolo- gist*, *118*, 284–300. https://doi.org/10.1111/aman.12524

Byers, S. N., & Roberts, C. A. (2003). Bayes' theorem in paleopathological diagnosis. *American Journal of Physical Anthropology*, *121*(1), 1–9. https://doi.org/10.1002/ajpa.10164

Byrnes, J. F. (2017). Injuries, impairment, and intersecting identities: The poor in Buffalo, NY 1851-1913. In J. F. Byrnes & J. L. Muller (Eds.), *Bioarchaeology of impairment and disability: Theoretical, ethnohistorical, and methodological perspectives* (pp. 201–222). Springer.

Cabana, G. S., & Clark, J. J. (Eds.). (2011). *Rethinking anthropological per- spectives on migration*. University Press of Florida.

Calloway, E. (2018). Divided by DNA: The uneasy relationship between archaeology and ancient genomics. *Nature*, *555*, 573–576. https://doi. org/10.1038/d41586-018-03773-6

Campanacho, V., Alves, C. F., & Ubelaker, D. H. (2021). Documented skele- tal collections and their importance in forensic anthropology in the United States. *Forensic Science*, *1*(3), 228–239. https://doi.org/10. 3390/forensicsci1030021

Campbell, B. M. S. (2016). *The great transition: Climate, disease and society in the Late-Medieval World*. Cambridge University Press.

Cannon, W. B. (1915). *Bodily changes in pain, hunger, fear, and rage: An account of recent researches into the function of emotional excitement*.
D. Appleton and Company.

Carleton, T., Hsiang, S. M., & Burke, M. (2016). Conflict in a changing cli- mate. *The European Physical Journal Special Topics*, *225*, 489–511. https://doi.org/10.1140/epjst/e2015-50100-5

Carlson, D. L. (2017). *Quantitative methods in archaeology using R*. Cam- bridge University Press.

Carmichael, A. G. (1986). *Plague and the poor in renaissance florence*. Cam- bridge University Press.

Cassman, V., Odegaard, N., & Powell, J. F. (Eds.). (2007). *Human remains: Guide for museums and academic institutions*. AltaMira Press.

Caussinus, H., & Courgeau, D. (2010). Estimating age without measuring it: A new method in paleodemography. *Population*, *65*(1), 117–144.

Cerezo-Roman, J. I., Wessman, A., & Williams, H. (Eds.). (2017). *Cremation and the archaeology of death*. Oxford University Press.

Chari, S., & Lavallee, J. M. N. (Eds.). (2013). *Accomplishing NAGPRA: Per- spectives on the intent, impact, and future of the native American graves protection and repatriation act*. Oregon State University Press.

Charnov, E. L. (1993). *Life history invariants: Some explorations of symmetry in evolution and ecology*. Oxford University Press.

Chen, J. (2011). Internal migration and health: Re-examining the healthy migrant phenomenon in China. *Social Science & Medicine*, *72*(8), 1294– 1301. https://doi.org/10.1016/j.socscimed.2011.02.016

Chen, J. T., & Krieger, N. (2021). Revealing the unequal burden of COVID- 19 by income, race/ethnicity, and household crowding: US County ver- sus zip code analyses. *Journal of Public Health Management and Practice*, *27*, S43–S56. https://doi.org/10.1097/PHH.0000000000001263

Chenal, F., Perrin, B., Barrad-Emam, H., & Boulestin, B. (2015). A farewell to arms: A deposit human limbs and bodies at bergheim, france, c. 4000 BC. *Antiquity*, *89*(348), 1313–1330. https://doi.org/10.15184/aqy.2015.180

Cheng, Q., Trangucci, R., Nelson, K. N., Fu, W., Collender, P. A., Head, J. R., Hoover, C. M., Skaff, N. K., Li, T., Li, X., You, Y., Fang, L., Liang, S., Yang, C., He, J., Zelner, J. L., & Remais, J. V. (2020). Prenatal and early- life exposure to the great Chinese famine increased the risk of tuber- culosis in adulthood across two generations. *Proceedings of the National Academy of Sciences*, *117*(44), 27549–27555. https://doi.org/ 10.1073/pnas.2008336117

Cheverko, C. M., Marklein, K. E., Clark, M. A., Mayus, R. C., McGuire, S. A., Turner-Byfield, E., Green, M. K., Weiss, N. M., Lagan, E. M., & Hubbe, M. (2020). Beyond the biocultural approach: A quantitative assessment of the use of theory in bioarchaeological literature from 2007 to 2018. *Bioarchaeology International*, *4*(1), 37–56. https://doi. org/10.5744/bi.2020.1002

Chinique de Armas, Y., Roksandic, M., Nikitovi,c, D., Rodríguez Suárez, R., Smith, D., Kanik, N., Jordá, D. G., & Buhay, W. M. (2017). Isotopic reconstruction of the weaning process in the archaeological popula- tion of Canímar Abajo, Cuba: A Bayesian probability mixing model approach. *PLoS One*, *12*(5), e0176065. https://doi.org/10.1371/ journal.pone.0176065

Chowdhury, F. R., Nur, Z., Hassan, N., von Seidlein, L., & Dunachie, S. (2017). Pandemics, pathogenicity and changing molecular epidemiol- ogy of cholera in the era of global warming. *Annals of Clinical Microbiol- ogy and Antimicrobials*, *16*(1), 10. https://doi.org/10.1186/s12941-017-0185-1

Chyun, Y. S., Kream, B. E., & Raisz, L. G. (1984). Cortisol decreases bone formation by inhibiting periosteal cell proliferation. *Endocrinology*, *114*(2), 477–480. https://doi.org/10.1210/endo-114-2-477

Clancy, K. B. H., Nelson, R. G., Rutherford, J. N., & Hinde, K. (2014). Survey of academic field experiences (SAFE): Trainees report harassment and assault. *PLoS One*, *9*(7), e102172. https://doi.org/10.1371/journal.pone.0102172

Clark, A. L. (2013). *Human sexual dimorphism and Health during the intensifi- cation of Agriculture in Prehistoric Thailand* [Thesis, Doctor of Philoso- phy, University of Otago]. http://hdl.handle.net/10523/3882

Clark, A. L., King, C. L., Buckley, H. R., Collins, C. J., Dhavale, N., Elliott, G. E., & West, K. (2017). Biological anthropology in the indo- Pacific region: New approaches to age-old questions. *Journal of Indo- Pacific Archaeology*, *41*, 78–94.

Clark, A. L., Tayles, N., & Halcrow, S. E. (2014). Aspects of health in prehis- toric mainland Southeast Asia: Indicators of stress in response to the intensification of rice agriculture. *American Journal of Physical Anthro- pology*, *153*(3), 484–495. https://doi.org/10.1002/ajpa.22449

Clark, G. (1972). *Star Carr: A case study in bioarchaeology*. Addison Wesley. Claw, K. G., Lippert, D., Bardhill, J., Cordova, A., Fox, K., Yracheta, J. M., Badar, A. C., Bolnick, D. A., Malhi, R. S., TallBear, K., & Garrison, N. A. (2017). Chaco canyon dig unearths ethical concerns. *Human Biology*, *89*(3), 177–180. https://doi.org/10.13110/humanbiology.89.3.01

Clayton, V. (2016). The problem with the GRE. The Atlantic. https://www.theatlantic.com/education/archive/2016/03/the-problem-with-the- gre/471633/

Cobb, W. M. (1936). *The laboratory of anatomy and physical anthropology at Howard University*. Howard

University.

Cohen, M. N. (1989). *Health and the rise of civilization*. Yale University Press.

Cohen, M. N., & Armelagos, G. J. (Eds.). (1984). *Paleopathology at the ori- gins of agriculture*. University Press of Florida.

Cohen, M. N., & Crane-Kramer, G. M. M. (Eds.). (2007). *Ancient health: Skel- etal indicators of agricultural and economic intensification*. University Press of Florida.

Cohn, S. K. (2012). Pandemics: Waves of disease, waves of hate from the plague of Athens to A.I.D.S. *Historical Research*, *85*(230), 535–555. https://doi.org/10.1111/j.1468-2281.2012.00603.x

Colaninno, C. E., Lambert, S. P., Beahm, E. L., & Drexler, C. G. (2020). Cre- ating and supporting a harassment- and assault-free field school. *Advances in Archaeological Practice*, *8*(2), 111–122. https://doi.org/10.1017/aap.2020.8

Collins, P. H. (2015). Intersectionality's definitional dilemmas. *Annual Review of Sociology*, *41*(1), 1–20. https://doi.org/10.1146/annurev- soc-073014-112142

Condori, C. M. (1989). History and prehistory in Bolivia: What about the Indians? In R. Layton (Ed.), *Conflict in the archaeology of living traditions* (pp. 46–59).London and New York: Routledge.

Conkey, M. W., & Spector, J. D. (1984). Archaeology and the study of gen- der. *Advances in Archaeological Method and Theory*, *7*, 1–38. https:// doi.org/10.1016/B978-0-12-003107-8.50006-2

Connolly-Boutin, L., & Smit, B. (2016). Climate change, food security, and livelihoods in sub-Saharan Africa. *Regional Environmental Change*, *16*(2), 385–399. https://doi.org/10.1007/s10113-015-0761-x

Conticini, E., Frediani, B., & Caro, D. (2020). Can atmospheric pollution be considered a co-factor in extremely high level of SARS-CoV-2 lethality in northern Italy? *Environmental Pollution*, *261*, 114465. https://doi.org/10.1016/j.envpol.2020.114465

Cook, D. C. (1979). Subsistence base and health in the prehistoric Illinois Valley: Evidence from the human skeleton. *Medical Anthropology*, *3*(1), 109–124. https://doi.org/10.1080/01459740.1979.9965835

Coqueugniot, H., Weaver, T. D., & Houët, F. (2010). Brief communication: A probabilistic approach to age estimation from infracranial sequences of maturation. *American Journal of Physical Anthropology*, *142*(4), 655– 664. https://doi.org/10.1002/ajpa.21312

Corruccini, R. S. (1984). An epidemiologic transition in dental occlusion in world populations. *American Journal of Orthodontics*, *86*(5), 419–426. https://doi.org/10.1016/S0002-9416(84)90035-6

Corruccini, R. S. (1990). Australian aboriginal tooth succession, interproxi- mal attrition, and Begg's theory. *American Journal of Orthodontics & Dentofacial Orthopaedics*, *97*(4), 349–357. https://doi.org/10.1016/ 0889-5406(90)70107-N

Corruccini, R. S. (1999). *How anthropology informs the orthodontic diagnosis of malocclusions causes*. Edwin Mellen Press.

Cramer, C. (2002). *Homo Economicus* goes to war: Methodological individual- ism, rational choice and the political economy of war. *World Development*, *30*(11), 1845–1864. https://doi.org/10.1016/S0305-750X(02)00120-1

Crandall, J. J., & Martin, D. L. (2014). The bioarchaeology of postmortem agency: Integrating archaeological theory with human skeletal remains. *Cambridge Archaeological Journal*, *24*(3), 429–435. https://doi.org/10.1017/S0959774314000584

Crenshaw, K. (1989). Demarginalizing the intersection of race and sex: A black feminist critique of antidiscrimination doctrine, feminist theory and antiracist policies. *University of Chicago Legal Forum*, *1989*(8), 139–167.

Crespi, E. J., & Denver, R. J. (2005). Ancient origins of human developmen- tal plasticity. *American Journal of Human Biology*, *17*(1), 44–54. https:// doi.org/10.1002/ajhb.20098

Crespi, E. J., Williams, T. D., Jessop, T. S., & Delehanty, B. (2013). Life history and the ecology of stress: How do glucocorticoid hormones influence life history variation in animals? *Functional Ecology*, *27*(1), 93–106. https://doi.org/10.1111/1365-2435.12009

Crespo, F. (2020). Reconstructing immune competence in skeletal samples: A theoretical and methodological approach. In *Theoretical approaches in bioarchaeology* (pp. 76–92). Routledge.

Crespo, F. A., Klaes, C. K., Switala, A. E., & DeWitte, S. N. (2017). Do lep- rosy and tuberculosis generate a systemic inflammatory shift? Settingthe ground for a new dialogue between experimental immunology and bioarchaeology. *American Journal of Physical Anthropology*, *162*(1), 143–156.

Crist, T. A., Mooney, D. B., & Morrell, K. A. (2017). "The mangled remains of what had been humanity": Evidence of autopsy and dissection at Philadelphia's Blockley almshouse, 1835-1895. In K. C. Nystrom (Ed.), *The bioarchaeology of dissection and autopsy in the United States* (pp. 259–278). Springer.

Cummins, N., Kelly, M., & Gráda, C. Ó. (2016). Living standards and plague in London, 1560-1665. *The Economic History Review*, *69*(1), 3–34. https://doi.org/10.1111/ehr.12098

Cybulski, J. S. (2001). Human biological relationships for the northern northwest coast. In J. S. Cybulski (Ed.), *Perspectives on northern north- west coast prehistory* (pp. 107–144). Canadian Museum of Civilization, Archaeological Survey of Canada.

Cybulski, J. S., Ossenberg, N. S., & Wade, W. D. (1979). Committee report: Statement on the excavation, treatment, analysis and disposition of human skeletal remains from archaeological sites in Canada. *Canadian Review of Physical Anthropology*, *1*(1), 32–36.

Davies, J. B. (2021). *Economic inequality and COVID-19 death rates in the first wave, a cross-country analysis* (CESifo working paper No. 8957). Social Science Research Network. https://papers.ssrn.com/abstract= 3812074

de la Cova, C. (2010). Cultural patterns of trauma among 19th-century- born males in cadaver collections. *American Anthropologist*, *112*(4), 589–606. https://doi.org/10.1111/j.1548-1433.2010.01278.x

de la Cova, C. (2011). Race, health, and disease in 19th century born males. *American Journal of Physical Anthropology*, *144*(4), 526–537. https:// doi.org/10.1002/ajpa.21434

de la Cova, C. (2012). Patterns of trauma and violence in 19th-century- born African American and euro-American females. *International Jour- nal of Paleopathology*, *2*(2-3), 61–68. https://doi.org/10.1016/j.ijpp. 2012.09.009

de la Cova, C. (2014). The biological effects of urbanization and in- migration on 19th century- born African Americans and euro- Americans of low socioeconomic status: An anthropological and historical approach. In M. K. Zuckermann (Ed.), *Modern environments and human health? Revisiting the second epidemiological transition* (pp. 243–264). Wiley Blackwell. https://doi.org/10.1002/ 9781118504338.ch13

de la Cova, C. (2019). Marginalized bodies and the construction of the Robert J. Terry anatomical skeletal collection: A promised land lost. In M. Mant & A. Holland (Eds.), *Bioarchaeology of marginalized people* (pp. 133–155). Academic Press.

de la Cova, C. (2020a). Making silenced voices speak: Restoring neglected and ignored identities in anatomical collections. In C. M. Cheverko, J. R. Prince-Buitenhuys, & M. Hubbe (Eds.), *Theoretical perspectives in bioarchaeology* (pp. 150–169). Routledge.

de la Cova, C. (2020b). Processing the destitute and deviant dead: Inequal- ity, dissection, politics, and the structurally violent legalization of social marginalization in American anatomical collections. In A. J. Osterholtz (Ed.), *The poetics of processing: Memory formation, identity, and the han- dling of the dead* (pp. 212–234). University Press of Colorado.

de Soysa, I., Gleditsch, N. P., Gibson, M., & Sollenberg, M. (1999). To culti- vate peace: Agriculture in a world of conflict. *Environmental Change & Security Project Report (Summer 1999)*, *5*, 15–25.

Devault, A. M., McLoughlin, K., Jaing, C., Gardner, S., Porter, T. M., Enk, J. M., Thissen, J., Allen, J., Borucki, M., DeWitte, S. N., Dhody, A. N., & Poinar, H. N. (2014). Ancient pathogen DNA in archaeological samples detected with a microbial detection array. *Sci- entific Reports*, *4*, 4245. https://doi.org/10.1038/srep04245

DeWitte, S., & Wissler, A. (2022). Demographic and evolutionary conse- quences of pandemic diseases. *Bioarchaeology International*. https:// doi.org/10.5744/bi.2020.0024

DeWitte, S. N. (2012). Sex differences in periodontal disease in cata- strophic and attritional assemblages from medieval London. *American Journal of Physical Anthropology*, *149*(3), 405–416. https://doi.org/10. 1002/ajpa.22138

DeWitte, S. N. (2014a). Differential survival among individuals with active and healed periosteal new bone formation. *International Journal of Paleopathology*, *7*, 38–44. https://doi.org/10.1016/j.ijpp.2014.06.001

DeWitte, S. N. (2015a). Bioarchaeology and the ethics of research using human skeletal remains. *History Compass*, *13*(1), 10–19. https://doi. org/10.1111/hic3.12213

DeWitte, S. N. (2015b). Setting the stage for medieval plague: Pre-black death trends in survival and mortality. *American Journal of Physical Anthropology*, *158*(3), 441–451. https://doi.org/10.1002/ajpa.22806

DeWitte, S. N. (2018). Stress, sex, and plague: Patterns of developmental stress and survival in pre- and post-black death London. *American Journal of Human Biology*, *30*(1), e23073. https://doi.org/10.1002/ajhb.23073

DeWitte, S. N. (2021). Urban environments: Demography, epidemiology, and the role of climate change in determining health outcomes. In G. Robbins Schug (Ed.), *The Routledge handbook of the bioarchaeology of environmental change* (pp. 189–204). Routledge.

DeWitte, S. N., & Hughes-Morey, G. (2012). Stature and frailty during the black death: The effect of stature on risks of epidemic mortality in London, A.D. 1348-1350. *Journal of Archaeological Science*, *39*(5), 1412–1419. https://doi.org/10.1016/j.jas.2012.01.019

DeWitte, S. N., & Kowaleski, M. (2017). Black death bodies. *Fragments: Interdisciplinary approaches to the study of ancient and medieval pasts*, 6, 1–37. http://hdl.handle.net/2027/spo.9772151.0006.001

DeWitte, S. N., & Lewis, M. (2021). Medieval menarche: Changes in puber- tal timing before and after the black death. *American Journal of Human Biology*, *33*(2), e23439. https://doi.org/10.1002/ajhb.23439

DeWitte, S. N., & Slavin, P. (2013). Between famine and death: England on the eve of the black death - evidence from Paleoepidemiology and manorial accounts. *Journal of Interdisciplinary History*, *44*(1), 37–60. https://doi.org/10.1162/JINH_a_00500

DeWitte, S. N., & Stojanowski, C. M. (2015). The osteological paradox 20 years later: Past perspectives, future directions. *Journal of Archaeo- logical Research*, *23*, 397–450. https://doi.org/10.1007/s10814-015-9084-1

DeWitte, S. N., & Wood, J. W. (2008). Selectivity of black death mortality with respect to preexisting health. *Proceedings of the National Academy of Sciences of the United States of America*, *105*(5), 1436–1441. https://doi.org/10.1073/pnas.0705460105

DeWitte, S. N., & Yaussey, S. L. (2020). Bioarchaeological applications of intersectionality. In C. M. Cheverko,

J. R. Prince-Buitenhuys, & M. Hubbe (Eds.), *Theoretical approaches in bioarchaeology* (pp. 45–58). Routledge.

DiGangi, E. A., Bethard, J. D., Kimmerle, E. H., & Konigsberg, L. W. (2009). A new method for estimating age-at-death from the first rib. *American Journal of Physical Anthropology*, *138*(2), 164–176. https://doi.org/10.1002/ajpa.20916

Dittmar, J. M., & Mitchell, P. D. (2015). A new method for identifying and differentiating human dissection and autopsy in archaeological human skeletal remains. *Journal of Archaeological Science: Reports*, *3*, 73–79. https://doi.org/10.1016/j.jasrep.2015.05.019

Domett, K., O'Reilly, D. J. W., & Buckley, H. R. (2011). Bioarchaeological evidence for conflict in iron age north-West Cambodia. *Antiquity*, *85*(328), 441–458. https://doi.org/10.1017/S0003598X00067867

Dong, Y., Morgan, C., Chinenov, Y., Zhou, L., Fan, W., Ma, X., & Pechenkina, K. (2017). Shifting diets and the rise of male-biased inequality on the Central Plains of China during eastern Zhoun. *Pro- ceedings of the National Academy of Sciences*, *114*(5), 932–937. https:// doi.org/10.1073/pnas.1611742114

Dorling, D. (2015). *Injustice: Why social inequality still persists* (Revised ed.). Policy Press.

Du Bois, W. E. B. (1914). Our baby pictures. *The Crisis*, *8*, 298–303. Duchêne, S., Ho, S. Y. W., Carmichael, A. G., Holmes, E. C., & Poinar, H.
(2020). The recovery, interpretation and use of ancient pathogen genomes. *Current Biology*, *30*(19), R1215–R1231. https://doi.org/10. 1016/j.cub.2020.08.081

Dunnavant, J., Justinvil, D., & Colwell, C. (2021). Craft an African American graves protections and repatriation act. *Nature*, *593*, 337–340.

Dyer, C. (2005). *An age of transition? Economy and Society in England in the later middle ages*. Oxford University Press.

Edes, A. N., & Crews, D. E. (2017). Allostatic load and biological anthropol- ogy. *Yearbook of Physical Anthropology*, *162*(S63), 44–70. https://doi. org/10.1002/ajpa.23146

Ehrlich, P. R., & Ehrlich, A. H. (2013). Can a collapse of global civilization be avoided? *Proceedings of the Royal Society B.*, *280*, 20122845. https://doi.org/10.1098/rspb.2012.2845

Elliott, C. P. (2016). The Antonine plague, climate change and local vio- lence in Roman Egypt. *Past & Present*, *231*(1), 3–31. https://doi.org/ 10.1093/pastj/gtv058

Evans, C. R. (2019). Modeling the intersectionality of processes in the social production of health inequalities. *Social Science and Medicine*, *226*, 249–253. https://doi.org/10.1016/j.socscimed.2019.01.017

Evans, T. M., Bira, L., Gastelum, J. B., Weiss, L. T., & Vanderford, N. L. (2018). Evidence for a mental health crisis in graduate education. *Nature Biotechnology*, *36*, 282–284. https://doi.org/10.1038/nbt.4089

Farmer, P. (2004). An anthropology of structural violence. *Current Anthropology*, *45*(3), 305–325.

Farmer, P. E., Nizeye, B., Stulac, S., & Keshvahjee, S. (2006). Structural vio- lence and clinical medicine. *PLoS Medicine*, *3*(10), e449. https://doi. org/10.1371/journal.pmed.0030449

Finnegan, M. (1972). *Population definition in the northwest coast by analysis of discrete character variation* [Unpublished doctoral dissertation Boul- der: University of Colorado].

Fish, P. R., Fish, S. K., DeBlasis, P., & Gaspar, M. D. (2013). Monumental shell mounds as persistent places in southeastern coastal Brazil. In
V. D. Thompson & J. Waggoner, Jr. (Eds.), *The archaeology and histori- cal ecology of small scale societies* (pp. 120–140). University Press of Florida.

Fix, A. G. (1978). The role of kin-structured migration in genetic micro- differentiation. *Annals of Human Genetics*, *41*(3), 329–339. https://doi. org/10.1111/j.1469-1809.1978.tb01900.x

Fix, A. G. (1979). Anthropological genetics of small populations. *Annual Review of Anthropology*, *8*, 207–239. https://doi.org/10.1146/ annurev.an.08.100179.001231

Fix, A. G. (1999). *Migration and colonization in human microevolution*. Cam- bridge University Press.

Fix, A. G. (2011). Migration in anthropological genetics. In G. S. Cabana & J. J. Clark (Eds.), *Rethinking anthropological perspectives on migrations* (pp. 248–262). University Press of Florida.

Fleskes, R. E., Ofunniyin, A. A., Gilmore, J. K., Poplin, E., Abel, S. M., Bueschgen, W. D., Juarez, C., Butler, N., Mishoe, G., Oubré, L., Cabana, G. S., & Schurr, T. G. (2021). Ancestry, health, and lived expe- riences of enslaved Africans in 18th century Charleston: An osteobiographical analysis. *American Journal of Physical Anthropology*, *175*(1), 3–24. https://doi.org/10.1002/ajpa.24149

Foo, Y. Z., Simmons, L. W., & Rhodes, G. (2017). Predictors of facial attrac- tiveness and health in humans. *Scientific Reports*, *7*, 39731. https://doi. org/10.1038/srep39731

Foucault, M. (1976 [2004]). In M. Bertani & A. Fontana (Eds.), D. Macey, transl. *Society must be defended.*

lectures at the Collège de France, 1975–76. Picador.

Frankenberg, S. R., & Konigsberg, L. (2011). Migration muddles in prehis- tory: The distinction between model-bound and model-free methods. In G. S. Cabana & J. J. Clark (Eds.), *Rethinking anthropological perspec- tives on migrations* (pp. 278–292). University Press of Florida.

Frisancho, A. R. (2013). Developmental functional adaptation to high alti- tude: Review. *American Journal of Human Biology*, *25*(2), 151–168. https://doi.org/10.1002/ajhb.22367

Fuentes, A. (2021). Biological anthropology's critical engagement with genomics, evolution, race/racism, and ourselves: Opportunities and challenges to making a difference in the academy and the world. *Amer- ican Journal of Physical Anthropology*, *175*(2), 326–338.

Furholt, M. (2018). Massive migrations? The impact of recent aDNA stud- ies on our view of third millennium Europe. *European Journal of Archaeology*, *21*(2), 159–191. https://doi.org/10.1017/eaa.2017.43

Furholt, M. (2019a). Re-integrating archaeology: A contribution to aDNA studies and the migration discourse on the 3rd millennium BC in Europe. *Proceedings of the Prehistoric Society*, *85*, 115–129. https://doi.org/10.1017/ppr.2019.4

Furholt, M. (2019b). De-contaminating the aDNA-archaeology dialogue on mobility and migration: Discussing the culture-historical legacy. *Cur- rent Swedish Archaeology*, *27*(1), 53–68. https://doi.org/10.37718/ CSA.2019.03

Futuyma, D. J. (1998). *Evolutionary biology*. Sinauer Associates Inc.

Gage, T. B. (1989). Bio-mathematical approaches to the study of human variation in mortality. *American Journal of Physical Anthropology*, *32*(S10), 185–214. https://doi.org/10.1002/ajpa.1330320509

Gage, T. B., & DeWitte, S. (2009). What do we know about the agricultural demographic transition? *Current Anthropology*, *50*(5), 649–655. https://doi.org/10.1086/605017

Galanaud, P., Galanaud, A., Giraudoux, P., & Labesse, H. (2020). Mortality and demographic recovery in early post-black death epidemics: Role of recent emigrants in medieval Dijon. *PLoS One*, *15*(1), e0226420. https://doi.org/10.1371/journal.pone.0226420

Galtung, J. (1969). Violence, peace, and peace research. *Journal of Peace Research*, *6*(3), 167–191. https://doi.org/10.1177/002234336900600301

Gamble, J. A., Boldsen, J. L., & Hoppa, R. D. (2017). Stressing out in medieval Denmark: An investigation of dental enamel defects and age at death in two medieval Danish cemeteries. *International Journal of Paleopathology*, *17*, 52–66. https://doi.org/10.1016/j.ijpp.2017.01.001

Gamble, L. H. (2017). Feasting, ritual practices, social memory, and persis- tent places: New interpretations of shell mounds in Southern Califor- nia. *American Antiquity*, *82*(3), 427–451. https://doi.org/10.1017/aaq.2017.5

Garland, C. J. (2020). Implications of accumulative stress burdens during critical periods of early postnatal life for mortality risk among Guale interred in a colonial era cemetery in Spanish Florida (ca. AD 1605-1680). *American Journal of Physical Anthropology*, *172*(4), 621–637. https://doi.org/10.1002/ajpa.24020

Garofalo, E. M., & Garvin, H. M. (2020). The confusion between biological sex and gender and potential implications of misinterpretations. In A. Klales (Ed.), *Sex estimation of the human skeleton* (pp. 35–52). Academic Press.

Garvin, H. M., Marciniec, D. K., Mohamed, M. M., Ternent, E., Cirillo, L. E., & Stull, K. (2021). Sex estimation of the subadult ilium prior to acetabular fusion. *Journal of Forensic Sciences*, *66*(6), 2113– 2125. https://doi.org/10.1111/1556-4029.14832

Geber, J. (2016). 'Children in a ragged state': Seeking a biocultural narrative of a workhouse childhood in Ireland during the great famine (1845–1852). *Childhood in the Past*, *9*(2), 120–138. https://doi.org/10.

1080/17585716.2016.1205344

Geller, P. L. (2017). *The bioarchaeology of socio-sexual lives: Queering com- mon sense about sex, gender, and sexuality*. Springer.

Geller, P. L. (2019). The fallacy of the transgender skeleton. In J. E. Buikstra (Ed.), *Bioarchaeologists speak out: Deep time perspectives on contempo- rary issues* (pp. 231–242). Springer.

Ghisleni, L., Jordan, A. M., & Fioccoprile, E. (2016). Introduction to "binary binds": Deconstructing sex and gender dichotomies in archaeological practice. *Journal of Archaeological Method and Theory*, *23*, 765–787. https://doi.org/10.1007/s10816-016-9296-9

Ghosh, S. K. (2015). Human cadaveric dissection: A historical account from ancient Greece to the modern era. *Anatomy & Cell Biology*, *48*(3), 153–
169. https://doi.org/10.5115/acb.2015.48.3.153

Gilchrist, R. (2004). Archaeology and the life course: A time and age for gender. In L. Meskell & R. W. Preucel (Eds.), *A companion to social archaeology* (pp. 142–160). Blackwell Publishing Ltd.

Gilgan, M. (2001). The rationality of resistance: Alternatives for engage- ment in complex emergencies. *Disasters*, *25*(1), 1–18. https://doi.org/ 10.1111/1467-7717.00158

Gilmore, C. C. (2013). A comparison of antemortem tooth loss in human hunter-gatherers and non-human catarrhines: Implications for the identification of behavioral evolution in the human fossil record. *Amer- ican Journal of Physical Anthropology*, *151*(2), 252–264. https://doi. org/10.1002/ajpa.22275

Gilmore, P., & Smith, D. M. (2005). Seizing academic power: Indigenous subaltern voices, metaliteracy, and counternarratives in higher educa- tion. In T. L. McCarty (Ed.), *Language, literacy, and power in schooling* (pp. 67–88). Lawrence Erlbaum Associates, Inc.

Godde, K., & Hens, S. M. (2012). Age-at-death estimation in an Italian his- torical sample: A test of the Suchey-Brooks and transition analysis methods. *American Journal of Physical Anthropology*, *149*(2), 259–265. https://doi.org/10.1002/ajpa.22126

Godde, K., & Hens, S. M. (2021). An epidemiological approach to the analy- sis of cribra orbitalia as an indicator of health status and mortality in medieval and post-medieval London under a model of parasitic infec- tion. *American Journal of Physical Anthropology*, *174*(4), 631–645. https://doi.org/10.1002/ajpa.24244

Godde, K., Pasillas, V., & Sanchez, A. (2020). Survival analysis of the black death: Social inequality of women and the perils of life and death in medieval London. *American Journal of Physical Anthropology*, *173*(1), 168–178. https://doi.org/10.1002/ajpa.24081

Gokhman, D., Malul, A., & Carmel, L. (2017). Inferring past environments from ancient Epigenomes. *Molecular Biology and Evolution*, *34*(10), 2429–2438. https://doi.org/10.1093/molbev/msx211

Gokhman, D., Nissim-Rafinia, M., Agranat-Tamir, L., Housman, G., García- Pérez, R., Lizano, E., Cheronet, O., Mallick, S., Nieves-Colo,n, M. A.,
Li, H., Alpaslan-Roodenberg, S., Novak, M., Gu, H., Osinski, J. M., Ferrando-Bernal, M., Gelabert, P., Lipende, I., Mjungu, D., Kondova, I., … Carmel, L. (2020). Differential DNA methylation of vocal and facial anatomy genes in modern humans. *Nature Communications*, *11*, 1189. https://doi.org/10.1038/s41467-020-15020-6

Goldstein, L., Hefner, J. T., Sewell, K. J., & Heilen, M. P. (2012). Cultural affinity, identity, and relatedness: Distinguishing individuals and cul- tural groups. In M. P. Heilen (Ed.), *Uncovering identity in mortuary analy- sis: Community-sensitive methods for identifying group affiliation in historical cemeteries* (pp. 91–103). SRI Press.

Goldstein, L., Mills, B. J., Herr, S., Burkholder, J. E., Aiello, L., & Thornton, C. (2018). Why do fewer women than men apply for Grants after their PhDs? *American Antiquity*, *83*(3), 367–386. https://doi.org/

10.1017/aaq.2017.73

Gomez-Verjan, J. C., Barrera-Vázquez, O. S., García-Velázquez, L., Samper- Ternent, R., & Arroyo, P. (2020). Epigenetic variations due to nutritional status in early-life and its later impact on aging and disease. *Clinical Genetics*, *98*(4), 313–321. https://doi.org/10.1111/cge.13748

Goodman, A. H. (1994). Cartesian reductionism and vulgar adaptationism: Issues in the interpretation of nutritional status in prehistory. In K. D. Sobolik (Ed.), *Paleonutrition: The diet and health of prehistoric Americans* (pp. 163–177). Center for Archaeological Investigations.

Goodman, A. H., Martin, D. L., Armelagos, G. J., & Clark, G. C. (1984). Indi- cations of stress from bones and teeth. In M. N. Cohen & G. J. Armelagos (Eds.), *Paleopathology at the origins of agriculture* (pp. 13– 49). Academic Press.

Goodman, A. H., Thomas, R. B., Swedlund, A. C., & Armelagos, G. J. (1988). Biocultural perspectives on stress in prehistoric, historic, and contem- porary population research. *Yearbook of Physical Anthropology*, *31*(S9), 169–202. https://doi.org/10.1002/ajpa.1330310509

Gosman, J. H. (2012). The molecular biological approach in paleopathol- ogy. In A. L. Gauer (Ed.), *A companion to paleopathology* (pp. 76–96). John Wiley & Sons, Ltd.. https://doi.org/10.1002/ 9781444345940.ch5

Gough, M. (2002). Human security: The individual in the security question - the case of Bosnia. *Contemporary Security Policy*, *23*(3), 145–191. https://doi.org/10.1080/713999755

Gowland, R. (2006). Ageing the past: Examining age identity from funerary evidence. In R. L. Gowland & C. J. Knüsel (Eds.), *Social archaeology of funerary remains* (pp. 143–154). Oxbow Books.

Gowland, R. (2007). Age, ageism and osteological bias: The evidence from late Roman Britain. *Journal of Roman Archaeology, Supplementary Series*, *65*, 153–169.

Gowland, R., & Halcrow, S. (Eds.). (2020). *The mother-infant nexus in anthropology: Small beginnings, significant outcomes*. Springer.

Gowland, R., Stewart, N. A., Crowder, K. D., Hodson, C., Shaw, H., Gron, K. J., & Montgomery, J. (2021). Sex estimation of teeth at differ- ent developmental stages using dimorphic enamel peptide analysis. *American Journal of Physical Anthropology*, *174*(4), 859–869. https:// doi.org/10.1002/ajpa.24231

Gowland, R., & Thompson, T. (2013). *Human identity and identification*. Cambridge University Press.

Gowland, R. L. (2015). Entangled lives: Implications of the developmental origins of health and disease hypothesis for bioarchaeology and the life course. *American Journal of Physical Anthropology*, *158*(4), 530–540. https://doi.org/10.1002/ajpa.22820

Gowland, R. L., & Chamberlain, A. T. (2002). A Bayesian approach to ageing perinatal skeletal material from archaeological sites: Implications for the evidence for infanticide in Roman-Britain. *Journal of Archaeological Science*, *29*(6), 677–685. https://doi.org/10.1006/jasc.2001.0776

Gowland, R. L., & Knüsel, C. J. (Eds.). (2006). *Social archaeology of funerary remains*. Oxbow Books.

Graeber, D., & Wengrow, D. (2021). *The Dawn of everything: A new history of humanity*. Farrer, Straus, and Giroux.

Graham, J. W. (2009). Missing data analysis: Making it work in the real world. *Annual Review of Psychology*, *60*, 549–576. https://doi.org/10. 1146/annurev.psych.58.110405.085530

Grauer, A. L. (1993). Patterns of anemia and infection from medieval York, England. *American Journal of Physical Anthropology*, *91*(2), 203–213. https://doi.org/10.1002/ajpa.1330910206

Gravlee, C. C. (2009). How race becomes biology: Embodiment of social inequality. *American Journal of Physical Anthropology*, *139*(1), 47–57. https://doi.org/10.1002/ajpa.20983

Greenaway, C., Hargreaves, S., Barkati, S., Coyle, C. M., Gobbi, F., Veizis, A., & Douglas, P. (2020). COVID-19:

Exposing and addressing health disparities among ethnic minorities and migrants. *Journal of Travel Medicine*, *27*(7), taaa113. https://doi.org/10.1093/jtm/ taaa113

Gregoricka, L. A. (2013). Residential mobility and social identity in the periphery: Strontium isotope analysis of archaeological tooth enamel from southeastern Arabia. *Journal of Archaeological Science*, *40*(1), 452–464. https://doi.org/10.1016/j.jas.2012.07.017

Gregoricka, L. A. (2016). Human response to climate change during the umm an-Nar/Wadi Suq transition in The United Arab Emirates. *Inter- national Journal of Osteoarchaeology*, *26*(2), 211–220. https://doi.org/ 10.1002/oa.2409

Gregoricka, L. A. (2021a). Aridity and adaptation among Arabian bronze age communities: Investigating mobility and climate change using isotope anal- ysis. In G. Robbins Schug (Ed.), *The Routledge handbook of the bio-archaeology of climate and environmental change* (pp. 431–452). Routledge.

Gregoricka, L. A. (2021b). Moving forward: The bioarchaeology of mobility and migration. *Journal of Archaeological Research*. *29*, 581–635. https://doi.org/10.1007/s10814-020-09155-9

Gregory, P. J., Ingram, J. S. I., & Brklacich, M. (2005). Climate change and food security. *Philosophical Transactions of the Royal Society B*, *360*(1463), 2139–2148. https://doi.org/10.1098/rstb.2005.1745

Groves, S. E., Roberts, C. A., Lucy, S., Pearson, G., Gröcke, D. R., Nowell, G., Macpherson, C. G., & Young, G. (2013). Mobility histories of 7th-9th century AD people buried at early medieval Bamburgh, Northumberland, England. *American Journal of Physical Anthropology*, *151*(3), 462–476. https://doi.org/10.1002/ajpa.22290

Guadagno, L. (2020). *Migrants and the COVID-19 pandemic: An initial analy- sis*. International Organization for Migration (IOM). https:// publications.iom.int/system/files/pdf/mrs-60.pdf

Guder, C., Gravius, S., Burger, C., Wirtz, D. C., & Schildberg, F. A. (2020). Osteoimmunology: A current update of the interplay between bone and the immune system. *Frontiers in Immunology*, *11*, 58. https://doi. org/10.3389/fimmu.2020.00058

Guijarro, C., Pérez-Fernández, E., González-Piñeiro, B., Meléndez, V., Goyanes, M. J., Renilla, M. E., Casas, M. L., Sastre, I., & Velasco, M. (2021). Differential risk for COVID-19 in the first wave of the disease among Spaniards and migrants from different areas of the world living in Spain. *Revista Clínica Española (English Edition)*, *221*(5), 264–273. https://doi.org/10.1016/j.rceng.2020.10.005

Guiry, E. J., & Szpak, P. (2021). Improved quality control criteria for stable carbon and nitrogen isotope measurements of ancient bone collagen. *Journal of Archaeological Science*, *132*, 105416. https://doi.org/10. 1016/j.jas.2021.105416

Haak, W., Brandt, G., de Jong, H. N., Meyer, C., Ganslmeier, R., Heyd, V., Hawkesworth, C., Pike, A. W. G., Meller, H., & Alt, K. W. (2008). Ancient DNA, strontium isotopes, and osteological analyses shed light on social and kinship organization of the later Stone age. *Proceedings of the National Academy of Sciences*, *105*(47), 18226–18231. https:// doi.org/10.1073/pnas.0807592105

Haak, W., Lazaridis, I., Patterson, N., Rohland, N., Mallick, S., Llamas, B., Brandt, G., Nordenfelt, S., Harney, E., Stewardson, K., Fu, Q., Mittnik, A., Bánffy, E., Economou, C., Francken, M., Friederich, S., Pena, R. G., Hallgren, F., Khartanovich, V., … Reich, D. (2015). Massive migration from the steppe was a source for indo-European languages in Europe. *Nature*, *522*, 207–211. https://doi.org/10.1038/nature14317

Haelewaters, D., Hofmann, T. A., & Romero-Olivares, A. L. (2021). Ten sim- ple rules for global north researchers to stop perpetuating helicopter research in the global south. *PLoS Computational Biology*, *17*(8), e1009277. https://doi.org/10.1371/journal.pcbi.1009277

Hajat, A., Hsia, C., & O'Neill, M. S. (2015). Socioeconomic disparities and air pollution exposure: A global review. *Current Environmental Health Reports*, *2*(4), 440–450. https://doi.org/10.1007/s40572-015-0069-5

Halcrow, S., Aranui, A., Halmhofer, S., Heppner, A., Johnson, N., Killgrove, K., & Schug, G. (2021). Moving beyond Weiss and Springer's repatriation and erasing the past: Indigenous values, relationships, and research. *International Journal of Cultural Property*, *28*(2), 211–220. https://doi.org/10.1017/S0940739121000229

Halcrow, S. E., Crozier, R., Domett, K. M., Lertcharnrit, T., Newton, J. S., Shewan, L. G., & Ward, S. M. (2019). Ethical issues of bioarchaeology in Southeast Asia. In K. Squires, D. Errickson, & N. Márquez-Grant (Eds.), *Ethical approaches to human remains: A global challenge in bio- archaeology and forensic anthropology* (pp. 465–484). Springer.

Halcrow, S. E., & Tayles, N. (2008). The bioarchaeological investigation of childhood and social age: Problems and prospects. *Journal of Archaeo- logical Method & Theory*, *15*(2), 190–215. https://doi.org/10.1007/ s10816-008-

9052-x

Halcrow, S. E., Tayles, N., & Elliott, G. E. (2018). The bioarchaeology of fetuses. In S. Han, T. K. Betsinger, & A. B. Scott (Eds.), *The anthropology of the fetus: Biology, culture, and society* (pp. 83–111). Berghahn Books. 2.2.

Ham, A. C., Temple, D. H., Klaus, H. D., & Hunt, D. R. (2021). Evaluating life history trade-offs through the presence of linear enamel hypoplasia at Pueblo Bonito and Hawikku: A biocultural study of early life stress and survival in the ancestral Pueblo southwest. *American Journal of Human Biology*, *33*(2), e23506. https://doi.org/10.1002/ajhb.23506

Han, S., Betsinger, T. K., & Scott, A. B. (Eds.). (2018). *The anthropology of the fetus: Biology, culture, and society*. Berghahn Books.

Hanjra, M. A., & Qureshi, M. E. (2010). Global water crisis and future food security in an era of climate change. *Food Policy*, *35*(5), 365–377. https://doi.org/10.1016/j.foodpol.2010.05.006

Harbeck, M., Seifert, L., Hänsch, S., Wagner, D. M., Birdsell, D., Parise, K. L., Wiechmann, I., Grupe, G., Thomas, A., Keim, P., Zöller, L., Bramanti, B., Riehm, J. M., & Scholz, H. C. (2013). Yersinia pestis DNA from skeletal remains from the 6th century AD reveals insights into Justinianic plague. *PLoS Pathogens*, *9*(5), e1003349. https://doi.org/10. 1371/journal.ppat.1003349

Harper, K. (2017). *The fate of Rome: Climate, disease, and the end of an empire*. Princeton University Press.

Harrison, F. V. (Ed.). (1991). *Decolonizing anthropology: Moving further toward an anthropology for liberation*. Arlington.

Harrod, R. P. (2017). *The bioarchaeology of social control: Assessing conflict and cooperation in pre-contact Puebloan society*. Springer.

Harrod, R. P., & Martin, D. L. (2014). *Bioarchaeology of climate change and violence: Ethical considerations*. Springer Science.

Harrod, R. P., Thompson, J. L., & Martin, D. L. (2012). Hard labor and hos- tile encounters: What human remains reveal about institutional vio- lence and Chinese immigrants living in Carlin, Nevada (1885-1923). *Historical Archaeology*, *46*, 85–111. https://doi.org/10.1007/ BF03376880

Harry, D. (2009) Indigenous peoples and gene disputes, 84 *Chi.-Kent L. Rev*.

147. https://scholarship.kentlaw.iit.edu/cklawreview/vol84/iss1/8 Hartemann, G. (2019). Nem ela nem ele: por uma arqueologia além do

binário. *Revista Publica Arqueologia Pública*, *13*(1), 99–115.

Hartmann, B. (2013). Lines in the shifting sand: The strategic politics of cli- mate change, human security and national defense. In L. Sygna, K. O'Brien, & J. Wolf (Eds.), *A changing environment for human security: Transformative approaches to research, policy and action* (pp. 72–81). Routledge.

Healey, M., Roberts, C., Jenkins, A., & Leach, J. (2002). Disabled students and fieldwork: Towards inclusivity? *Planet*, *5*, 9–10. https://doi.org/ 10.11120/plan.2002.00050009

Heath-Stout, L. E., & Hannigan, E. M. (2020). Affording archaeology: How field school costs promote exclusivity. *Advanced in Archaeological Prac- tice*, *8*(2), 123–133. https://doi.org/10.1017/aap.2020.7

Hefner, J. T., Pilloud, M. A., Buikstra, J. E., & Vogelsberg, C. C. M. (2016). A brief history of biological distance analysis. In M. A. Pilloud & J. T. Hefner (Eds.), *Biological distance analysis: Forensic and bioarchaeological perspectives* (pp. 3–22). Academic Press.

Hegmon, M., Peeples, M. A., Kinzig, A. P., Kulow, S., Meegan, C. M., & Nelson, M. C. (2008). Social transformations and its human costs in the Prehispanic U.S. Southwest. *American Anthropologist*, *110*(3), 313–324. https://doi.org/10.1111/j.1548-1433.2008.00041.x

Hillson, S. W. (2014). *Tooth development in human evolution and bio- archaeology*. Cambridge University Press.

Hodge, C. J., & Nystrom, K. C. (2020). Dissection as social process: Ana- tomical settings in the nineteenth-century United States. In A. J. Osterholtz (Ed.), *The poetics of processing: Memory formation, identity, and the handling of the dead* (pp. 189–210). University Press of Colorado.

Holbraad, M., & Pedersen, M. A. (2017). *The ontological turn: An anthropo- logical exposition*. Cambridge University Press.

Holliday, T. W. (1999). Brachial and crural indices of European late upper Paleolithic and Mesolithic humans. *Journal of Human Evolution*, *36*(5), 549–566. https://doi.org/10.1006/jhev.1998.0289

Holliday, T. W., & Hilton, C. E. (2010). Body proportions of circumpolar peoples as evidenced from skeletal data: Ipiutak and Tigara (point Hope) versus Kodiak Island Inuit. *American Journal of Physical Anthro- pology*, *142*(2), 287–302. https://doi.org/10.1002/ajpa.21226

Holling, C. S. (1973). Resilience and stability of ecological systems. *Annual Review of Ecology, Evolution and Systematics*, *4*, 1–23. https://doi.org/ 10.1146/annurev.es.04.110173.000245

Holling, C. S., & Gunderson, L. H. (2002). Resilience and adaptive cycles. In L. H. Gunderson & C. S. Holling (Eds.), *Panarchy: Understanding trans- formations in human and natural systems* (pp. 25–62). Island Press.

Holmes, M. A., & Ruff, C. B. (2011). Dietary effects on development of the human mandibular corpus. *American Journal of Physical Anthropology*, *145*(4), 615–628. https://doi.org/10.1002/ajpa.21554

Holmes, S. M. (2013). *Fresh fruit, broken bodies: Migrant farmworkers in the United States*. University of California Press.

Holt, B. (2003). Mobility in upper Paleolithic and Mesolithic Europe: Evi- dence from the lower limb. *American Journal of Physical Anthropology*, *122*(3), 200–215.

Hoppa, R. D., & Vaupel, J. W. (2002). *Paleodemography: Age distributions from skeletal samples*. Cambridge University Press.

Hoppe, T. (2018). "Spanish flu": When infectious disease names blur origins and stigmatize those infected. *American Journal of Public Health*, *108*(11), 1462–1464. https://doi.org/10.2105/AJPH.2018.304645

Horsburgh, K. A. (2015). Molecular anthropology: The judicial use of genetic data in archaeology. *Journal of Archaeological Science*, *56*, 141–145. https://doi.org/10.1016/j.jas.2015.02.033

Hosek, L., & Robb, J. (2019). Osteobiography: A platform for bio- archaeology research. *Bioarchaeology International*, *3*(1), 1–15. https:// doi.org/10.5744/bi.2019.1005

Hsiang, S. M., Burke, M., & Miguel, E. (2013). Quantifying the influence of climate on human conflict. *Science*, *341*, 1235367. https://doi.org/10. 1126/science.1235367

Hu, S., Xiong, J., Fu, P., Qiao, L., Tan, J., Jin, L., & Tang, K. (2017). Signa- tures of personality on dense 3D facial images. *Scientific Reports*, *7*, 73. https://doi.org/10.1038/s41598-017-00071-5

Hubbe, M., Harvati, K., & Neves, W. (2011). Paleoamerican morphology in the context of European and east Asian late Pleistocene variation: Implications for human dispersion into the New World. *American Journal of Physical Anthropology*, *144*(3), 442–453. https://doi.org/10.1002/ajpa.21425

Hughes-Morey, G. (2016). Interpreting adult stature in industrial London. *American Journal of Physical Anthropology*, *159*(1), 126–134. https:// doi.org/10.1002/ajpa.22840

Immel, A., Key, F. M., Szolek, A., Barquera, R., Robinson, M. K., Harrison, G. F., Palmer, W. H., Spyrou, M. A., Susat, J., Krause- Kyora, B., Bos, K. I., Forrest, S., Hernández-Zaragoza, D. I., Sauter, J., Solloch, U., Schmidt, A. H., Schuenemann, V. J., Reiter, E., Kairies, M. S., … Krause, J. (2021). Analysis of genomic DNA from medieval plague victims suggests long-term effect of *Yersinia pestis* on human immunity genes. *Molecular Biology and Evolution*, *38*, 4059– 4076. https://doi.org/10.1093/molbev/msab147

Inglis, R. M., & Halcrow, S. E. (2018). The bioarchaeology of childhood: Theoretical development in the field. In P. Beauchesne & S. C. Agarwal (Eds.), *Children and childhood in bioarchaeology* (pp. 33–60). University of Florida Press.

Ingvarsson, A., & Bäckström, Y. (2019). Bioarchaeological field analysis of human remains from the mass graves at Phaleron, Greece. With an introduction by S. Chryssoulaki and an appendix by A. Linderholm,

A. Kjellström, V. K. Lagerholm, & M. Krzewin,ska. *Opuscula*, *12*, 7–158. https://doi.org/10.30549/opathrom-12-02

Jasienska, G. (2009). Low birth weight of contemporary African Americans: An intergenerational effect of slavery? *American Journal of Human Biol- ogy*, *21*(1), 16–24. https://doi.org/10.1002/ajhb.20824

Johnson, K. M. (2019). Opening up the family tree: Promoting More diverse and inclusive studies of family, kinship, and relatedness in bioarchaeology. In J. E. Buikstra (Ed.), *Bioarchaeologists speak out: Deep time perspectives on contemporary issues* (pp. 201–230). Springer.

Johnson, K. M., & Paul, K. S. (2016). Bioarchaeology and kinship: Integrat- ing theory, social relatedness, and biology in ancient family research. *Journal of Archaeological Research*, *24*, 75–123. https://doi.org/10. 1007/s10814-015-9086-z

Jones, G. (2014). *Not a yes or no question: Critical perspectives on sex and gender in forensic anthropology* [Master's thesis. Windsor, ON: Univer- sity of Windsor].

Justice, L. C., & Temple, D. H. (2019). Bioarchaeological evidence for cul- tural resilience at point Hope, Alaska: Persistence and memory in the ontology of personhood in northern hunter-gatherers. In D. H. Tem- ple & C. M. Stojanowski (Eds.), *Hunter-gatherer adaptation and resil- ience: A bioarchaeological perspective* (pp. 253–273). Cambridge University Press.

Kachur, A., Osin, E., Davydov, D., Shutilov, K., & Novokshonov, A. (2020). Assessing the big five personality traits using real-life static facial images. *Scientific Reports*, *10*, 8487. https://doi.org/10.1038/s41598-020-65358-6

Kaifu, Y., Kasai, K., Townsend, G. C., & Richards, L. C. (2003). Tooth wear and the "design" of the human dentition: A perspective from evolu- tionary medicine. *American Journal of Physical Anthropology*, *122*(S37), 47–61.

Kakaliouras, A. (2012). An anthropology of repatriation: Contemporary physical anthropological and native American ontologies of practice. *Current Anthropology*, *53*(S5), S210–S221. https://doi.org/10.1086/ 662331

Kakaliouras, A. (2017). NAGPRA and repatriation in the twenty-first cen- tury: Shifting the discourse from benefits to responsibilities. *Bio- archaeology International*, *1*, 183–190. https://doi.org/10.5744/bi. 2017.1007

Kakaliouras, A. (2021a). The ancestors should go home: Bioanthropology, collaboration, and repatriation in the twenty-first century. In C. H. Meloche, L. Spake, & K. L. Nichols (Eds.), *Working with and for ances- tors: Collaboration in the care and study of ancestral remains* (pp. 281– 294). Routledge. https://doi.org/10.4324/9780367809317

Kakaliouras, A. (2021b). Review of the book: Repatriation and erasing the past by E. Weiss & J. W. Springer (Eds.). Gainesville: University of Flor- ida Press, 2020. *American Antiquity*, *86*(3), 646–647. https://doi.org/ 10.1017/aaq.2021.41

Kappleman, J., Ketcham, R. A., Pearce, S., Todd, L., Akins, W., Colbert, M. W., Feseha, M., Maisano, J. A., & Witzel, A. (2016). Per- imortem fractures in Lucy suggest mortality from fall out of tall tree. *Nature*, *537*, 503–507. https://doi.org/10.1038/nature19332

Katz, D. C., Grote, M. N., & Weaver, T. D. (2017). Changes in human skull morphology across the agricultural transition are consistent with softer diets in preindustrial farming groups. *Proceedings of the National Academy of Sciences*, *114*(34), 9050–9055. https://doi.org/10.1073/ pnas.1702586114

Katzenberg, M. A., & Waters-Rist, A. L. (2019). Stable isotope analysis: A tool for studying past diet, demography and life history. In M. A. Katzenberg & A. L. Grauer (Eds.), *Biological anthropology of the human skeleton* (3rd ed., pp. 469–514). John Wiley & Sons.

Katzmarzyk, P. T., & Leonard, W. R. (1998). Climatic influences on human body size and proportions: Ecological adaptations and secular trends. *American Journal of Physical Anthropology*, *106*(4), 483–503. https://doi.org/10.1002/(SICI)1096-8644(199808)106:4%3C483::AID- AJPA4%3E3.0.CO;2-K

Keeley, L. H. (1996). *War before civilization: The myth of the peaceful savage*. Oxford University Press.

Kent, J. D., & McCarthy, M. T. (2016). *Holistic review in graduate admis- sions: A report from the Council of Graduate Schools*. Council of Gradu- ate Schools. http://cgsnet.org/ckfinder/userfiles/files/CGS_HolisticReview_final_web.pdf

Kerner, G., Laval, G., Patin, E., Boisson-Dupuis, S., Abel, L., Casanova, J.-L., & Quintana-Murci, L. (2021). Human ancient DNA analyses reveal the high burden of tuberculosis in Europeans over the last 2,000 years. *The American Journal of Human Genetics*, *108*(3), 517–524. https://doi.org/10.1016/j.ajhg.2021.02.009

Kinaston, R. L., Walter, R., Jacomb, C., Brooks, E., Tayles, N., Halcrow, S. E., Stirling, C., Reid, M., Gray, A. R., Spinks, J., Shaw, B., Fyfe, R., & Buckley, H. R. (2013). The first new Zealanders: Patterns of diet and mobility revealed through isotope analysis. *PLoS One*, *8*(9), e64580. https://doi.org/10.1371/journal.pone.0064580

King, M., Altdorf, D., Li, P., Galagedara, L., Holden, J., & Unc, A. (2018). Northward shift of the agricultural climate zone under 21st-century global climate change. *Scientific Reports*, *8*, 7904. https://doi.org/10.1038/s41598-018-26321-8

Kiriyama, K., & Kusaka, S. (2017). Prehistoric diet and mortuary practices in the Jomon period. Isotopic evidence from human skeletal remains from the Yoshigo shell mound. *Journal of Archaeological Science: Reports*, *11*, 200–210. https://doi.org/10.1016/j.jasrep.2016.11.048

Klaus, H. D. (2012). The bioarchaeology of structural violence: A theoretical model and a case study. In D. L. Martin, R. P. Harrod, & V. R. Pérez (Eds.), *The bioarchaeology of violence* (pp. 29–62). University Press of Florida.

Klaus, H. D. (2014). Frontiers in the bioarchaeology of stress and disease: Cross-disciplinary perspectives from pathophysiology, human biology, and epidemiology. *American Journal of Physical Anthropology*, *155*(2), 294–308. https://doi.org/10.1002/ajpa.22574

Klaus, H. D., & Toyne, J. M. (Eds.). (2016). *Ritual violence in the ancient Andes: Reconstructing sacrifice on the north coast of Peru*. University of Texas Press.

Klunk, J., Duggan, A. T., Redfern, R., Gamble, J., Boldsen, J. L., Golding, G. B., Walter, B. S., Eaton, K., Stangroom, J., Rouillard, J.-M., Devault, A., DeWitte, S. N., & Poinar, H. N. (2019). Genetic resiliency and the black death: No apparent loss of mitogenomic diversity due to the black death in medieval London and Denmark. *American Journal of Physical Anthropology*, *169*(2), 240–252. https://doi.org/10.1002/ajpa.2382

Knapp, M., Horsburgh, K. A., Prost, S., Stanton, J.-A., Buckley, H. R., Walter, R. K., & Matisoo-Smith, E. A. (2012). Complete mitochondrial DNA genome sequences from the first new Zealanders. *PNAS*, *109*(45), 18350–18354. https://doi.org/10.1073/pnas.1209896109

Knudson, K., & Torres-Rouff, C. (2015). Migration as a response to envi- ronmental and political disruption: The middle horizon and late inter- mediate periods in the south-Central Andes. In B. J. Baker & T. Tsuda (Eds.), *Migration and disruptions: Toward a unifying theory of ancient and contemporary migrations* (pp. 123–142). University Press of Florida.

Knudson, K. J. (2011). Identifying archaeological human migration using biogeochemistry: Case studies from the south-Central Andes. In G. S. Cabana & J. J. Clark (Eds.), *Rethinking anthropological perspectives on migration* (pp. 231–247). University Press of Florida.

Knudson, K. J., & Stojanowski, C. M. (2008). New directions in bio- archaeology: Recent contributions to the study of human social identi- ties. *Journal of Archaeological Research*, *16*, 397–432. https://doi.org/10.1007/s10814-008-9024-4

Knudson, K. J., & Stojanowski, C. M. (Eds.). (2009a). *Bioarchaeology and identity in the Americas*. University Press of Florida.

Knudson, K. J., & Stojanowski, C. M. (2009b). The bioarchaeology of iden- tity. In K. J. Knudson & C. M.

Stojanowski (Eds.), *Bioarchaeology and identity in the Americas* (pp. 1–23). University Press of Florida.

Knudson, K. J., & Stojanowski, C. M. (Eds.). (2020). *Bioarchaeology and iden- tity revisited*. University Press of Florida.

Knudson, K. J., Torres-Rouff, C., & Hoff, A. (2020). Intersectionality and the multiplicity of identities in the Andean past. In K. J. Knudson & C. Stojanowski (Eds.), *Bioarchaeology and identity revisited* (pp. 185–198). University Press of Florida.

Knüsel, C., & Smith, M. J. (Eds.). (2014). *The Routledge handbook of the bio- archaeology of human conflict*. Routledge. Knüsel, C. J. (2002). More Circe than Cassandra: The princess of Vix in rit- ualized social context. *European Journal of Archaeology*, *5*(3), 275–308. https://doi.org/10.1179/eja.2002.5.3.275

Knüsel, C. J. (2005). The physical evidence of warfare- subtle stigmata? In M. Parker-Pearson & I. J. N. Thorpe (Eds.), *Warfare, violence, and slav- ery, British Archaeological Reports International Series 1374* (pp. 49–64). Archaeopress.

Knüsel, C. J. (2011). Men take up arms for war: Sex and status distinctions of humeral medial Epicondylar avulsion fractures in the archaeological record. In A. Baadsgaard, A. T. Boutin, & J. E. Buikstra (Eds.), *Breathing new life into the evidence of death: Contemporary approaches to bio- archaeology* (pp. 221–250). School for Advanced Research Press.

Knüsel, C. J., Glencross, B., Tsoraki, C., Belmonte, C., Bennison- Chapman, L., & Milella, M. (2021). Social tolerance and violence at Neolithic Çatalhöyük (7100-5950 cal. BC). In I. Hodder & C. Tsoraki (Eds.), *Communities at work. The making of Çatalhöyük* (pp. 243–261). British Institute at Ankara Monograph 56. Çatalhöyük Research Pro- ject Series 15.

Konigsberg, L. W. (1988). Migration models of prehistoric postmarital resi- dence. *American Journal of Physical Anthropology*, *77*(4), 471–481. https://doi.org/10.1002/ajpa.1330770408

Konigsberg, L. W., & Buikstra, J. E. (1995). Regional approaches to the investigation of past human biocultural structure. In L. A. Beck (Ed.), *Regional approaches to mortuary analysis* (pp. 191–219). Plenum Press.

Konigsberg, L. W., & Frankenberg, S. R. (1992). Estimation of age structure in anthropological demography. *American Journal of Physical Anthropol- ogy*, *89*(2), 235–256. https://doi.org/10.1002/ajpa.1330890208

Konigsberg, L. W., & Frankenberg, S. R. (1994). Paleodemography: "Not quite dead". *Evolutionary Anthropology*, *3*(3), 92–105. https://doi.org/ 10.1002/evan.1360030306

Konigsberg, L. W., & Frankenberg, S. R. (2013). Bayes in biological anthro- pology. *American Journal of Physical Anthropology*, *152*(S57), 153–184. https://doi.org/10.1002/ajpa.22397

Konigsberg, L. W., & Hens, S. M. (1998). Use of ordinal categorical vari- ables in skeletal assessment of sex from the cranium. *American Journal of Physical Anthropology*, *107*(1), 97–112. https://doi.org/10.1002/(SICI)1096-8644(199809)107:1<97::AID-AJPA8>3.0.CO;2-A

Konigsberg, L. W., Hens, S. M., Jantz, L. M., & Jungers, W. L. (1998). Stat- ure estimation and calibration: Bayesian and maximum likelihood per- spectives in physical anthropology. *American Journal of Physical Anthropology*, *107*(S27), 65–92. https://doi.org/10.1002/(SICI)1096- 8644(1998)107:27+%3C65::AID-AJPA4%3E3.0.CO;2-6

Kowaleski, M. (2013). Gendering demographic change in the middle ages. In J. M. Bennett & R. M. Karras (Eds.), *The Oxford handbook of women and gender in medieval Europe* (pp. 181–196). Oxford University Press.

Kuijt, I., Quinn, C. P., & Cooney, G. (Eds.). (2014). *Transformation by fire: The archaeology of cremation in cultural context*. The University of Ari- zona Press.

Kusaka, S., Ikarashi, T., Hyodo, F., Yumoto, T., & Katayama, K. (2008). Vari- ability in stable isotope ratios in two late-final Jomon communities in the Tokai coastal region and its relationship with sex and ritual tooth ablation.

Anthropological Science, *116*(2), 171–181. https://doi.org/10. 1537/ase.070703

Kusaka, S., Uno, K. T., Nakano, T., Nakatsukasa, M., & Cerling, T. E. (2015). Carbon isotope ratios of human tooth enamel record the evidence of terrestrial resource consumption during the Jomon period, Japan. *American Journal of Physical Anthropology*, *158*(2), 300–311. https:// doi.org/10.1002/ajpa.22775

Kuzawa, C. W. (2007). Developmental origins of life history: Growth, pro- ductivity, and reproduction. *American Journal of Human Biology*, *19*(5), 654–661. https://doi.org/10.1002/ajhb.20659

Kuzawa, C. W., & Sweet, E. (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. https://doi. org/10.1002/ajhb.20822

L'Abbé, E. N., Symes, S. A., Pokines, J. T., Cabo, L. L., Stull, K. E., Kuo, S., Raymond, D. E., Randolph-Quinney, P. S., & Berger, L. R. (2015). Evi- dence of fatal skeletal injuries on Malapa hominins 1 and 2. *Scientific Reports*, *5*, 15120. https://doi.org/10.1038/srep15120

L'Abbé, E. N., Symes, S. A., Stull, K. E., LaCroix, M., & Pokines, J. T. (2021). Taphonomy and the timing of bone fractures in trauma analysis. In J. T. Pokines, E. N. L'Abbé & S. A. Symes, *Manual of forensic taphon- omy*. 2nd ed., (pp. 473-502). CRC Press.

Lahr, M. M., Rivera, F., Power, R. K., Mounier, A., Copsey, B., Crivellaro, F., Edung, J. E., Fernandez, J. M. M., Kiarie, C., Lawrence, J., Leakey, A., Mbua, E., Miller, H., Muigai, A., Mukhongo, D. M., Van Baelen, A., Wood, R., Schwenninger, J.-L., Grün, R., … Foley, R. A. (2016). Inter- group violence among early Holocene hunter-gatherers of West Turk- ana, Kenya. *Nature*, *529*, 394–398. https://doi.org/10.1038/ nature16477

Lambert, P. (2012). Ethics and issues in the use of human skeletal remains in paleopathology. In A. Grauer (Ed.), *A companion to paleopathology* (pp. 17–33). Wiley-Blackwell.

Lambert, P. M., & Walker, P. L. (2019). Bioarchaeological ethics: Perspec- tives on the use and value of human remains in scientific research. In M. A. Katzenberg & A. L. Grauer (Eds.), *Biological anthropology of the human skeleton* (pp. 3–42). Wiley-Blackwell.

Lamnidis, T. C., Majander, K., Jeong, C., Salmela, E., Wessman, A., Moiseyev, V., Khartanovich, V., Balanovsky, O., Ongyerth, M., Weihmann, A., Sajantila, A., Kelso, J., Pääbo, S., Onkamo, P., Haak, W., Krause, J., & Schiffels, S. (2018). Ancient Fennoscandian genomes reveal origin and spread of Siberian ancestry in Europe. *Nature Com- munications*, *9*(5018), 1–12. https://doi.org/10.1038/s41467-018-07483-5

Lane, L. (2010). National Security Implications of climate change. In *Joint hearing before the select committee on energy Independence and global warming and subcommittee on intelligence, community management, per- manent select committee on intelligence, house of representatives. One Hundred Tenth Congress, Second Session, June 25, 2008. Serial No.110– 41* (pp. 114–125). Government Printing Office.

Lane, R. A., & Sublett, A. J. (1972). Osteology of social organization: Resi- dence pattern. *American Antiquity*, *37*(2), 186–201. https://doi.org/10. 2307/278205

Larsen, C. S. (1982). Functional implications of postcranial size reduction on the prehistoric Georgia coast. *Journal of Human Evolution*, *10*(6), 489–502. https://doi.org/10.1016/S0047-2484(81)80095-4

Larsen, C. S. (2015). *Bioarchaeology: Interpreting behavior from the human skeleton*. Cambridge University Press.

Larsen, C. S., Knüsel, C. J., Haddow, S. D., Pilloud, M. A., Milella, M., Sadvari, J. W., Pearson, J., Ruff, C. B., Garofalo, E. M., Bocaege, E., Betz, B. J., Dori, I., & Glencross, B. (2019). Bioarchaeology of Neolithic Çatalhöyük reveals fundamental transitions in health, mobility, and life- style in early farmers. *Proceedings of the National Academy of Sciences*, *116*(26), 12615–12623. https://doi.org/10.1073/pnas.1904345116

Larsen, C. S., Ruff, C. B., & Griffin, M. C. (1996). Implications of changing biomechanical and nutritional environments for activity and lifeway in the eastern Spanish borderlands. In B. J. Baker & L. Kealhofer (Eds.), *Bioarchaeology of native American adaptation in Spanish borderlands* (pp. 95–125). University of Florida Press.

Larsen, C. S., & Walker, P. L. (2005). The ethics of bioarchaeology. In T. R. Turner (Ed.), *Biological anthropology and ethics: From repatriation to genetic identity* (pp. 111–120). State University of New York Press.

Ledford, H. (2008). Collaborations: With all good intentions. *Nature*, *452*, 682–684.

Lefranc, P., Denaire, A., Jeunesse, C., Boulestin, B. (2018). Dismembering bodies and atypical human deposits of the

4th millennium in the upper Rhine Valley: Sacrificial practices? In

Lewis, M. E. (2017). Fetal paleopathology: an impossible discipline? In S. Han, T. K. Betsinger, & A. B. Scott (Eds.), *The anthropology of the fetus: Biology, culture, and society* (pp. 112–145). Berghahn Books.

Lewis, M. E., Shapland, F., & Watts, R. (2016). The influence of chronic conditions and the environment on pubertal development: An example from medieval England. *International Journal of Paleopathol- ogy*, *12*, 1–10. https://doi.org/10.1016/j.ijpp.2015.10.004

Li, Q. (2018). *Using R for data analysis in social sciences: A research project- oriented approach*. Oxford University Press.

Lieberman, D. E., Devlin, M. J., & Pearson, O. M. (2001). Articular area responses to mechanical loading: Effects of exercise, age, and skeletal location. *American Journal of Physical Anthropology*, *116*(4), 266–277. https://doi.org/10.1002/ajpa.1123

Lieberman, D. E., Krovitz, G. E., Yates, F. W., Devlin, M., & Claire, M. S. (2004). Effects of food processing on masticatory strain and craniofa- cial growth in a retrognathic face. *Journal of Human Evolution*, *46*(6), 655–677. https://doi.org/10.1016/j.jhevol.2004.03.005

Lippert, D. T., & Sholts, S. B. (2021). Repatriation carries us forward; we should leave our fears in the past. *American Journal of Physical Anthro- pology*. *176*(4), 713–714. https://doi.org/10.1002/ajpa.24400

Lipson, M., Skoglund, P., Spriggs, M., Valentin, F., Bedford, S., Shing, R., Buckley, H., Phillip, I., Ward, G. K., Mallick, S., Rohland, N., Broomandkhoshbacht, N., Cheronet, O., Ferry, M., Harper, T. K., Michel, M., Oppenheimer, J., Sirak, K., Stewardson, K., … Reich, D. (2018). Population turnover in remote Oceania shortly after initial set- tlement. *Current Biology*, *28*(7), 1157–1165. https://doi.org/10.1016/j. cub.2018.02.051

Little, R. J. A., & Rubin, D. B. (2019). *Statistical analysis with missing data*. John Wiley & Sons.

Littleton, J., Karstens, S., Busse, M., & Malone, N. (2022). Human-Animal Interactions and Infectious Disease. *Bioarchaeology International*, https://doi.org/10.5744/bi.2021.0002

Lombardo, G., Vena, F., Negri, P., Pagano, S., Barilotti, C., Paglia, L., Colombo, S., Orso, M., & Cianetti, S. (2020). Worldwide prevalence of malocclusion in the different stages of dentition: A systematic review and meta-analysis. *European Journal of Paediatric Dentistry*, *21*(2), 115–122. https://doi.org/10.23804/ejpd.2020.21.02.05

Longman, D. R., Wells, J. C. K., & Stock, J. T. (2020). Human athletic paleo- biology; using sport as a model to investigate human evolutionary adaptation. *Yearbook of Physical Anthropology*, *171*(Suppl. 70), 42–59. https://doi.org/10.1002/ajpa.23992

Lopez, L., Hart, L. H., & Katz, M. H. (2021). Racial and ethnic health dispar- ities related to COVID-19. *JAMA*, *325*(8), 719–720. https://doi.org/ 10.1001/jama.2020.26443

Lo,pez, N., & Gadsden, V. L. (2017). Health inequities, social determinants, and intersectionality. In K. Bogard, V. M. Murry, & C. Alexander (Eds.), *Health equity & social determinates of health* (pp. 9–30). National Acad- emy of Medicine.

Lorentz, K. O., Lemmers, S. A. M., Chrysostomou, C., Dirks, W., Zaruri, M. R., Foruzanfar, F., & Sajjadi, S. M. S. (2019). Use of dental microstructure to investigate the role of prenatal and early life physio- logical stress and death. *Journal of Archaeological Science*, *104*, 85–96. https://doi.org/10.1016/j.jas.2019.01.007

Louie, D. W., Poitras-Pratt, Y., Hanson, A. J., & Ottmann, J. (2017). Apply- ing indigenizing principles of decolonizing methodologies in university classrooms. *Canadian Journal of Higher Education*, *47*(3), 16–33. https://doi.org/10.7202/1043236ar

Lovell, N. C., & Grauer, A. L. (2019). Analysis and interpretation of trauma in skeletal remains. In M. A.

Katzenberg & A. L. Grauer (Eds.), *Biological anthropology of the human skeleton* (pp. 335–383). John Wiley & Sons.

Lu, Y. (2008). Test of the 'healthy migrant hypothesis': A longitudinal analysis of health selectivity of internal migration in Indonesia. *Social Sci- ence & Medicine*, *67*(8), 1331–1339. https://doi.org/10.1016/j. socscimed.2008.06.017

Łukasik, S., Bijak, J., Krenz-Niedbała, M., & Sinika, V. (2021). Paleodemographic analysis of age at death for a population of Black Sea Scythians: An exploration by using Bayesian methods. *American Journal of Physical Anthropology*, *174*(4), 595–613. https://doi.org/10. 1002/ajpa.24211

Lull, V., Rihuete-Herrada, C., Risch, R., Bonora, B., Celdrán-Beltrán, E., Fregeiro, M. I., Molero, C., Moreno, A., Oliart, C., Velasco-Felipe, C., Andügar, L., Haak, W., Villalba-Mouco, V., & Miéo, R. (2021). Emblems and spaces of power during the Argaric bronze age La Almoloya, Murcia. *Antiquity*, *95*(380), 329–348. https://doi.org/10. 15184/aqy.2021.8

Lynch, J. J., & Stephan, C. N. (2018). Computational tools in forensic anthropology: The value of open-source licensing as a standard. *Foren- sic Anthropology*, *1*(4), 228–243. https://doi.org/10.5744/fa.2018. 0025Or

MacGillivray, D. M., & Kollmann, T. R. (2014). The role of environmental factors in modulating immune responses in early life. *Frontiers in Immu- nology*, *5*, 434. https://doi.org/10.3389/fimmu.2014.00434

Mack, C., Su, Z., & Westreich, D. (2018). Types of Missing Data. In *Manag- ing Missing Data in Patient Registries: Addendum to Registries for Evalu- ating Patient Outcomes: A User's Guide, Third Edition [Internet]*. Rockville, MD. Agency for Healthcare Research and Quality (US).

Mackenzie, J. S., & Jeggo, M. (2019). The one health approach-why is it so important? *Tropical Medicine and Infectious Disease*, *4*(2), 5–8. https:// doi.org/10.3390/tropicalmed4020088

Mackey, K., Ayers, C. K., Kondo, K. K., Saha, S., Advani, S. M., Young, S., Spencer, H., Rusek, M., Anderson, J., Veazie, S., Smith, M., & Kansagara, D. (2021). Racial and ethnic disparities in COVID- 19-related infections, hospitalizations, and deaths. *Annals of Internal Medicine*, *174*(3), 362–373. https://doi.org/10.7326/M20-6306

Mafessoni, F., Grote, S., de Filippo, C., Slon, V., Kolobova, K. A., Viola, B., Markin, S. V., Chintalapati, M., Peyrégne, S., Skov, L., Skoglund, P., Krivoshapkin, A. I., Derevianko, A. P., Meyer, M., Kelso, J., Peter, B., Prüfer, K., & Pääbo, S. (2020). A high-coverage Neanderthal genome from Chagyrskaya cave. *Proceedings of the National Academy of Sci- ences*, *117*(26), 15132–15136. https://doi.org/10.1073/pnas. 2004944117

Magalh˜aes, B. M., Mays, S., & Santos, A. L. (2020). A new approach to recording nasal fracture in skeletonized individuals. *International Jour- nal of Paleopathology*, *30*, 105–109. https://doi.org/10.1016/j.ijpp. 2020.04.003

Mahato, S., Bhattarai, S., & Singh, S. (2020). Inequities towards leprosy- affected people: A challenge during COVID-19 pandemic. *PLoS Neglected Tropical Diseases*, *14*(7), e0008537. https://doi.org/10. 1371/journal.pntd.0008537

Manning, P. (2006). Cross-community migration: A distinctive human pat- tern. *Social Evolution & History*, *5*, 24–54.

Mant, M., de la Cova, C., & Brickley, M. B. (2021). Intersectionality and trauma analysis in bioarchaeology. *American Journal of Physical Anthro- pology*, *174*(4), 583–594. https://doi.org/10.1002/ajpa.24226

Mant, M., & Holland, A. (Eds.). (2019). *Bioarchaeology of marginalized people* (pp. 133–155). Academic Press. https://doi.org/10.1016/C2017-0- 02300-5

Marklein, K. E., & Crews, D. E. (2017). Frail or hale: Skeletal frailty indices in medieval London skeletons. *PLoS One*, *12*(5), e0176025. https://doi. org/10.1371/journal.pone.0176025

Marks, J. (2017). *Is science racist?*. Polity Press.

Marmot, M. (2005). Social determinants of health inequalities. *The Lancet*, *365*(9464), 1099–1104. https://doi.org/10.1016/S0140-6736(05)71146-6

Marmot, M. (2015). *The health gap: The challenge of an unequal world*. Bloomsbury Press.

Martin, D. L. (2021). Violence and masculinity in small-scale societies. *Cur- rent Anthropology*, *62*(Suppl 23), S169–S181.

Martin, D. L., & Anderson, C. P. (2014). Introduction: Interpreting violence in the ancient and modern world when skeletonized bodies are all you have. In D. L. Martin & C. P. Anderson (Eds.), *Bioarchaeological and forensic perspectives on violence: How violent death is interpreted from skeletal remains* (pp. 3–14). Cambridge University Press.

Martin, D. L., & Frayer, D. W. (1997). *Troubled times: Violence and warfare in the past*. Gordon and Breach Publishers.

Martin, D. L., & Harrod, R. P. (2015). Bioarchaeological contributions to the study of violence. *Yearbook of Physical Anthropology*, *156*(S59), 116–145. https://doi.org/10.1002/ajpa.22662

Martin, D. L., & Harrod, R. P. (2020). The climate change-witch execution connection: Living with environmental uncertainties on the Colorado plateau (AD 800-1350). In G. Robbins Schug (Ed.), *The Routledge hand- book of the bioarchaeology of climate and environmental change* (pp. 301–315). Routledge.

Martin, D. L., Harrod, R. P., & Pérez, V. R. (Eds.). (2012). *The bioarchaeology of violence*. University Press of Florida.

Martin, D. L., Harrod, R. P., & Pérez, V. R. (Eds.). (2013). *Bioarchaeology: An integrated approach to working with human remains*. Springer.

Martinelli, C. E., Jr., & Moreira, A. C. (1994). Relation between growth hormone and cortisol spontaneous secretion in children. *Clinical Endocrinology*, *41*(1), 117–121. https://doi.org/10.1111/j.1365-2265.1994.tb03792.x

Marwick, B. (2018). R coding and modeling. In S. L. Lo,pez Varela (Ed.), *The encyclopedia of archaeological sciences* (pp. 1–5). John Wiley & Sons, Inc.. https://doi.org/10.1002/9781119188230.saseas0631

Mascaro,, M., Sacristán, A. I., & Rufino, M. (2014). Teaching and learning statistics and experimental analysis for environmental science stu- dents, through programming activities in R. In G. Futschek & C. Kynigos (Eds.), *Constructionism and Creativity. Proceedings of the 3rd International Constructionism Conference* (pp. 407–416). Computer Gesellschaft.

Matisoo-Smith, E. (2015). Ancient DNA and the human settlement of the Pacific: A review. *Journal of Human Evolution*, *79*, 93–104. https://doi. org/10.1016/j.jhevol.2014.10.017

Matthew, R. A., Barnett, J., McDonald, B., & O'Brien, K. L. (Eds.). (2009). *Global environmental change and human security*. The MIT Press.

Mays, S., Brickley, M., & Ives, R. (2006). Skeletal manifestations of rickets in infants and young children in a historic population from England. *American Journal of Physical Anthropology*, *129*(3), 362–374. https:// doi.org/10.1002/ajpa.20292

Mays, S., Elders, J., Humphrey, L., White, W., & Marshall, P. (2013). *Science and the dead: A guideline for the destructive sampling of archaeological human remains for scientific analysis*. English Heritage Publishing.

Mbembé, A. (2003). Necropolitics. *Public Culture*, *15*(1), 11–40. https:// doi.org/10.1215/08992363-15-1-11

Mbembé, A. (2019 [2016]). *Necropolitics (theory in forms)*. Duke University Press.

McCool, W. C., Anderson, A. S., & Kennett, D. J. (2021). Using a multi- method life history approach to navigate the osteological paradox: A case study from Prehispanic Nasca, Peru. *American Journal of Physical*

Anthropology, *175*(4), 816–833. https://doi.org/10.1002/ajpa.24279

McCormick, M., Büntgen, U., Cane, M. A., Cook, E. R., Harper, K., Huybers, P., Litt, T., Manning, S. W., Mayewski, P. A., More, A. F. M., Nicolussi, K., & Tegel, W. (2012). Climate change during and after the Roman empire: Reconstructing the past from scientific and historical evidence. *Journal of Interdisciplinary History*, *43*(2), 169–220. https:// doi.org/10.1162/JINH_a_00379

McEvoy, K., & Conway, H. (2004). The dead, the law, and the politics of the past. *Journal of Law and Society*, *31*(4), 539–562. https://doi.org/ 10.1111/j.1467-6478.2004.00302.x/full

McEwen, C. A., & McEwen, B. S. (2017). Social structure, adversity, toxic stress, and intergenerational poverty: An early childhood model. *Annual Review of Sociology*, *43*(1), 445–472. https://doi.org/10.1146/annurev-soc-060116-053

McMichael, A. J. (2015). Extreme weather events and infectious disease outbreaks. *Virulence*, *6*(6), 543–547. https://doi.org/10.4161/21505594.2014.975022

Meloche, C. H., Spake, L., & Nichols, K. L. (Eds.). (2021). *Working with and for the ancestors: Collaboration in the care and study of ancestral remains*. Routledge.

Meyer, C., Brandt, G., Haak, W., Ganslmeier, R. A., Meller, H., & Alt, K. W. (2009). The Eulau eulogy: Bioarchaeological interpretation of lethal violence in corded ware multiple burials from Saxony-Anhalt, Germany. *Journal of Anthropological Archaeology*, *28*(4), 412–423. https://doi.org/10.1016/j.jaa.2009.07.002

Meyer, C., Lohr, C., Gronenborn, D., & Alt, K. W. (2015). The massacre mass grave of Schöneck-Kilianstädten reveals new insights into collec- tive violence in Early Neolithic Central Europe. *Proceedings of the National Academy of Sciences*, *112*(36), 11217–11222. https://doi.org/ 10.1073/pnas.1504365112

Michou, L. (2018). Epigenetics of bone diseases. *Joint, Bone, Spine*, *85*(6), 701–707. https://doi.org/10.1016/j.jbspin.2017.12.003

Migliano, A. B., Vinicius, L., & Lahr, M. M. (2007). Life history trade-offs explain the evolution of human pygmies. *Proceedings of the National Academy of Sciences*, *104*(51), 20216–20219. https://doi.org/10.1073/pnas.0708024105

Mihesuah, D. A. (Ed.). (2000). *Repatriation reader: Who owns American Indian remains?*. University of Nebraska Press.

Miller, C., & Stassun, K. (2014). A test that fails. *Nature*, *510*, 303–304. https://doi.org/10.1038/nj7504-303a

Miller, M. J., Dong, Y., Pechenkina, K., Fan, W., & Halcrow, S. E. (2020). Raising girls and boys in early China: Stable isotope data reveal sex dif- ferences in weaning and childhood diets during the eastern Zhou era. *American Journal of Physical Anthropology*, *172*(4), 567–585. https:// doi.org/10.1002/ajpa.24033

Milner, G. R. (1999). Warfare in prehistoric and early historic eastern North America. *Journal of Archaeological Research*, *7*, 105–151. https://doi. org/10.1007/s10814-005-0001-x

Milner, G. R. (2007). Warfare, population, and food production in prehis- toric eastern North America. In R. J. Chacon & R. G. Mendoza (Eds.), *North America indigenous warfare and ritual violence* (pp. 182–201). University of Arizona Press.

Milner, G. R. (2019). Bridging the Precontact and Postcontact divide in eastern North America: Prior conditions set the stage for historic- period outcomes. In J. E. Buikstra (Ed.), *Bioarchaeologists speak out: Deep time perspectives on contemporary issues* (pp. 79–107). Springer.

Milner, G. R., & Boldsen, J. L. (2012). Transition analysis: A validation study with known-age modern American skeletons. *American Journal of Phys- ical Anthropology*, *148*(1), 98–110. https://doi.org/10.1002/ajpa.22047

Milner, G. R., & Boldsen, J. L. (2017). Life not death: Epidemiology from skeletons. *International Journal of Paleopathology*, *17*, 26–39. https:// doi.org/10.1016/j.ijpp.2017.03.007

Milner, G. R., Boldsen, J. L., Ousley, S. D., Getz, S. M., Weise, S., & Tarp, P. (2021). Great expectations: The rise, fall, and resurrection of adult skeletal age estimation. In B. F. B. Algee-Hewitt & J. Kim (Eds.), *Remo- deling forensic skeletal age: Modern applications and new research direc- tions* (pp. 139–154). Academic Press.

Milner, G. R., Wood, J. W., & Boldsen, J. L. (2019). Paleodemography: Problems, Progress, and potential. In M. A. Katzenberg & A. Grauer (Eds.), *Biological anthropology of the human skeleton* (3rd ed., pp. 593– 633). Wiley-Blackwell.

Miranda, J. J., Barrientos-Gutiérrez, T., Corvalan, C., Hyder, A. A., Lazo- Porras, M., Oni, T., & Wells, J. C. K. (2019). Understanding the rise of cardiometabolic diseases in low- and middle-income countries. *Nature Medicine*, *25*(11), 1667–1679. https://doi.org/10.1038/s41591-019-0644-7

Mittnik, A., Wang, C.-C., Svoboda, J., & Krause, J. (2016). A molecular approach to the sexing of the triple burial at the upper Paleolithic site of Dolní Věstonice. *PLoS One*, *11*(10), e0163019. https://doi.org/10.

1371/journal.pone.0163019

Mochizuki, K. (2004). Conflict and People's insecurity: An insight from the experiences of Nigeria. In H. Shinoda & H.-W. Jeong (Eds.), *Conflict and human security: A search for new approaches of peace-building* (pp. 207–228). Institute for Peace Science, Hiroshima University.

Moffat, I. (2015). Isotope geochemistry in archaeology. In C. Smith (Ed.), *Encyclopaedia of global archaeology* (2nd ed., pp. 4016–4111). Springer. Moore, G. E., & Baldwin, T. (1993 [1903]). *Principia ethica*. Cambridge University Press.

Moore, S. E., Cole, T. J., Collinson, A. C., Poskitt, E. M., McGregor, I. A., & Prentice, A. M. (1999). Prenatal or early postnatal events predict infec- tious deaths in young adulthood in rural Africa. *International Journal of Epidemiology*, *28*(6), 1088–1095. https://doi.org/10.1093/ije/28.6.1088

Mühlemann, B., Vinner, L., Margaryan, A., Wilhelmson, H., De, C., Castro, F., Allentoft, M. E., de Barros Damgaard, P., Hansen, A. J., Nielsen, S. H., Strand, L. M., Bill, J., Buzhilova, A., Pushkina, T., Falys, C., Khartanovich, V., Moiseyev, V., Jørkov, M. L. S., Sørensen, P. Ø., … Sikora, M. (2020). Diverse variola virus (smallpox) strains were widespread in northern Europe in the Viking age. *Science*, *369*(6502), eaaw8977. https://doi.org/10.1126/science.aaw8977

Muhs, G. G., Niemann, Y. F., González, C. G., & Harris, A. P. (Eds.). (2012). *Presumed incompetent: The intersections of race and class for women in academia*. The University Press of Colorado.

Mukumbang, F. C. (2021). Pervasive systemic drivers underpin COVID-19 vulnerabilities in migrants. *International Journal for Equity in Health*, *20*(1), 146. https://doi.org/10.1186/s12939-021-01487-2

Müller, H.-G., Love, B., & Hoppa, R. D. (2002). Semiparametric method for estimating paleodemographic profiles from age indicator data. *Ameri- can Journal of Physical Anthropology*, *117*(1), 1–14. https://doi.org/10.1002/ajpa.10000

Mulligan, C. (2016). Early environments, stress, and the epigenetics of human health. *Annual Review of Anthropology*, *45*(1), 233–249. https:// doi.org/10.1146/annurev-anthro-102215-095954

Mulligan, C. J., & Raff, J. A. (2021). Special issue: Race reconciled II: Inter- preting and communicating biological variation and race in 2021. *American Journal of Physical Anthropology*, *175*(2), 311–509.

Nafilyan, V., Islam, N., Ayoubkhani, D., Gilles, C., Katikireddi, S. V., Mathur, R., Summerfield, A., Tingay, K., Asaria, M., John, A., Goldblatt, P., Banerjee, A., Glickman, M., & Khunti, K. (2021). Ethnicity, household composition and COVID-19 mortality: A national linked data study. *Journal of the Royal Society of Medicine*, *114*(4), 182–211. https://doi.org/10.1177/0141076821999973

Nagaoka, T., & Hirata, K. (2007). Reconstruction of paleodemographic characteristics from skeletal age at death distributions: Perspectives from Hitotsubashi, Japan. *American Journal of Physical Anthropology*, *134*(3), 301–311. https://doi.org/10.1002/ajpa.20670

Naji, S., Collard, T., Blondiaux, J., Bertrand, B., d'Incau, E., & Bocquet- Appel, J.-P. (2016). Cementochronology, to cut or not to cut? *Interna- tional Journal of Paleopathology*, *15*, 113–119. https://doi.org/10.1016/j.ijpp.2014.05.003

Naji, S., Rendu, W., & Gourichon, L. (Eds.). (2021). *Dental cementum in anthropology*. Cambridge University Press.

Nakamura, K., & Watanabe, K. (2019). Data-driven mathematical model of east-Asian facial attractiveness: The relative contributions of shape and reflectance to attractiveness judgements. *Royal Society Open Sci- ence*, *6*(5), 182189. https://doi.org/10.1098/rsos.182189

Nakayama, N. (2016). The relationship between linear enamel hypoplasia and social status in 18th to 19th century

Edo, Japan. *International Jour- nal of Osteoarchaeology*, *26*(6), 1034–1044. https://doi.org/10.1002/ oa.2515

Nazroo, J. & Bécares, L. (2020). Evidence for ethnic inequalities in mortal- ity related to COVID-19 infections: Findings from an ecological analy- sis of England and Wales. medRxiv, 20125153. https://doi.org/10. 1101/2020.06.08.20125153

Nelson, M. C., Hegmon, M., Kulow, S., & Schollmeyer, K. G. (2006). Archaeological and ecological perspectives on reorganization: A case study from the Mimbres region of the US southwest. *American Antiq- uity*, *71*(3), 403–432. https://doi.org/10.1017/S0002731600039755

Nelson, M. C., Ingram, S. E., Dugmore, A. J., Streeter, R., Peeples, M. A., McGovern, T. H., Hegmon, M., Arneborg, J., Kintigh, K. W.,Brewington, S., Spielmann, K. A., Simpson, I. A., Strawhacker, C., Comeau, L. E. L., Torvinen, A., Madsen, C. K., Hambrecht, G., & Smiarowski, K. (2016). Climate challenges, vulnerabilities, and food security. *Proceedings of the National Academy of Sciences*, *113*(2), 298–303. https://doi.org/10.1073/pnas.1506494113

Nelson, R. (2021). Prioritize care for a more resilient future. *Nature Human Behaviour*, *5*(3), 295–295. https://doi.org/10.1038/s41562-020- 01037-w

Nelson, R. G., Rutherford, J. N., Hinde, K., & Clancy, K. B. H. (2017). Signal- ing safety: Characterizing fieldwork experiences and their implications for career trajectories. *American Anthropologist*, *119*(4), 710–722. https://doi.org/10.1111/aman.12929

Neves, W. A., & Hubbe, M. (2005). Cranial morphology of early Americans from Lagoa Santa, Brazil: Implications for the settlement of the New World. *Proceedings of the National Academy of Sciences of the United States of America*, *102*(51), 18309–18314. https://doi.org/10. 1073/pnas.0507185102

Ng, R. (2021). Societal age stereotypes in the U.S. and U.K. from a media database of 1.1 billion words. *International Journal of Environmental Research and Public Health*, *18*(16), 8822. https://doi.org/10.3390/ ijerph18168822

Nieves-Colo,n, M. A., & Stone, A. C. (2018). Ancient DNA analysis of archaeological remains. In M. A. Katzenberg & A. L. Grauer (Eds.), *Bio- logical anthropology of the human skeleton* (3rd ed., pp. 515–544). John Wiley & Sons.

Noback, M. L., & Harvati, K. (2015). The contribution of subsistence to global human cranial variation. *Journal of Human Evolution*, *80*, 34–50.

Nordås, R., & Gleiditsch, N. P. (2007). Climate change and conflict. *Political Geography*, *26*(6), 627–638. https://doi.org/10.1016/j.polgeo.2007.06.003

Nystrom, K. C. (2011). Postmortem examinations and the embodiment of inequality in 19th century United States. *International Journal of Paleopa- thology*, *1*(3-4), 164–172. https://doi.org/10.1016/j.ijpp.2012.02.003

Nystrom, K. C. (2014). The bioarchaeology of structural violence and dis- section in the 19th-century United States. *American Anthropologist*, *116*(4), 765–779. https://doi.org/10.1111/aman.12151

Nystrom, K. C. (Ed.). (2017a). *The bioarchaeology of dissection and autopsy in the United States*. Springer.

Nystrom, K. C. (2017b). Introduction. In K. C. Nystrom (Ed.), *The bio- archaeology of dissection and autopsy in the United States* (pp. 1–22). Springer.

Nystrom, K. C., & Robbins Schug, G. (2020). A bioarchaeology of social inequality and environmental change. In G. Robbins Schug (Ed.), *The Routledge handbook of the bioarchaeology of climate and environmental change* (pp. 159–188). Routledge.

Nystrom, K. D., & Tilley, L. (Eds.). (2019). The bioarchaeology of care and mummy studies. *International Journal of Paleopathology*, *25*, 62–149.

Obertová, Z., Stewart, A., & Cattaneo, C. (Eds.). (2020). *Statistics and proba- bility in forensic anthropology*. Academic

Press.

O'Donnell, L. (2019). Indicators of stress and their association with frailty in the precontact southwestern United States. *American Journal of Physical Anthropology*, *170*(3), 404–417. https://doi.org/10.1002/ajpa.23902

Oels, A. (2012). From 'securitization' of climate change to 'Climatization' of the security field: Comparing three theoretical perspectives. In J. Scheffran, M. Brzoska, H. G. Brauch, P. M. Link, & J. Schillin (Eds.), *Cli- mate change, human security and violent conflict* (pp. 185–205). Springer.

Ohlsson, L. (2000). Water conflicts and social resource scarcity. *Physics and Chemistry of the Earth Part B Hydrology Oceans and Atmosphere*, *25*(3), 213–220. https://doi.org/10.1016/S1464-1909(00)00006-X

Oka, R. C., Ames, N., Chesson, M. S., Kuijt, I., Kusimba, C. M., Gogte, V. D., & Dandekar, A. (2018). Dreaming beyond Gini: Methodological steps towards a composite archaeological inequality index. In T. A. Kohler &M. E. Smith (Eds.), *Ten thousand years of inequality: The archaeology of wealth differences* (pp. 67–95). University of Arizona Press.

Orlando, L., Allaby, R., Skoglund, P., Der Sarkissian, C.,Stockhammer, P. W., Ávila-Arcos, M., Fu, Q., Kruase, J., Willerslev, E., Stone, A. C., & Warriner, C. (2021). Ancient DNA analysis. *Nature Reviews*, *1*, 14. https://doi.org/10.1038/s43586-020-00011-0

Ortman, S. G. (2019). A new kind of relevance for archaeology. *Frontiers in Digital Humanities*, *6*(16), 1–13. https://doi.org/10.3389/fdigh.2019.00016

Ossenberg, N. S. (1970). The influence of artificial cranial deformation on discontinuous morphological traits. *American Journal of Physical Anthropology*, *33*(3), 357–371. https://doi.org/10.1002/ajpa.1330330310

Osterholtz, A. J. (2012). The social role of hobbling and torture: Violence in the prehistoric southwest. *International Journal of Paleopathology*, *2*(2-3), 148–155.

Osterholtz, A. J. (Ed.). (2014). *Theoretical approaches to analysis and inter- pretation of commingled human remains*. Springer. https://doi.org/10. 1007/978-3-319-22554-8

Osterholtz, A. J. (Ed.). (2020). *The poetics of processing: Memory formation, identity, and the handling of the dead*. University Press of Colorado.

Osterholtz, A. J., Baustian, K. M., & Martin, D. L. (Eds.). (2014). *Commingled and disarticulated human remains*. Springer. https://doi.org/10.1007/ 978-1-4614-7560-6

Owsley, D. W., & Jantz, R. L. (Eds.). (2014). *Kennewick man: The scientific investigation of an ancient American skeleton*. Texas A&M University Press.

Palmer, A. C. (2011). Nutritionally mediated programming of the develop- ing immune system. *Advances in Nutrition*, *2*(5), 377–395. https://doi. org/10.3945/an.111.000570

Parker, G. J., Yip, J. M., Eerkens, J. W., Salemi, M., Durbin-Johnson, B., Kiesow, C., Haas, R., Buikstra, J. E., Klaus, H., Regan, L. A., Rocke, D. M., & Phinney, B. (2019). Sex estimation using sexually dimorphic Ameologenin protein fragments in human enamel. *Journal of Archaeological Science*, *101*, 169–180. https://doi.org/10.1016/j.jas.2018.08.011

Parker, P., Holland, D., Dennison, J., Smith, S. H., & Jackson, M. (2018). Decolonizing the academy: Lessons from the graduate certificate in participatory research at the University of North Carolina at Chapel Hill. *Qualitative Inquiry*, *24*(7), 464–477. https://doi.org/10.1177/1077800417729846

Parsons, P. A. (1992). Fluctuating asymmetry: A biological monitor of envi- ronmental and genomic stress. *Heredity*, *68*, 361–364. https://doi.org/ 10.1038/hdy.1992.51

Patel, J. A., Nielsen, F. B. H., Badiani, A. A., Assi, S., Unadkat, V. A., Patel, B., Ravindrane, R., & Wardle, H. (2020). Poverty, inequality and COVID-19: The forgotten vulnerable. *Public Health*, *183*, 110–111. https://doi.org/10.1016/j.puhe.2020.05.006

Paul, K. S., Astorino, C. M., & Bailey, S. E. (2017). The patterning Cascade model and Carabelli's trait expression in metameres of the mixed human dentition: Exploring a morphogenetic model. *American Journal of Physical Anthropology*, *162*(1), 3–18. https://doi.org/10.1002/ajpa.
23080

Paul, K. S., & Stojanowski, C. M. (2015). Performance analysis of deciduous morphology for detecting biological siblings. *American Journal of Physi- cal Anthropology*, *157*(4), 615–629. https://doi.org/10.1002/ajpa.
22755

Peregrine, P. N., & Ember, M. (2002). Response to Schillaci and Stojanowski. *American Antiquity*, *67*(2), 357–359. https://doi.org/10. 2307/2694572

Peres, K. G., Chaffee, B. W., Feldens, C. A., Flores-Mir, C., Moynihan, P., & Rugg-Gunn, A. (2018). Breastfeeding and Oral health: Evidence and methodological challenges. *Journal of Dental Research*, *97*(3), 251–258. https://doi.org/10.1177/0022034517738925

Perez, V. (2010). From the singing tree to the hanging tree: Structural vio- lence and death within the Yaqui landscape. *Landscapes of Violence*, *1*(1), 9.

Perlin, S. A., Wong, D., & Sexton, K. (2001). Residential proximity to industrial sources of air pollution: Interrelationships among race, poverty, and age. *Journal of the Air & Waste Management Associa- tion*, *51*(3), 406–421. https://doi.org/10.1080/10473289.2001.10464271

Petersen, S. L., Erenrich, E. S., Levine, D. L., Vigoreaux, J., & Gile, K. (2018). Multi-institutional study of GRE scores as predictors of STEM PhD degree completion: GRE gets a low mark. *PLoS One*, *13*(10), e0206570. https://doi.org/10.1371/journal.pone.0206570

Pfeiffer, S. (2021). *Osteobiographies: The discovery, interpretation and repa- triation of human remains*. Academic Press.

Pickrell, J. K., & Reich, D. (2014). Toward a new history and geographic of human genes informed by ancient DNA. *Trends in Genetics*, *30*(9), 377–389. https://doi.org/10.1016/j.tig.2014.07.007

Pilloud, M. A., & Larsen, C. S. (2011). "Official" and "practical" kin: Inferring social and community structure from dental phenotype at Neolithic Çatalhöyük, Turkey. *American Journal of Physical Anthropology*, *145*(4), 519–530. https://doi.org/10.1002/ajpa.21520

Pilloud, M. A., & Schwitalla, A. W. (2020). Re-evaluating traditional markers of stress in an archaeological sample from Central California. *Journal of Archaeological Science*, *116*, 105102. https://doi.org/10.1016/j.jas.2020.105102

Pinker, S. (2011). *The better angels of our nature: Why violence has declined*.Viking.

Piombino-Mascali, D., & Gill-Frerking, H. (2019). The mummy autopsy: Some ethical considerations. In K. A. Squires, D. Errickson, & N. Már- quez-Grant (Eds.), *Ethical approaches to human remains: A global chal- lenge in bioarchaeology and forensic anthropology* (pp. 605–625). Springer. https://doi.org/10.1007/978-3-030-32926-6_29

Pitts, M., & Griffin, R. (2012). Exploring health and social well-being in late Roman Britain: An intercemetery approach. *American Journal of Archaeology*, *116*, 253–276.

Plomp, K. A., Roberts, C. A., Bentley, G., & Elton, S. (Eds.). (2022). *Evolving health: Integrating Palaeopathology and evolutionary medicine*. Oxford University Press.

Pokines, J. T., L'Abbe, E. N., & Symes, S. A. (Eds.). (2021). *Manual of forensic Taphonomy* (2nd ed.). CRC Press.

Pomeroy, E., Mushrif-Tripathy, V., Cole, T. J., Wells, J. C. K., & Stock, J. T. (2019). Ancient origins of low lean mass among south Asians and implications for modern type 2 diabetes susceptibility. *Scientific Reports*, *9*, 10515. https://doi.org/10.1038/s41598-019-46960-9

Powell, J. F. (2005). *The first Americans: Race, evolution, and the origin of native Americans*. Cambridge University Press.

Price, N., Hedenstierna-Jonson, C., Zachrisson, T., Kjellström, A., Storå, J., Krzewin,ska, M., Günther, T., Sobrado, V., Jakobsson, M., & Götherstrom, A. (2019). Viking warrior women? Reassessing Birka chamber grave Bj.581. *Antiquity*, *93*(367), 181–198. https://doi.org/ 10.15184/aqy.2018.258

Prüfer, K., de Filippo, C., Grote, S., Mafessoni, F., Korlevi,c, P., Hajdinjak, M., Vernot, B., Skov, L., Hsieh, P., Peyrégne, S., Reher, D., Hopfe, C., Nagel, S., Maricic, T., Fu, Q., Theunert, C., Rogers, R., Skoglund, P., Chintalapati, M., … Pääbo, S. (2017). A high-coverage Neandertal genome from Vindija cave in Croatia. *Science*, *358*(6363), 655–658. https://doi.org/10.1126/science.aao1887

Prüfer, K., Racimo, F., Patterson, N., Jay, F., Sankaraman, S., Sawyer, S., Heinze, A., Renaud, G., Sudmant, P. H., de Filippo, C., Li, H., Mallick, S., Dannemann, M., Fu, Q., Kircher, M., Kuhlwilm, M., Lachmann, M., Meyer,

M., Ongyerth, M., … Pääbo, S. (2014). The complete genome sequence of a Neanderthal from the Altai Mountains. *Nature*, *505*, 43–49. https://doi.org/10.1038/nature12886

Quinn, C. P., & Beck, J. (2016). Essential tensions: A framework for explor- ing inequality through mortuary archaeology and bioarchaeology.*Open Archaeology*, *2*(1), 19–41. https://doi.org/10.1515/opar-2016-0002

Quintero, I., & Wiens, J. J. (2013). Rates of projected climate change dra- matically exceed past rates of climatic niche evolution among verte- brate species. *Ecology Letters*, *16*(8), 1095–1103. https://doi.org/10.1111/ele.12144

Rambaran-Olm, M. (2020). "Black death" Matters: A Modern Take on a Medieval Pandemic. https://mrambaranolm.medium.com/black-death- matters-a-modern-take-on-a-medieval-pandemic-8b1cf4062d9e

Rathmann, H., Kyle, B., Nikita, E., Harvati, K., & Semerari, G. S. (2019). Pop- ulation history of southern Italy during Greek colonization inferred from dental remains. *American Journal of Physical Anthropology*, *170*(4), 519–534. https://doi.org/10.1002/ajpa.23937

Ravosa, M. J., Lopez, E. K., Menegaz, R. A., Stock, S. R., Stack, M. S., & Hamrick, M. W. (2008). Adaptive plasticity in the mammalian mastica- tory complex: You AreWhat, and how, You eat. In C. Vinyard, M. J. Ravosa, & C. Wall (Eds.), *Primate craniofacial function and biology* (pp. 293–328). Springer.

Reardon, J., & TallBear, K. (2012). "Your DNA is *our* history": Genomics, anthropology, and the construction of whiteness as property. *Current Anthropology*, *53*(S5), S233–S245. https://doi.org/10.1086/662629

Redfern, R., & Fibiger, L. (2019). Bioarchaeological evidence for prehistoric violence: Use and misuse in the popular media. In J. E. Buikstra (Ed.), *Bioarchaeologists speak out: Deep time perspectives on contemporary issues* (pp. 59–77). Springer.

Redfern, R. C. (2016). *Injury and trauma in bioarchaeology: Interpreting vio- lence in past lives*. Cambridge University Press.

Redfern, R. C. (2020). Making sense of violence and environmental change in Europe. In G. Robbins Schug (Ed.), *The Routledge handbook of the bioarchaeology of environmental change* (pp. 279–300). Routledge.

Redfern, R. C., & Dewitte, S. N. (2011). Status and health in Roman Dorset: The effect of status on risk of mortality in post-conquest populations. *American Journal of Physical Anthropology*, *146*(2), 197–208. https://doi.org/10.1002/ajpa.21563

Redfern, R. C., DeWitte, S. N., Beaumont, J., Millard, A. R., & Hamlin, C. (2019). A new method for investigating the relationship between diet and mortal- ity: Hazard analysis using dietary isotopes. *Annals of Human Biology*, *46*, 378–373. https://doi.org/10.1080/03014460.2019.1662484

Reeves, N. M., Auerbach, B. M., & Sylvester, A. D. (2016). Fluctuating and directional asymmetry in the long bones of captive cotton-top tama- rins (*Saguinus oedipus*). *American Journal of Physical Anthropology*, *160*(1), 41–51. https://doi.org/10.1002/ajpa.22942

Reich, D. (2018). *Who we are and how we got here: Ancient DNA and the new science of the human past*. Pantheon Books.

Reich, D., Green, R. E., Kircher, M., Krause, J., Patterson, N., Durand, E. Y., Viola, B., Briggs, A. W., Stenzel, U., Johnson, P. L. F., Maricic, T., Good, J. M., Marques-Bonet, T., Alkan, C., Fu, Q., Mallick, S., Li, H., Meyer, M., Eichler, E. E., … Pääbo, S. (2010). Genetic history of an archaic hominin group from Denisova cave in Siberia. *Nature*, *468*, 1053–1060. https://doi.org/10.1038/nature09710

Reinhard, K. J., Tieszen, L. L., Sandness, K. L., Beiningen, L. M., Miller, E., Mohammad Ghazi, A., Miewald, C. E., & Barnum, S. V. (1994). Trade, contact, and female health in Northeast Nebraska. In C. S. Larsen & G. R. Milner (Eds.), *In the wake of contact: Biological responses to con- quest* (pp. 63–74). Wiley-Liss.

Reitsema, L. J., Vercellotti, G., & Boano, R. (2016). Subadult dietary varia- tion at Trino Vercellese, Italy, and its relationship to adult diet and mortality. *American Journal of Physical Anthropology*, *160*, 653–664. https://doi.org/10.1002/ajpa.22995

Riesenfeld, A. (1973). The effect of extreme temperatures and starvation on the body proportions of the rat. *American Journal of Physical Anthropology*, *39*(3), 427–459. https://doi.org/10.1002/ajpa.1330390311

Robbins Schug, G. (2011). *Bioarchaeology and climate change: A view from south Asian prehistory*. University Press of Florida.

Robbins Schug, G. (2016). Begotten of corruption? Bioarchaeology and "othering" of leprosy in South Asia. *International Journal of Paleopa- thology*, *15*, 1–9. https://doi.org/10.1016/j.ijpp.2016.09.002

Robbins Schug, G. (2017). A hierarchy of values: The bioarchaeology of order, complexity, health, and trauma at Harappa. In H. D. Klaus, A. R. Harvey, & M. N. Cohen (Eds.), *Bones of complexity: Bioarchaeological case studies of social organization and skeletal biology* (pp. 263–289). University Press of Florida.

Robbins Schug, G. (Ed.). (2020). *The Routledge handbook of the bio- archaeology of climate and environmental change*. Routledge.

Robbins Schug, G., & Blevins, K. E. (2016). The center cannot hold: A bio- archaeological perspective on environmental crisis in the second mil- lennium BCE, South Asia. In G. Robbins Schug & S. R. Walimbe (Eds.), *A companion to South Asia in the past* (pp. 255–273). Wiley-Blackwell.

Robbins Schug, G., Blevins, K. E., Cox, B., Gray, K., & Mushrif-Tripathy, V. (2013). Infection, disease, and biosocial processes at the end of the Indus civilization. *PLoS One*, *8*(12), e84814. https://doi.org/10.1371/journal.pone.0084814

Robbins Schug, G., & Goldman, H. M. (2014). Birth is but our death begun: A bioarchaeological assessment of skeletal emaciation in immature human skeletons in the context of environmental, social, and subsis- tence transition. *American Journal of Physical Anthropology*, *155*(2), 243–259. https://doi.org/10.1002/ajpa.22536

Robbins Schug, G., Gray, K., Mushrif-Tripathy, V., & Sankhyan, A. R. (2012). A peaceful realm? Trauma and social differentiation at Harappa. *International Journal of Paleopathology*, *2*(2-3), 136–147. https://doi.org/10.1016/j.ijpp.2012.09.012

Robbins Schug, G., Parnell, E. K., & Harrod, R. P. (2019). Changing the cli- mate: Bioarchaeology responds to deterministic thinking about human-environmental interactions in the past. In J. E. Buikstra (Ed.), *Bioarchaeologists speak out: Deep time perspectives on contemporary issues* (pp. 133–159). Springer.

Roberts, C. A. (2020a). *Leprosy: Past and present*. University Press of Florida.

Roberts, C. A. (2020b). Words, stigma and the coronavirus: Implications of COVID-19 for holistic approaches to infectious diseases. *Journal of the British Academy*, *8*, 240–244.

Roberts, C. A. (2020c). *Mortui vivos docent*: Let the dead teach the living in a post-pandemic landscape. In D. Abrams, D. J. Hand, A. Heath, J. Nazroo, L. Richards, S. Karlsen, M. Mills, & C. Roberts (Eds.), *What makes a community more vulnerable to COVID-19? Summary of A British Academy workshop* (pp. 41–46). British Academy.

Roberts, C. A., & Buikstra, J. E. (2003). *The bioarchaeology of tuberculosis: A global view on a reemerging disease*. University Press of Florida.

Roberts, C. A., & Steckel, R. H. (2019). The developmental origins of health and disease: Early life health conditions and adult age at death in Europe. In R. H. Steckel, C. S. Larsen, C. A. Roberts, & J. Baten (Eds.), *The backbone of Europe: Health, diet, work and violence over two millennia* (pp. 325–351). Cambridge, UK.

Roberts, D. F. (1953). Body weight, race, and climate. *American Journal of Physical Anthropology*, *11*(4), 533–558. https://doi.org/10.1002/ajpa.1330110404

Rockman, M. (2012). The necessary roles of archaeology in climate change mitigation and adaptation. In M. Rockman & J. Flatman (Eds.), *Archaeology in society: Its relevance in the modern world* (pp. 193–215). Springer.

Rose, J. C., Green, T. J., & Green, V. D. (1996). NAGPRA is forever: Osteol- ogy and the repatriation of skeletons. *Annual Review of Anthropology*, *25*, 81–103. https://doi.org/10.1146/annurev.anthro.25.1.81

Ross, A. H., & Pilloud, M. (2021). The need to incorporate human variation and evolutionary theory in forensic anthropology: A call for reform. *American Journal of Physical Anthropology*, *176*(4), 672–683. https://

doi.org/10.1002/ajpa.24384

Ross, A. H., & Williams, S. E. (2021). Ancestry studies in forensic anthro- pology: Back on the frontier of racism. *Biology*, *10*(7), 602. https://doi. org/10.3390/biology10070602

Rubin, D. B. (1976). Inference and missing data. *Biometrika*, *63*(3), 581–592. https://doi.org/10.1093/biomet/63.3.581

Ruckstuhl, K., Tayles, N., Buckley, H., Bradley, R., Fyfe, R., & Ellison, M. (2016). The ancestors speak: Ko-iwi Tangata, M-atauranga M-aori and the development of biological anthropology in New Zealand. In M. Oxenham & H. Buckley (Eds.), *The Routledge handbook of bio- archaeology in Southeast Asia and the Pacific Islands* (pp. 637–654). Routledge.

Ruff, C. B. (1994). Morphological adaptation to climate in modern and fos- sil hominids. *Yearbook of Physical Anthropology*, *37*(S19), 65–107. https://doi.org/10.1002/ajpa.1330370605

Ruff, C. B. (2019). Biomechanical analyses of archaeological human skele- tons. In M. A. Katzenberg & A. L. Grauer (Eds.), *Biological anthropology of the human skeleton* (3rd ed., pp. 189–224). John Wiley & Sons.

Ruff, C. B., & Holt, B. (2018). The Balkans. In C. B. Ruff (Ed.), *Skeletal varia- tion and adaptation in Europeans: Upper Paleolithic to the twentieth cen- tury* (pp. 397–418). John Wiley & Sons, Inc.

Ruff, C. B., Holt, B., & Trinkaus, E. (2006). Who's afraid of the big bad Wolff? "Wolff's law" and bone functional adaptation. *American Journal of Physical Anthropology*, *129*(4), 484–498. https://doi.org/10.1002/ajpa.20371

Ruff, C. B., & Larsen, C. S. (1990). Postcranial biomechanical adaptations to subsistence strategy changes on the Georgia coast. In C. S. Larsen (Ed.), *The archaeology of Mission Santa Catalina de Guale 2: Biocultural interpretations of a population in transition* (pp. 94–120). Anthropologi- cal Papers of the American Museum of Natural History.

Ruff, C. B., Larsen, C. S., & Hayes, W. C. (1984). Structural changes in the femur with the transition to agriculture on the Georgia coast. *American Journal of Physical Anthropology*, *64*(2), 125–136. https://doi.org/10.1002/ajpa.1330640205

Ruff, C. B., Scott, W. W., & Liu, A. Y.-C. (1991). Articular and diaphyseal remodeling of the proximal femur with changes in body mass in adults. *American Journal of Physical Anthropology*, *87*(3), 397–413. https://doi.org/10.1002/ajpa.1330860306

Ruff, C. B., & Walker, A. (1993). Body size and body shape. In A. Walker & R. Leakey (Eds.), *The Narikotome Homo erectus skeleton* (pp. 234–265). Harvard University Press.

Sabloff, J. A. (2009). How can archaeologists usefully contribute to public policy considerations? *Archaeological Dialogues*, *16*(2), 169–171. https://doi.org/10.1017/S1380203809990110

Sala, N., Arsuaga, J. L., Martínez, I., & Gracia-Téllez, A. (2015). Breakage patterns in Sima de los Huesos (Atapuerca, Spain) hominin sample. *Journal of Archaeological Science*, *55*, 113–121.

Sala, N., Arsuaga, J. L., Pantoja-Pérez, A., Pablos, A., Martínez, I., Quam, R. M., Go,mez-Olivencia, A., Bermúdez de Castro, J. M., & Carbonell, E. (2015). Lethal interpersonal violence in the middle Pleistocene. *PLoS One*, *10*(5), e0126589. https://doi.org/10.1371/journal. pone.0126589

Sala, N., Pantoja-Pérez, A., Arsuaga, J. L., Pablos, A., & Martínez, I. (2016). The Sima de los Huesos crania: Analysis of the cranial breakage pat- terns. *Journal of Archaeological Science*, *72*, 25–43. https://doi.org/10.1016/j.jas.2016.06.001

Sasaki, T., & Kondo, O. (2016). An informative prior probability distribution of the Gompertz parameters for Bayesian approaches in paleo- demography. *American Journal of Physical Anthropology*, *159*(3), 523–533. https://doi.org/10.1002/ajpa.22891

Sasaki, T., Takagi, M., & Yanagisawa, T. (2007). Structure and function of secretory ameloblasts in enamel formation. In D. J. Chadwick & G. Cardew (Eds.), *Ciba found symposium, 205 - dental enamel* (pp. 32–46). Novartis Foundation Symposia. https://doi.org/10.1002/9780470515303.ch4

Scarre, C., & Scarre, G. (Eds.). (2006). *The ethics of archaeology: Philosophi- cal perspectives on archaeological practice*. Cambridge University Press.

Schillaci, M. A., & Bustard, W. J. (2010). Controversy and conflict: NAGPRA and the role of biological anthropology in determining cultural affiliation. *Political and Legal Anthropology Review*, *33*(2), 352–374. https://doi.org/10.1111/j.1555-2934.2010.01118.x

Schillaci, M. A., & Stojanowski, C. (2003). Postmarital residence and biolog- ical variation at Pueblo Bonito. *American Journal of Physical Anthropol- ogy*, *120*(1), 1–15. https://doi.org/10.1002/ajpa.10147

Schillaci, M. A., & Stojanowski, C. M. (2002). A reassessment of Matrilocality in Chacoan culture. *American Antiquity*, *67*(2), 343–356. https://doi.org/10.2307/2694571

Schulte, P. M. (2014). What is environmental stress? Insights from fish liv- ing in a variable environment. *Journal of Experimental Biology*, *217*(1), 23–34. https://doi.org/10.1242/jeb.089722

Schulting, R. J. (2019). The success and failure of resilience in the European Mesolithic. In D. H. Temple & C. M. Stojanowski (Eds.), *Hunter-gatherer adaptation and resilience: A bioarchaeological perspec- tive* (pp. 65–84). Cambridge University Press.

Schultz, E. (2021). Sex vs gender in a forensic anthropological analysis. *Nebraska Anthropologist*, *29*, 5–19.

Seetah, K., LaBeaud, D., Kumm, J., Grossi-Soyster, E., Anangwe, A., & Barry, M. (2020). Archaeology and contemporary emerging zoonosis: A framework for predicting future Rift Valley fever virus outbreaks. *International Journal of Osteoarchaeology*, *30*(3), 345–354. https://doi. org/10.1002/oa.2862

Séguy, I., Caussinus, H., Courgeau, D., & Buchet, L. (2013). Estimating the age structure of a buried adult population: A new statistical approach applied to archaeological digs in France. *American Journal of Physical Anthropology*, *150*(2), 170–183. https://doi.org/10.1002/ajpa.22187

Sella-Tunis, T., Pokhojaev, A., Sarig, R., O'Higgins, P., & May, H. (2018). Human mandibular shape is associated with masticatory muscle force. *Scientific Reports*, *8*(1), 6042. https://doi.org/10.1038/s41598-018-24293-3

Selye, H. (1936). A syndrome produced by diverse nocuous agents. *Nature*, *138*, 32. https://doi.org/10.1038/138032a0

Sen, G., & Iyer, A. (2012). Who gains, who loses and how: Leveraging gen- der and class intersections to secure health entitlements. *Social Sci- ence & Medicine*, *74*(11), 1802–1811. https://doi.org/10.1016/j.socscimed.2011.05.035

Seow, W. K., Masel, J. P., Weir, C., & Tudehope, D. I. (1989). Mineral defi- ciency in the pathogenesis of enamel hypoplasia in prematurely born, very low birthweight children. *Pediatric Dentistry*, *11*(4), 297–302.

Shapland, F., & Lewis, M. E. (2014). A proposed method for the assessment of pubertal stage in human skeletal remains using cervical vertebrae maturation. *American Journal of Physical Anthropology*, *153*(1), 144–153. https://doi.org/10.1002/ajpa.22416

Shea, B. T., & Bailey, R. C. (1996). Allometry and evolution of body propor- tions and stature in African pygmies. *American Journal of Physical Anthropology*, *100*(3), 311–340. https://doi.org/10.1002/(SICI)1096-8644(199607)100:3%3C311::AID-AJPA2%3E3.0.CO;2-X

Shin, D. H., & Bianucci, R. (Eds.). (2021). *The handbook of mummy studies*. Springer Nature. https://doi.org/10.1007/978-981-15-3354-9

Singer, M., & Clair, S. (2003). Syndemics and public health: Recon- ceptualizing disease in bio-social context. *Medical Anthropology Quar- terly*, *17*(4), 423–441. https://doi.org/10.1525/maq.2003.17.4.423

Skoglund, P., Posth, C., Sirak, K., Spriggs, M., Valentin, F., Bedford, S., Clark, G. R., Reepmeyer, C., Petchey, F., Fernandes, D., Fu, Q., Harney, E., Lipson, M., Mallick, S., Novak, M., Rohland, N., Stewardson, K., Abdullah, S., Cox, M. P., … Reich, D. (2016). Genomic insights into the peopling of the Southwest Pacific. *Nature*, *538*(7626), 510–513. https://doi.org/10.1038/nature19844

Skoglund, P., Storå, J., Götherström, A., & Jakobsson, M. (2013). Accurate sex identification of ancient human remains using DNA shotgun sequencing. *Journal of Archaeological Science*, *40*(12), 4477–4482. https://doi.org/10.1016/j.jas.2013.07.004

Slatkin, M., & Racimo, F. (2016). Ancient DNA and human history. *Proceed- ings of the National Academy of Sciences*, *113*(23), 6380–6387. https:// doi.org/10.1073/pnas.1524306113

Smith, L. T. (1999). *Decolonizing methodologies; research and indigenous peo- ples*. Zed Books, Ltd.

Smith-Oka, V., Nissen, N. J., Wornhoff, R., & Sheridan, S. G. (2020). "I thought I was going to die": Examining experiences of childbirth pain through bioarchaeological and ethnographic perspectives. In S. G. Sheridan & L. A. Gregoricka (Eds.), *Purposeful pain: The bioarchaeology of intentional suffering* (pp. 149–176). Springer.

Snoddy, A. M. E., Beaumont, J., Buckley, H. R., Colombo, A., Halcrow, S. E., Kinaston, R. L., & Vlok, M. (2020). Sensationalism and speaking to the public: Scientific rigour and interdisciplinary collaborations in palaeopathology. *International Journal of Paleopathology*, *28*, 88–91. https://doi.org/10.1016/j.ijpp.2020.01.003

Snoddy, A. M. E., King, C. L., Halcrow, S. E., Millard, A. R., Buckley, H. R., Standen, V. G., & Arriaza, B. T. (2020). Living on the edge: Climate- induced micronutrient famines in the ancient Atacama Desert? In G. Robbins Schug (Ed.), *The Routledge handbook of the bioarchaeology of climate and environmental change* (pp. 60–82). Routledge.

Sofaer, J. (2012). Bioarchaeological approaches to the gendered body. In D. Bolger (Ed.), *A companion to gender prehistory* (pp. 226–243). John Wiley & Sons.

Sofaer, J. R. (2006). *The body as material culture: A theoretical osteoarchaeology*. Cambridge University Press.

Sohler-Snoddy, A. M., Halcrow, S. E., Buckley, H. R., Standen, V. G., & Arriaza, B. T. (2017). Scurvy at the agricultural transition in the Ata- cama Desert (ca 3600-3200 BP): Nutritional stress at the maternal-foetal interface. *International Journal of Paleopathology*, *18*, 108–120. https://doi.org/10.1016/j.ijpp.2017.05.011

Somel, M. (2021). Collaborate equitably in ancient DNA research and beyond. *Nature*, *600*, 37.

Speakman, R. J., Hadden, C. S., Colvin, M. H., Cramb, J., Jones, K. C., Jones, T. W., Lulewicz, I., Napora, K. G., Reinberger, K. L., Ritchison, B. T., Edwards, A. R., & Thompson, V. D. (2018). Market share and recent hiring trends in anthropology faculty positions. *PLoS One*, *13*(9), e0202528. https://doi.org/10.1371/journal.pone.0202528 Spence, M. W. (1974). Residential practices and the distribution of skeletal traits in Teotihuacán, Mexico. *Man*, *9*(2), 252–273.

Spyrou, M. A., Keller, M., Tukhbatova, R. I., Scheib, C. L., Nelson, E. A., Valtueña, A. A., Neumann, G. U., Walker, D., Alterauge, A., Carty, N., Cessford, C., Fetz, H., Gourvennec, M., Hartle, R., Henderson, M., von Heyking, K., Inskip, S. A., Kacki, S., Key, F. M., … Krause, J. (2019). Phy- logeography of the second plague pandemic revealed through analysis of historical Yersinia pestis genomes. *Nature Communications*, *10*, 4470. https://doi.org/10.1038/s41467-019-12154-0

Squires, K., Errickson, D., & Márquez-Grant, N. (Eds.). (2019). *Ethical approaches to human remains: A global challenge in bioarchaeology and forensic anthro- pology*. Springer. https://doi.org/10.1007/978-3-030-32926-6

Squires, K., Roberts, C. A., & Márquez-Grant, N. (2022). Ethical consider- ations and publishing in human bioarcheology. *American Journal of Bio- logical Anthropology*, *1-5*. https://doi.org/10.1002/ajpa.24467

Squires, K. A., Booth, T., & Roberts, C. A. (2019). The ethics of sampling human skeletal remains for destructive analyses. In K. A. Squires, D. Errickson, &
N. Márquez-Grant (Eds.), *Ethical approaches to human remains: A global challenge in bioarchaeology and forensic anthropology* (pp. 265–297). Springer. https://doi.org/10.1007/978-3-030-32926-6_12

Stantis, C., Schutkowski, H., & Sołtysiak, A. (2020). Reconstructing breastfeeding and weaning practices in the bronze age near east using stable nitrogen isotopes. *American Journal of Physical Anthropology*, *172*(1), 58–69. https://doi.org/10.1002/ajpa.23980

Stearns, S. C. (1992). *The evolution of life histories*. University of Oxford Press.

Steckel, R. H., Larsen, C. S., Roberts, C. A., & Baten, J. (Eds.). (2019). *The backbone of Europe: Health, diet, work and violence over two millennia*. Cambridge University Press.

Stephens, L., Fuller, D., Boivin, N., Rick, T., Gauthier, N., Kay, A., Marwick, B., Armstrong, C. G., Barton, C. M., Denham,T.,Douglass,K., Driver, J., Janz, L., Roberts, P., Rogers, J. D., Thakar, H., Altaweel, M., Johnson, A. L., Vattuone, M. M. S., … Ellis, E. (2019). Archaeological assessment reveals Earth's early transformation through land use. *Sci- ence*, *365*(6456), 897–902. https://doi.org/10.1126/science.aax1192

Stewart, N. A., Gerlach, R. F., Gowland, R. L., Gron, K. L., & Montgomery, J. (2017). Sex determination of human remains from peptides in tooth enamel. *Proceedings of the National Academy of Sciences*, *114*(52), 13649–13654. https://doi.org/10.1073/pnas.1714926115

Stinson, S., Bogin, B., & O'Rourke, D. (2012). *Human biology: An evolution- ary and biocultural perspective*. Wiley-Liss.

Stock, J. T., Bazaliiskii, V. I., Goriunova, O. I., Savel'ev, N. A., & Weber, A. W. (2010). Skeletal morphology, climatic adaptation, and habitual behavior among mid-Holocene cis-Baikal populations. In
A. W. Weber, M. A. Katzenberg, & T. G. Schurr (Eds.), *Prehistoric hunter-gatherers of the cis-Baikal region, Siberia: Bioarchaeological stud- ies of past life ways* (pp. 193–216). University of Pennsylvania Press.

Stock, J. T., & MacIntosh, A. A. (2016). Lower limb biomechanics and habit- ual mobility among mid-Holocene populations of the cis-Baikal. *Qua- ternary International*, *405*, 200–209. https://doi.org/10.1016/j.quaint.
2015.04.052

Stock, J. T., & Pfeiffer, S. K. (2001). Linking structural variability in long bone diaphyses to habitual behaviors: Foragers from the southern African later Stone age and the Andaman Islands. *American Journal of Physical Anthropology*, *115*(4), 337–348. https://doi.org/10.1002/ajpa.
1090

Stock, J. T., & Pfeiffer, S. K. (2004). Long bone robusticity and subsistence behaviour among late Stone age foragers of the forest and fynbos biomes of South Africa. *Journal of Archaeological Science*, *31*(7), 999– 1013. https://doi.org/10.1016/j.jas.2003.12.012

Stockman, C., & Fandrey, J. (2006). Hypoxia-induced erythropoietin pro- duction: A paradigm for oxygen-regulated gene expression. *Clinical and Experimental Pharmacology and Physiology*, *33*(10), 968–979. https://doi.org/10.1111/j.1440-1681.2006.04474.x

Stodder, A. L. W., & Palkovich, A. M. (Eds.). (2012). *The bioarcheology of individuals*. University Press of Florida.

Stojanowski, C. (2019b). Ancient migrations: Biodistance, genetics, and the persistence of typological thinking. In J. E. Buikstra (Ed.), *Bio- archaeologists speak out: Deep time perspectives on contemporary issues* (pp. 181–200). Springer.

Stojanowski, C. M. (2010). *Bioarchaeology of ethnogenesis in the colonial southeast*. University Press of Florida.

Stojanowski, C. M. (2019a). Persistence or pastoralism: The challenges of studying hunter-gatherer resilience in Africa. In D. H. Temple & C. M. Stojanowski (Eds.), *Hunter-gatherer adaptation and resilience: A bio-archaeological perspective* (pp. 193–225). Cambridge University Press.

Stojanowski, C. M., & Buikstra, J. E. (2005). Research trends in human osteology: Content analysis of papers published in the *American Jour- nal of Physical Anthropology*. *American Journal of Physical Anthropology*, *109*(1), 98–109. https://doi.org/10.1002/ajpa.20088

Stojanowski, C. M., & Duncan, W. N. (2015). Engaging bodies in the public imaginations: Bioarchaeology as social science, science, and humani- ties. *American Journal of Human Biology*, *27*(1), 51–60. https://doi.org/10.1002/ajhb.22522

Stojanowski, C. M., & Johnson, K. M. (2015). Observer error, dental wear, and the inference of new world sundadonty. *American Journal of Physical Anthropology*, *156*(3), 349–362. https://doi.org/10.1002/ ajpa.22653

Stojanowski, C. M., & Knudson, K. J. (2011a). Changing patterns of mobil- ity as a response to climatic deterioration and aridification in the mid- dle Holocene Southern Sahara. *American Journal of Physical Anthropology*, *154*(1), 79–93. https://doi.org/10.1002/ajpa.22474

Stojanowski, C. M., & Knudson, K. J. (2011b). Bioarchaeologists also are able to identify how history and sociocultural variation shape the likelihood of climate and environmental change leading to migration and this permits disciplinary exploration of other pathways to resilience. Biogeochemical inference of mobility of early Holocene fisher-foragers from the Central Sahara Desert. *American Journal of Physical Anthropology*, *146*(1), 49–61. https://doi.org/10.1002/ajpa.21542

Stojanowski, C. M., & Knudson, K. J. (2014). Changing patterns of mobility as a response to climatic deterioration and aridification in the middle holocene southern sahara. *American Journal of Physical Anthropology*, *154*(1), 79–93. https://doi.org/10.1002/ajpa.22474

Stojanowski, C. M., Paul, K. S., Seidel, A. C., Duncan, W. N., & Guatelli- Steinberg, D. (2017). Heritability and genetic integration of tooth size in the South Carolina Gullah. *American Journal of Physical Anthropology*, *164*(3), 505–521. https://doi.org/10.1002/ajpa.23290

Stojanowski, C. M., Seidel, A. C., Fulginiti, L. C., Johnson, K. M., & Buikstra, J. E. (2016). Contesting the massacre at Nataruk. *Nature*, *539*, E8–E10. https://doi.org/10.1038/nature19778

Stottman, M. J. (Ed.). (2010). *Archaeologists as activists: Can archaeologists change the world?*. University of Alabama Press.

Stull, K. E., L'Abbé, E. N., & Ousley, S. D. (2017). Subadult sex estimation from Diaphyseal dimensions. *American Journal of Physical Anthropol- ogy*, *163*(1), 64–74. https://doi.org/10.1002/ajpa.23185

Sumida Huaman, E., & Abeita, S. (2018). Indigenous teachers and learners: Higher education and social justice. *Anthropology & Education Quar- terly*, *49*(2), 201–209. https://doi.org/10.1111/aeq.12239

Susat, J., Lübke, H., Immel, A., Brinker, U., Mac-ane, A., Meadows, J., Steer, B., Tholey, A., Zagorska, I., Gerhards, G., Schmölcke, U., Kalnin¸š, M., Franke, A., Pe-tersone-Gordina, E., Teßman, B., Tõrv, M., Schreiber, S., Andree, C., Be-rzin¸š, V., … Krause-Kyora, B. (2021). A 5,000-year-old hunter-gatherer already plagued by *Yersinia pestis*. *Cell Reports*, *35*(13), 109278. https://doi.org/10.1016/j.celrep.2021.109278

TallBear, K. (2003). DNA, blood, and racializing the tribe. *Wíčazo Ša Review*, *18*(1), 81–107.

TallBear, K. (2013). *Native American DNA: Tribal belonging and the false promise of genetic science*. University of Minnesota Press.

TallBear, K. (2015). An indigenous reflection on working beyond the human/not human. *GLQ: A Journal of Lesbian and Gay Studies*, *21*(2-3), 231–235.

TallBear, K. (2017). Beyond the life/not-life binary: A feminist-indigenous Reading of cryopreservation, interspecies thinking, and the new mate- rialisms. In J. Radin & E. Kowal (Eds.), *Cryopolitics: Frozen life in a melt- ing world* (pp. 179–202). The MIT Press.

TallBear, K. (2019). Caretaking relations, not American dreaming. *Kalfou: A Journal of Comparative and Relational Ethnic Studies*, *6*(1), 24–41.

Tan, S. B., de Souza, P., & Raifman, M. (2021). Structural racism and COVID-19 in the USA: A county-level empirical analysis. *Journal of Racial and Ethnic Health Disparities*. 236–246. https://doi.org/10.1007/s40615-020-00948-8

Temple, D. H. (2014). Plasticity and constraint in response to early-life stressors among late/final Jomon period foragers from Japan: Evi- dence for life history trade-offs from incremental microstructures of enamel. *American Journal of Physical Anthropology*, *155*(4), 537–545. https://doi.org/10.1002/ajpa.22606

Temple, D. H. (2019a). Persistence of time: Resilience and adaptability in prehistoric Jomon hunter-gatherers from the Inland Sea region of southwestern Honshu, Japan. In D. H. Temple & C. M. Stojanowski (Eds.), *Hunter-gatherer adaptation and resilience: A bioarchaeological per- spective* (pp. 85–109). Cambridge University Press.

Temple, D. H. (2019b). Bioarchaeological evidence for adaptive plasticity and constraint: Exploring life-history trade-offs in the human past. *Evo- lutionary Anthropology*, *28*(1), 34–46. https://doi.org/10.1002/evan.21754

Temple, D. H., Auerbach, B. M., Nakatsukasa, M., Sciulli, P. W., & Larsen, C. S. (2008a). Variation in limb proportions between Jomon foragers and Yayoi agriculturalists from prehistoric Japan. *American Journal of Physical Anthropology*, *137*(2), 164–174. https://doi.org/10. 1002/ajpa.20853

Temple, D. H., & Goodman, A. H. (2014). Bioarcheology has a "health" problem: Conceptualizing "stress" and "health" in bioarcheological research. *American Journal of Physical Anthropology*, *155*(2), 186–191. https://doi.org/10.1002/ajpa.22602

Temple, D. H., & Kusaka, S. (2022). Enduring Jomon: Bioarchaeological explorations of hunter gatherer resilience and adaptability at Yoshigo shell mounds, Aichi prefecture, Japan. In C. Goudge (Ed.), *Archaeologies of adaptation and resilience to climate change and environmental haz- ards*. University Press of Florida.

Temple, D. H., & Matsumura, H. (2011). Do body proportions among Jomon foragers from Hokkaido conform to ecogeographic expecta- tions? Evolutionary implications of body size and shape among north- erly hunter-gatherers. *International Journal of Osteoarchaeology*, *21*(3), 268–282. https://doi.org/10.1002/oa.1129

Temple, D. H., Rosa, E. R., Hunt, D. R., & Ruff, C. B. (2021). Adapting in the Arctic: Habitual activity and landscape interaction in late Holocene hunter-gatherers from Alaska. *American Journal of Physical Anthropol- ogy*, *176*(1), 3–20. https://doi.org/10.1002/ajpa.24250

Temple, D. H., & Stojanowski, C. M. (Eds.). (2019a). *Hunter-gatherer adap- tation and resilience: A bioarchaeological perspective*. Cambridge Univer- sity Press.

Temple, D. H., & Stojanowski, C. M. (2019b). Interrogating the alterity of hunter-gatherers in bioarchaeological context: Adaptability, tran- sformability, and resilience of hunter-gatherers in the past. In D. H. Temple & C. M. Stojanowski (Eds.), *Hunter-gatherer adaptation and resilience: A bioarchaeological perspective* (pp. 1–25). Cambridge Univer- sity Press.

Thomas, D. H. (1999). *Skull wars: Kennewick man, archaeology, and the bat- tle for native American identity*. Basic Books.

Thomas, J. A., Temple, D. H., & Klaus, H. D. (2019). Crypt fenestration enamel defects and early life stress: Contextual explorations of growth and mortality in colonial Peru. *American Journal of Physical Anthropol- ogy*, *168*(3), 582–594. https://doi.org/10.1002/ajpa.23775

Thomas, J.-L., & Krupa, K. L. (2021). Bioarchaeological ethics and consider- ations for the deceased. *Human Rights Quarterly*, *43*(2), 344–354.

Thompson, A. H., Richards, M. P., Andrew Shortland, A., & Zakrzewski, S. R. (2005). Isotopic palaeodiet studies of ancient Egyptian fauna and humans. *Journal of Archaeological Science*, *32*(3), 451–463. https://doi.org/10.1016/j.jas.2004.11.004

Threedy, D. L. (2007). Claiming the shields: Law, anthropology, and the role of storytelling in a NAGPRA repatriation case study. *Journal of Land, Resources & Environmental Law*, *29*(1), 91–119.

Tiesler, V., Chi-Keb, J. R., & Muñoz, A. O. (2020). Crossing the threshold of modern life: Comparing disease patterns between two documented urban cemetery series from the City of Mérida, Yucatán, Mexico. In H. Azcorra & F. Dickinson (Eds.), *Culture, environment and health in the Yucatan peninsula* (pp. 243–256). Springer.

Tiesler, V., & Scherer, A. K. (Eds.). (2018). *Smoke, flames, and the human body in Mesoamerican ritual practice*. Harvard University Press.

Tito, R. Y., Knights, D., Metcalf, J., Obregon-Tito, A. J., Cleeland, L., Najar, F., Roe, B., Reinhard, K., Sobolik, K., Belknap, S., Foster, M., Spicer, P., Knight, R., & Lewis, C. M., Jr. (2012). Insights from charac- terizing extinct human gut microbiomes. *PLoS One*, *7*(12), e51146. https://doi.org/10.1371/journal.pone.0051146

Torres-Rouff, C. (2020). Environmental, behavioral, and bodily change: Violence in the late intermediate period (AD 1000-1450), North Chile. In G. Robbins Schug (Ed.), *The Routledge handbook of the bio- archaeology of environmental change* (pp. 332–344). Routledge.

Torres-Rouff, C., & Costa Junqueira, M. A. (2006). Interpersonal violence in prehistoric San Pedro de Atacama, Chile: Behavioral implications of environmental stress. *American Journal of Physical Anthropology*, *130*(1), 60–70. https://doi.org/10.1002/ajpa.20315

Torres-Rouff, C., & Knudson, K. J. (2017). Integrating identities: An innova- tive bioarchaeological and biogeochemical approach to analyzing the multiplicity of identities in the mortuary record. *Current Anthropology*, *58*(3), 381–409. https://doi.org/10.1086/692026

Travaglio, M., Yu, Y., Popovic, R., Selley, L., Leal, N. S., & Martins, L. M. (2021). Links between air pollution and COVID-19 in England. *Environ- mental Pollution*, *268*, 115859. https://doi.org/10.1016/j.envpol.2020.115859

Tremblay, L. A., & Reedy, S. (Eds.). (2020). *The bioarchaeology of structural violence: A theoretical framework for industrial era inequality*. Springer.

Trinkaus, E. (2012). Neandertals, early modern humans, and rodeo riders. *Journal of Archaeological Science*, *39*(12), 3691–3693. https://doi.org/ 10.1016/j.jas.2012.05.039

Truong, N., & Asare, A. O. (2021). Assessing the effect of socio-economic features of low-income communities and COVID-19 related cases: An empirical study of new York City. *Global Public Health*, *16*(1), 1–16. https://doi.org/10.1080/17441692.2020.1850830

Tsosie, K. S. (2021). Ancient-DNA researchers write their own rules. *Nature*, *600*, 37.

Tsuda, T., & Baker, B. J. (2015). Conclusion: Migration and disruptions from prehistory to the present. In B. J. Baker & T. Tsuda (Eds.), *Migra- tion and disruptions: Toward a unifying theory of ancient and contempo- rary Migrations* (pp. 296–331). University Press of Florida.

Tsuda, T., Baker, B. J., Eder, J., Knudson, K., Maupin, J., Meierotto, L, & Scott, R. E. (2015). Unifying themes in studies of ancient and contem- porary migrations.

Tsukasaki, M., & Takayanagi, H. (2019). Osteoimmunology: Evolving con- cepts in bone-immune interactions in health and disease. *Nature Reviews Immunology*, *19*, 626–642. https://doi.org/10.1038/s41577-019-0178-8

Tung, T. (2021). Making and marking maleness and valorizing violence: A bioarchaeological analysis of embodiment in the Andean past. *Current Anthropology*, *62*(S23), 125–144. https://doi.org/10.1086/712305

Tung, T. A., Miller, M., DeSantis, L., Sharp, E. A., & Kelly, J. (2016). Patterns of violence and diet among children during a time of imperial decline and climate change in the ancient Peruvian Andes. In A. M. VanDerwarker & G. D. Wilson (Eds.), *The archaeology of food and war- fare: Food insecurity in prehistory* (pp. 193–228). Springer.

Turner, B. L., & Andrushko, V. A. (2011). Partnerships, pitfalls, and ethical concerns international bioarchaeology. In S. C. Agarwal & B. A. Glencross (Eds.), *Social bioarchaeology* (pp. 44–67). John Wiley and Sons, Ltd.

Turner, C. G., II, & Turner, J. A. (1999). *Man corn: Cannibalism and violence in the prehistoric American southwest*. University of Utah Press.

Turner, M. G., Calder, W. J., Cumming, G. S., Hughes, T. P., Jentsch, A., LaDeau, S. L., Lenton, T. M., Shuman, B. N., Turetsky, M. R., Ratajczak, Z., Williams, J. W., Williams, A. P., & Carpenter, S. R. (2020). Climate change, ecosystems and abrupt change: Science priorities. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *375*(1794), 20190105. https://doi.org/10.1098/rstb.2019.0105

Usher, B. M. (2000). *A multistate model of health and mortality for paleo- demography: Tirup cemetery*

[Unpublished Doctoral Dissertation. The Pennsylvania State University, State College].

Van de Noort, R. (2011). Conceptualising climate change archaeology. *Antiquity*, *85*(329), 1039–1048. https://doi.org/10.1017/S0003598X00068472

van Schaik, K., Vinichenko, D., & Rühli, F. (2014). Health is not always writ- ten in bone: Using a modern comorbidity index to assess disease load in paleopathology. *American Journal of Physical Anthropology*, *154*(2), 215–221.

Vaupel, J. W., Manton, K. G., & Stallard, E. (1979). The impact of heteroge- neity in individual frailty on the dynamics of mortality. *Demography*, *16*, 439–454. https://doi.org/10.2307/2061224

Verdery, K. (1999). *The political lives of dead bodies: Reburial and Post- socialist change*. Columbia University Press.

Vick, A. E. (2005). *Sexual dimorphism and the transition to agriculture: A meta-analysis (unpublished master thesis)*. University of Florida.

Vitelli, K. D., & Colwell-Chanthaphonh, C. (Eds.). (2006). *Archaeological ethics* (2nd ed.). AltaMira Press.

Viveiros de Castro, E. (2004). Perspectival anthropology and the method of controlled equivocation. *Tipití: Journal of the Society for the Anthro- pology of Lowland South America*, *2*(1), 1.

von Cramon-Taubadel, N. (2011). Global human mandibular variation reflects differences in agricultural and hunter-gatherer subsistence strategies. *Proceedings of the National Academy of Sciences*, *108*(49), 19546–19551.

Von Cramon-Taubadel, N., Stock, J. T., & Pinhasi, R. (2013). Skull and limb morphology differentially track population history and environmental factors in the transition to agriculture in Europe. *Proceedings of the Royal Society B*, *280*, 20131337. https://doi.org/10.1098/rspb.2013.
1337

Voss, B. L. (2021). Disrupting cultures of harassment in archaeology: Social-environmental and trauma-informed approaches to disciplinary transformation. *American Antiquity*, *86*(3), 447–464. https://doi.org/10.1017/aaq.2021.1

Waddington, C. H. (1953). Genetic assimilation of an acquired character.
Evolution, *7*(2), 118–126.

Wagner, D. M., Klunk, J., Harbeck, M., Devault, A., Waglechner, N., Sahl, J. W., Enk, J., Birdsell, D. N., Kuch, M., Lumibao, C., Poinar, D.,
Pearson, T., Fourment, M., Golding, B., Riehm, J. M., Earn, D. J. D., DeWitte, S., Rouillard, J.-M., Grupe, G., … Poinar, H. (2014). Yersinia pestis and the plague of Justinian 541-543 AD: A genomic analysis. *The Lancet Infectious Diseases*, *14*(4), 319–326. https://doi.org/10. 1016/S1473-3099(13)70323-2

Wagner, J. K., Colwell, C., Claw, C. G., Stone, A. C., Bolnick, D. A., Hawks, J., Brothers, K., & Garrison, N. A. (2020). Fostering responsible research on ancient disease. *American Journal of Human Genetics*, *107*(2), 183–195. https://doi.org/10.1016/j.ajhg.2020.06.017

Wagner-Pacifici, R. (1994). *Discourse and destruction: The City of Philadel- phia versus MOVE*. The University of Chicago Press.

Walker, P. L. (1989). Cranial injuries as evidence of violence in prehistoric southern California. *American Journal of Physical Anthropology*, *80*(3), 313–323. https://doi.org/10.1002/ajpa.1330800305

Walker, P. L. (2000). Bioarchaeological ethics: A historical perspective on the value of human remains. In M. A. Katzenberg & S. R. Saunders (Eds.), *Bio- logical anthropology of the human skeleton* (pp. 3–40). Wiley-Liss.

Walker, P. L. (2001). A bioarchaeological perspective on the history of vio- lence. *Annual Review of Anthropology*, *30*, 573–596. https://doi.org/ 10.1146/annurev.anthro.30.1.573

Walker, P. L. (2004). Caring for the dead: Finding a common ground in dis- putes over Museum collections of human remains. In G. Grupe & J. Peters (Eds.), *Conservation policy and current research* (pp. 13–27). Ver- lag Marie Leidorf GmbH.

Walker, P. L. (2007). Bioarchaeological ethics: A historical perspective on the value of human remains. In M. A. Katzenberg & S. R. Saunders (Eds.), *Biological anthropology of the human skeleton* (3rd ed., pp. 3–39). Wiley-Liss. https://doi.org/10.1002/9780470245842

Walker, P. L., & Cook, D. C. (1998). Gender and sex: Vive la difference.
American Journal of Physical Anthropology, *106*, 255–259.

Walker, R. S., & Hill, K. R. (2014). Causes, consequences, and kin bias of human group fissions. *Human Nature*, *25*(4), 465–475. https://doi.org/ 10.1007/s12110-014-9209-0

Walter, B. S., & DeWitte, S. N. (2016). Urban and rural mortality and sur- vival in medieval England. *Annals of Human Biology*, *44*(4), 338–348. https://doi.org/10.1080/03014460.2016.1275792

Walter, R., Buckley, H., Jacomb, C., & Matisoo-Smith, E. (2017). Mass migration and the Polynesian settlement of New Zealand. *Journal of World Prehistory*, *30*(4), 351–376. https://doi.org/10.1007/s10963-017-9110-y

Warinner, C., Rodrigues, J. F. M., Vyas, R., Trachsel, C., Shved, N., Grossmann, J., Radini, A., Hancock, Y., Tito, R. Y., Fiddyment, S., Speller, C., Hendy, J., Charlton, S., Luder, H. U., Salazar-García, D. C.,Eppler, E., Seiler, R., Hansen, L. H., Castruita, J. A. S., … Cappellini, E. (2014). Pathogens and host immunity in the ancient human oral cavity. *Nature Genetics*, *46*(4), 336–344. https://doi.org/10.1038/ng.2906

Watkins, R. (2018). Anatomical collections as anthropological other: Some considerations. In P. Stone (Ed.), *Bioarchaeological analyses and bodies: New ways of knowing anatomical and archaeological skeletal collections* (pp. 27–48). Springer.

Watkins, R. J. (2020). An Alter(ed)native perspective on historical bio- archaeology. *Historical Archaeology*, *54*, 17–33. https://doi.org/10. 1007/s41636-019-00224-5

Watkins, R. J., & Muller, J. (2015). Repositioning the Cobb human archive: The merger of a skeletal collection and its texts. *American Journal of Human Biology*, *27*, 41–50.

Watts, R. (2015). The long-term impact of developmental stress: Evidence from later medieval and post-medieval London (AD1117-1853). *Ameri- can Journal of Physical Anthropology*, *158*(4), 569–580. https://doi.org/ 10.1002/ajpa.22810

Wedel, V. L., & Galloway, A. (2014). *Broken bones: Anthropological analysis of blunt force trauma* (2nd ed.). Charles C. Thomas.

Weidenreich, F. (1939). The duration of life of fossil man in China and the pathological lesions found in his skeleton. *Chinese Medical Journal*, *55*(1), 37–44.

Weidenreich, F. (1943). The skull of *Sinanthropus pekinensis*: A comparative study on a primitive hominid skull. *Paleontologia Sinica*, *10*.

Weinstein, K. J. (2007). Thoracic skeletal morphology and high-altitude hypoxia in Andean prehistory. *American Journal of Physical Anthropol- ogy*, *134*(1), 36–49. https://doi.org/10.1002/ajpa.20619

Weisensee, K. E. (2013). Assessing the relationship between fluctuating asymmetry and cause of death in skeletal remains: A test of the devel- opmental origins of health and disease hypothesis. *American Journal of Human Biology*, *25*(3), 411–417. https://doi.org/10.1002/ajhb.22390

Weiss, K. M., & Lambert, B. W. (2011). When the time seems ripe: Eugen- ics, the *annals*, and the subtle persistence of typological thinking. *Annals of Human Genetics*, *75*, 334–343. https://doi.org/10.1111/j. 1469-1809.2010.00611.x

Weiss, K. M., & Lambert, B. W. (2014). What type of person are you? Old- fashioned thinking even in modern science. *Cold Spring Harbor Perspec- tives in Biology*, *6*, a021238. https://doi.org/10.1101/cshperspect. a021238

Weiss, K. M., & Long, J. C. (2009). Non-Darwinian estimation: My ances- tors, my genes' ancestors. *Genome Research*, *19*, 703–710. https://doi. org/10.1101/gr.076539.108

Weisse, A. (2020). Provenancing Australian aboriginal ancestors: The importance of incorporating traditional knowledge. In C. H. Meloche,
L. Spake, & K. L. Nichols (Eds.), *Working with and for ancestors: Collabo- ration in the care and study of ancestral remains* (pp. 241–248). Routledge.

Welch, J. R. (2010). Review of the book: *Opening archaeology: Repatri- ation's impact on contemporary research and practice* by T. W. Killion (Ed.) Santa Fe: School for Advanced Research press. *American Antiq- uity*, *75*(1), 201–202. https://doi.org/10.1017/S0002731600049866

Wells, J. C. K., Pomeroy, E., Walimbe, S. R., Popkin, B. M., & Yajnik, C. S. (2016). The elevated susceptibility to diabetes in India: An evolution- ary perspective. *Frontiers in Public Health*, *4*, 145. https://doi.org/10.3389/fpubh.2016.00145

West-Eberhard, M. J. (2003). *Developmental plasticity and evolution*. Oxford University Press.

West-Eberhard, M. J. (2008). Phenotypic plasticity. In S. E. Jørgensen & B. D. Fath (Eds.), *Encyclopedia of ecology* (pp. 2701–2707). Elsevier. White, T. D. (1992). *Prehistoric cannibalism at Mancos 5MTUMR-2346*. Princeton University Press.

Whitehead, N. L. (2002). *Dark shamans: Kanaimà and the poetics of violent death*. Duke University Press.

Whitehead, N. L. (2004). On the poetics of violence. In N. L. Whitehead (Ed.), *Violence* (pp. 55–78). School of American Research Press.

Wilkinson, R., & Pickett, K. (2009). *The spirit level: Why equality is better for everyone*. Bloomsbury Press.

Willerslev, E., & Meltzer, D. J. (2021). Peopling of the Americas as inferred from ancient genomics. *Nature*, *594*, 356–364. https://doi.org/10. 1038/s41586-021-03499-y

Williamson, R. F., & Pfeiffer, S. (Eds.). (2003). *Bones of the ancestors: The archaeology and Osteobiography of the Moatfield ossuary*. Canadian Museum of Civilization.

Wilson, J. J. (2014). Paradox and promise: Research on the role of recent advances in paleodemography and paleoepidemiology to the study of "health" in Precolumbian societies. *American Journal of Physical Anthropology*, *155*(2), 268–280. https://doi.org/10.1002/ ajpa.22601

Wissler, A. (2021). *Engaging the osteological paradox: A study of frailty and survivorship in the 1918 influenza pandemic*. PhD Dissertation. Arizona State University.

Wood, J. W., Holman, D. J., O'Connor, K. A., & Ferrell, R. J. (2002). Mortal- ity models for paleodemography. In R. D. Hoppa & J. W. Vaupel (Eds.), *Paleodemography: Age distributions from skeletal samples* (pp. 129–168). Cambridge University Press.

Wood, J. W., Milner, G. R., Harpending, H. C., & Weiss, K. M. (1992). The osteological paradox: Problems of inferring prehistoric health from skeletal samples. *Current Anthropology*, *33*(4), 343–370. https://doi.org/10.1086/204084

World Health Organization. Regional Office for Europe. (2017). Protecting health in Europe from climate change: 2017 update. World Health Organization. Regional Office for Europe. https://apps.who.int/iris/handle/10665/329522

Worthmann, C. M., & Kuzara, J. (2005). Life history and early origins of health differentials. *American Journal of Human Biology*, *17*(1), 95–112. https://doi.org/10.1002/ajhb.20096

Wright, L. E., & Yoder, C. J. (2003). Recent progress in bioarchaeology: Approaches to the osteological paradox. *Journal of Archaeological Research*, *11*, 43–70. https://doi.org/10.1023/A:1021200925063

Wu, X., Nethery, R. C., Sabath, B. M., Braun, D., & Dominici, F. (2020). Expo- sure to air pollution and COVID-19 mortality in the United States. Med- Rxiv, https://doi.org/10.1101/2020.04.05.20054502

Wynter, S. (2003). Unsettling the Coloniality of being/Power/truth/ free- dom: Towards the human, after man, its overrepresentation-an argu- ment. *The New Centennial Review*, *3*(3), 257–337.

Yaka, R., Mapelli, I., Kaptan, D., Dovgu, A., Chylen,ski, M., Erdal, O. D., Koptekin, D., Vural, K. B., Bayliss, A., Mazzucato, C., Fer, E., Çokovglu, S. S., Kempe Lagerholm, V., Krzewin,ska, M., Karamurat, C., Gemici, H. C., Sevkar, A., Dagvtas¸, N. D., Kılınç, G. M., … Somel, M. (2021). Variable kinship patterns in Neolithic Anatolia revealed by ancient genomes. *Current Biology*, *31*, 1–14.

https://doi.org/10.1016/j. cub.2021.03.050

Yamaguchi, B. (1989). Limb segment proportions in human skeletal remains of the Jomon period. *Bulletin of the National Science Museum, Series D*, *15*, 41–48.

Yang, J., Jin, Z. B., Chen, J., Huang, X. F., Li, X. M., Liang, Y. B., Mao, J.-Y., Chen, X., Zheng, Z., Bakshi, A., Zheng, D.-D., Zheng, M.-Q., Wray, N. R., Visscher, P. M., Lu, F., & Qu, J. (2017). Genetic signatures of high-altitude adaptation in Tibetans. *Proceedings of the National Academy of Sciences*, *114*(16), 4189–4194. https://doi.org/10.1073/ pnas.1617042114

Yaussy, S. L. (2019). The intersections of industrialization: Variation in skel- etal indicators of frailty by age, sex, and socioeconomic status in 18th- and 19th-century England. *American Journal of Physical Anthropology*, *170*(1), 116–130. https://doi.org/10.1002/ajpa.23881

Yaussy Samantha (2022). Intersectionality and the Interpretation of Past Pandemics. *Bioarchaeology International*, https://doi.org/10.5744/bi. 2020.0028

Zakrzewski, S. R. (2015). Religious disruption and the Islamic conquest of Andalucia. In B. J. Baker & T. Tsuda (Eds.), *Migrations and disruptions:Toward a unifying theory of ancient and contemporary migrations* (pp. 52–72). University Press of Florida.

Zebrowitz, L. A., Franklin, R. G., & Boshyan, J. (2015). Face shape and behavior: Implications of similarities in infants and adults. *Personality and Individual Differences*, *86*, 312–317. https://doi.org/10.1016/j. paid.2015.06.036

Ziganshin, R., Berezina, N. Y., Alexandrov, P., Ryabinin, V. V., & Buzhilova, A. (2020). Optimization of method for human sex determi- nation using Peptidome analysis of teeth enamel from teeth of differ- ent biological generation, archeological age, and degrees of Taphonomic preservation. *Biochemistry (Moscow)*, *85*(5), 614–622.

Zimmerman, L. J., Vitelli, K. D., & Hollowell, J. J. (2003). *Ethical issues in archaeology*. AltaMira Press.

Zink, A. R., & Maixner, F. (2019). The current situation of the Tyrolean ice- man. *Gerontology*, *65*(1), 1–8. https://doi.org/10.1159/000501878 Zinsstag, J., Schelling, E., Waltner-Toews, D., & Tanner, M. (2011). From "one medicine" to "one health" and systemic approaches to health and well-being. *Preventive Veterinary Medicine*, *101*(3-4), 148–156. https://doi.org/10.1016/j.prevetmed.2010.07.003

Zuckerman, M., Emery, T., DeGaglia, C., & Gibson, L. (2022). Institutionali- zation within the context of pandemic infectious disease: Examining social vulnerability to the 1918 influenza pandemic among individuals institutionalized in the Mississippi State asylum. *Bioarchaeology Inter- national*. https://doi.org/10.5744/bai.2021.0006

Zuckerman, M. K., & Banks, P. (2017). Potential applications of public health tools to bioarchaeological datasets: The "dirty war index" and the biological costs of armed conflict for children. In D. L. Martin & C. Tegtmeyer (Eds.), *Bioarchaeology of women and children in times of war* (pp. 149–175). Springer.

Zuckerman, M. K., Kamnikar, K. R., & Mathena, S. A. (2014). Recovering the 'body politic': A relational ethics of meaning for bioarchaeology. *Cambridge Archaeological Journal*, *24*(3), 513–522. https://doi.org/10. 1017/S0959774314000766

Zuckermann, M. K., Austin, R. M., & Hofman, C. A. (2021). Historical ana- tomical collections of human remains: Exploring their reinterpretation as representations of racial violence. *The Annals of the American Acad- emy of Political and Social Science*, *694*(1), 39–47. https://doi.org/10. 1177/00027162211008815