

## Stronger Together: Advancing a Global Bioarchaeology

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**ABSTRACT** Bioarchaeology is a relatively young field that aims to improve our understanding of life, death, and interrelationships among past humans around the globe. The discipline grew out of 1960s American processual archaeology and biological anthropology and emerged as human osteoarchaeology in the UK. Today, bioarchaeology is a vibrant, interdisciplinary field of study that cross-cuts biological anthropology, archaeology, and social theory to situate past peoples within their biological, cultural, and environmental circumstances. The field emphasizes not only the study of human remains but the integrative analysis and interpretation of their context, including the archaeological, sociocultural, and political milieu and the environmental setting in which people lived. The growing interest in bioarchaeological research has created the need for a new peer-reviewed journal to help unify and advance this discipline around the globe. In this introduction to *Bioarchaeology International*, we trace the origins of the field and the different “schools” of bioarchaeology that have developed and are now merging as the discipline has matured. We then delineate the purpose and goals of the journal, highlighting how the articles in the first issue contribute to those goals. Finally, as co-editors in chief, we describe our vision for contemporary and future directions in bioarchaeology. With this overview of the field and journal, we wish to stimulate discussion and promote international submissions. We intend for *Bioarchaeology International* to strengthen this growing field and help promote scholarly and public interest in our collective research.

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Bioarchaeology is a burgeoning, integrative field that spans the globe. Bioarchaeology is often thought to encompass the study of only the human remains found within archaeological sites, frequently divorced from the contexts in which they were found. The physical remains of people store a record of their biological attributes, providing information on illnesses or trauma they survived or that may have contributed to their deaths, their daily activities, biological affinities, and more. Equally informative are the different ways that people were treated in death by those who survived them. Rather than investigating only the

biological remains or studying material culture alone, integrating these components permits a more complete understanding of how people experienced an array of circumstances over the course of their own lives and through multiple generations. Differing subsistence practices, access to resources, exposure to hazards, and changes in economic, political, religious, or environmental factors over time and across vast areas of the world are topics explored by bioarchaeologists. Learning how past peoples were affected by pathogens, climate change, and immigration, for example, provides insight into contemporary issues and

problems. Such studies demonstrate how bioarchaeology is relevant to multiple stakeholders and can inform the general public.

### The Development of Bioarchaeology

Bioarchaeology as a field of research has had different trajectories related to variability in academic traditions between North America and those in Britain, France, and other countries (for detailed reviews, see Buikstra et al. 2011; Knüsel 2010; O'Donnabhain and Lozada 2014; Sheridan 2017). In North America, bioarchaeology grew out of processual archaeology and the "New Physical Anthropology" in the 1950s and 1960s, which began a shift from typological and descriptive studies to problem-oriented investigations of populations embedded within a biocultural paradigm (Armélagos 2003; Armélagos and Van Gerven 2003; Zuckerman and Armélagos 2011; Zuckerman and Martin 2016a). This "bio-cultural" perspective, which considers biological, cultural, and environmental factors in the study of past human populations, was promulgated by Don Brothwell (1967) of the UK (see also Roberts 2006). Incorporation of human osteologists and biological anthropologists, including George Armélagos, in large-scale rescue excavations of mortuary sites in southern Egypt and northern Sudan in the 1960s accelerated this paradigm shift (Baker 2016:183–184; see Martin and Zuckerman 2016 for a review of Armélagos's influence on biocultural research). While the term "bioarchaeology" initially appeared in the late 1950s (Sheridan 2017:112) and was applied by Grahame Clark (1972) to the study of faunal remains from a Mesolithic site in Yorkshire (northern England), it was later used by Jane Buikstra (1977:69) to describe a regionally based, interdisciplinary research program in the lower Illinois River Valley that integrated archaeology and human osteology to investigate "biocultural change within the Woodland period."

In North America, the merging of archaeological and biological anthropological perspectives in the investigation of human remains on a regional scale over time has led to an integrative biocultural approach and promoted population-level analyses that marked a shift from the mostly descriptive studies that focused on measurement and classification of people and their diseases. Within American bioarchaeology, however, different schools of thought developed within the nascent discipline (Buikstra and Beck 2006; Rakita 2014; Stojanowski and Duncan 2014). The biocultural approach was championed by George Armélagos, his colleagues, and their students, who acquired broad training across the subfields of anthropology (Zuckerman and Martin 2016b). Jane Buikstra's

bioarchaeology emphasizes contextualization and integration of social theory with biological data from human remains (Buikstra et al. 2011; Buikstra and Beck 2006). Clark Larsen's definition of bioarchaeology focuses primarily on the interpretation of behavior from the human skeleton (as per the subtitle of his book; Larsen 1997, 2015). This perspective separated bioarchaeology from wider aspects of archaeological and social theory. Larsen's form of bioarchaeology has begun to recognize the linkage of archaeology and biological anthropology, acknowledging new developments that situate human biology within "the social past" (Larsen and Walker 2010:380) and relate to aspects of identity, gender, and other "social and cultural forces that leave their impression on the skeletal body" (Larsen 2015:xi). Clearly, the lines among these different perspectives both within and beyond North America are blurring as the field has matured.

The term "bioarchaeology," however, is not universally understood or applied globally. In the United States, "bioarchaeology" pertains to both mortuary site archaeology and human osteology, though these components frequently have been treated separately (see Goldstein 2006) and often continue to be separate purviews of archaeologists and "anthropologists" in many parts of the world, particularly where archaeologists are trained in classical or Near Eastern studies (see, e.g., Sheridan 2017). In France, different terminology is used for investigation of ritual surrounding death (*les gestes funéraires*), the study of field anthropology (*anthropologie de terrain*), or ancient burial (*archéothanatologie*) as it is now more commonly known (Knüsel 2010:68–69). Henri Duda's work, commencing in the 1970s (e.g., Duda 1978), has become widely influential, particularly since its more recent dissemination in English (e.g., Duda 2006, 2009), and is informing studies of body treatment, taphonomy, and commingling (e.g., Geber et al. and Haddow and Knüsel in this issue).

Although the biocultural paradigm links both British and American perspectives, "bioarchaeology" in the UK refers to the study of all ancient biological remains, including those of humans, animals, and plants, and more generally to environmental archaeology and paleoecology (Knüsel 2010:62–63). The study of faunal and human skeletal remains came to be known as "oste archaeology" (Roberts 2006:418). In the UK, oste archaeologists are found in departments of archaeology, whereas North American bioarchaeologists are typically housed in anthropology programs. In both the UK and North America, this field grew rapidly in the 1980s and 1990s. Training programs at the master's degree level were developed at multiple universities in the UK (Roberts 2006:430–431), but only one specific master of arts graduate

curriculum in bioarchaeology developed in the United States. Designed in the mid-1980s by a group of Arizona State University archaeologists and biological anthropologists led by Christopher Carr, Charles Merbs, and Christy Turner II, this curriculum required coursework in both archaeology and biological anthropology, producing bioarchaeologists trained in both these subfields of anthropology.

The field of bioarchaeology matured in the 1980s and 1990s, largely in response to major criticisms of methods and interpretations. The first potential death knell emerged with post-processual reevaluations of mortuary behavior (e.g., Chapman et al. 1981; Pader 1982; Parker Pearson 1982; Shanks and Tilley 1982) that challenged inferences about socioeconomic status based on grave attributes and inclusions as a straightforward reflection of social status (e.g., Binford 1971; Saxe 1972). Another serious challenge arose when the use of life tables in paleodemography was questioned and, at a more fundamental level, methods of estimating age from the skeleton were criticized for reflecting the structure of the sample on which they were based (Bocquet-Appel and Masset 1982). These criticisms met with numerous rebuttals (e.g., Buikstra and Konigsberg 1985; Van Gerven and Armelagos 1983) but spurred efforts to address the concerns in both archaeology (see Parker Pearson 1999) and biological anthropology. Improvements to existing techniques of age estimation (e.g., Brooks and Suchey 1990), development of new techniques (e.g., using the auricular surface [Lovejoy et al. 1985] and sternal ends of ribs [İşcan et al. 1984a, 1984b]), and new statistical approaches (e.g., transition analysis [Boldsen et al. 2002]) have helped allay these concerns. Additionally, more sophisticated and critically applied paleodemographic analyses have arisen that incorporate Bayesian statistics and hazards analysis (for more information concerning these developments see Chamberlain 2000; Hoppa and Vaupel 2002; and Milner et al. 2008) as well as fertility centered models (Jackes 2011).

Issues concerning demography and pathology subsequently were addressed in “The Osteological Paradox,” an influential paper by Wood et al. (1992) that brought the issues of demographic nonstationarity, selective mortality, and heterogeneous frailty to the forefront 25 years ago. This work began perhaps an even more important critical examination of our approach to analyzing the skeletal samples that comprise much of bioarchaeological research. Like the critique of assumptions concerning mortuary practices and the “Farewell to Paleodemography,” publication of “The Osteological Paradox” also met with substantial debate and discussion (e.g., Wright and Yoder 2003), yet the issues raised continue to be deliberated and new analytical approaches are being

developed to address them in contemporary bioarchaeological research (DeWitte and Stojanowski 2015; see the section “Contemporary Directions” below for further discussion).

An additional obstacle in the field was spurred principally by repatriation legislation in the early 1990s, as it had already been recognized that data sets generated by different researchers frequently could not be compared due to a lack of standardized scoring criteria and publication of only summary statistics rather than raw data. Efforts were made by various organizations and groups of scholars to formulate standards for recording data that are widely used today (Brickley and McKinley 2004; Buikstra and Ubelaker 1994) and are being supplemented with new electronic database applications (e.g., Osteoware, the free database software for human skeletal remains [Smithsonian Institution, <https://osteoware.i.edu>]).

With the self-reflection on the development of the field in the early 2000s and recognition of continuing challenges (e.g., Agarwal and Glencross 2011; Buikstra et al. 2011; Buikstra and Beck 2006; Knüsel 2010), bioarchaeology is emerging as a more robust field of inquiry that engages social theory more fully and frequently to contextualize biological information gleaned from human remains. Bioarchaeologists regularly address questions of both cultural and biological significance through integration of research involving human remains, their burial sites, and their curation. Recent work, as outlined below, is contextualizing our understanding of humanity through the lens of the life course, from fetus to death, and over generations, recognizing that rituals surrounding death and body treatment as a form of material culture involve the interaction of both the living and dead. Such research serves to bridge the gap that has previously existed between archaeologists and bioarchaeologists and help unify the different research trajectories that developed in the early decades of bioarchaeological inquiry.

### Contemporary Directions

Contemporary bioarchaeology continues to emphasize both contextual and multi-scalar approaches. While there remains a focus on population-level trends in the field, there has been a shift to consider and integrate a focus on the individual life course in bioarchaeological research. At the same time, the field has continued to embrace the use of innovative methods in geospatial analysis, (micro)imaging, and molecular and chemical analysis, coupled with ecological, ethnographic, and historical approaches. Recent research in bioarchaeology allows the exploration of

broad issues that encompass growth, health, demography, human ecology, sociopolitical and subsistence transitions, epigenetics and developmental biology, and social theoretical approaches to understanding the conceptualization of mortuary landscapes, spatial organization of cemeteries, embodiment of social identity, and more. Bioarchaeologists are addressing questions of great relevance to modern issues, including the effects of climate change, demographic and epidemiological transitions, inequality, and migration. We outline here some of the major directions in the contemporary field, although it is certainly not exhaustive. Our aim is to showcase many of these current directions of research in the coming issues of *Bioarchaeology International*.

Although researchers have slowly addressed the complex issues raised by the osteological paradox, its use as a worthy research endeavor in itself has emerged only recently (DeWitte and Stojanowski 2015). Several innovative studies have embraced the investigation of selective mortality and heterogeneous frailty through an examination of specific mortality risks associated with factors such as age, sex, and non-specific indicators of stress (e.g., Boldsen 2007; DeWitte 2009; DeWitte and Bekvalac 2010; DeWitte and Hughes-Morey 2012; DeWitte and Wood 2008; Marklein et al. 2016; Wilson 2014). Differential frailty and risk of death for subgroups that are identified through archaeological evidence or mortuary context now are more frequently investigated (e.g., DeWitte 2010; Stojanowski 2013; Storey et al. 2012; Sullivan 2005).

Contemporary studies continue to clarify the interpretation of skeletal stress indicators in relation to risk of death in distinct age cohorts, such as preadults versus surviving adolescent or adult cohorts. While early studies such as that by Saunders and Hoppa (1993) suggested there was no association with indicators of stress (specifically, stunted growth) and risk of death, more recent research supports the relationship of stress indicators and increased risk of death, and demonstrates high frequencies of stress lesions in the very youngest age groups and recovery from stress in older cohorts (Littleton 2011; Perry 2014; Robbins Schug 2011). In particular, new studies highlight relationships between stress indicators and mortality, with influences from factors such as gender or status (Vercellotti et al. 2014) or early diet (weaning) patterns (for a recent review see Tsutaya and Yoneda 2015).

Interest in assessing the consequences of childhood stress for later risk of death and morbidity also has prompted bioarchaeologists to engage more directly with concepts of epigenetics and, particularly, what has been termed the Barker hypothesis or, more recently, the developmental origins of health and disease (DOHaD) hypothesis (Agarwal 2016; Gowland

2015b; Klaus 2014). Following an early study by Armelagos et al. (2009), researchers have tested the DOHaD hypothesis using bioarchaeological data on dental defects (enamel hypoplasias) and adult health and mortality (e.g., Amoroso et al. 2014; Temple 2014; Weisensee 2013). This research is enhanced by analysis of stable isotopes from different parts of bones and teeth and among teeth that form at different times to reveal diet change over the life course and gain a better understanding of individual life histories, even in commingled deposits (e.g., Gregoricka 2014; Gregoricka et al. 2017). New techniques that examine serial (incremental) sections of tooth dentine (e.g., Beaumont et al. 2013; Burt and Garvie-Lok 2013; Eerikens et al. 2011), along with analyses of bone collagen and apatite, are advancing our understanding of the weaning process and the identification of a weaning diet, a post-weaning diet, and the age at which an adult diet is adopted (e.g., Dupras and Tocheri 2007; Eerikens and Bartelink 2013; Richards et al. 2002; Waters-Rist et al. 2011). These methodological advances have led to a proliferation of research that has begun to tease out biocultural and environmental influences on past communities and contribute to the elucidation of relationships among diet, morbidity, and mortality in various subgroups (e.g., Bourbou et al. 2013; Gregoricka and Sheridan 2012; Henderson et al. 2014; Káupová et al. 2014; Prowse 2011; Reitsema and Vercellotti 2012; Reitsema et al. 2016; Sandberg et al. 2014). Additional tests of hypotheses concerning developmental pathways of health in the past and potential multigenerational effects (see, e.g., Beaumont et al. 2015) will require multifaceted approaches to investigating the linkage between morbidity and mortality and address the osteological paradox. Such research clearly illustrates the maturation and breadth of contemporary bioarchaeology.

Diet in the past also is being investigated through a life-course approach. When combined with archaeobotanical and zooarchaeological information, stable isotope analysis is the gold standard method for reconstructing diet, subsistence, and even for examining land-use strategies and environments of past populations (e.g., Fraser et al. 2013; Iacumin et al. 2016). Biogeochemical research once provided only an average of what a person consumed over many years based on bulk bone collagen values, although tissue and hair samples in well-preserved assemblages permitted a window into diet during shorter intervals much closer to the person's death (e.g., White and Schwarz 1994). Stable isotopes of strontium and oxygen now go well beyond diet reconstruction and are used regularly to trace residential mobility and identify immigrants within a cemetery, providing further insight into life histories of individuals and social networks

and population movements in the past (e.g., Bentley et al. 2009; Gregoricka and Sheridan 2017; Killgrove and Montgomery 2016; Neil et al. 2016; Parker Pearson et al. 2016; Shaw et al. 2015; Valentine 2016; Wright 2012). Stable isotope research is illuminating new aspects of urbanization, immigration, colonization, interaction, and identity (e.g., Buzon and Simonetti 2013; Knudson 2011; Knudson et al. 2014). In fact, more holistic and multidisciplinary approaches to the investigation of migration, culture contact, and colonization have been revitalized in bioarchaeology (Baker and Tsuda 2015; Cabana and Clark 2011; Murphy and Klaus 2017).

Recent studies of bone mass and biomechanics also have begun to consider life-course approaches and the role of growth on bone remodeling (Agarwal 2016). For example, changes in cross-sectional bone geometry along with indicators of stress during growth explore trade-offs between bone development and morphology over the life course (Robbins Schug and Goldman 2014; Temple et al. 2013). The critical evaluation of skeletal alterations at sites of tendon and ligament attachments, their etiology, and their relationship to pathological processes as well as habitual activities (Henderson and Alves Cardoso 2012; Jurmain et al. 2012) also has led to new investigations of enthesal changes and their development over the life course (Villotte and Knüsel 2012). While primate functional adaptation in bone morphology is well studied in paleoanthropology and primatology, bioarchaeologists are uniquely positioned to investigate the larger synergistic relationships between social behavior, context, and bone adaptation in the human skeleton across different human communities through time.

Along with continued attention in bioarchaeology to health and frailty in the past, significant effort has been directed toward refining our methods for diagnosing skeletal indicators of disease and clarifying our interpretation of lesions in ancient bones. For example, new research is challenging our traditional interpretation of non-specific indicators of stress as measures of health status (Reitsema and McIlvaine 2014), including dental enamel defects (Hassett 2014; Hubbard et al. 2009), periosteal reaction (e.g., DeWitte 2014a, 2014b; DeWitte and Wood 2008; Weston, 2008, 2009, 2012), and porotic hyperostosis (McIlvaine 2013; Piperata et al. 2014), as well as specific patterns of pathology that are diagnostic of metabolic conditions such as scurvy (Crandall and Klaus 2014) and anemia (Smith-Guzman 2015), and infections such as leishmaniasis (Marsteller et al. 2011). The study of disease progression over the life course also is being examined more broadly in contemporary studies of paleopathology that also draw upon medical sources (e.g.,

Baker and Bolhofner 2013). Data from both clinical and medical anthropological sources are used increasingly, and we expect work to continue in these areas in both living populations and skeletal assemblages to improve the understanding of pathological lesions in bioarchaeological research.

Contemporary bioarchaeological analyses of health also use state-of-the-art technology. Imaging technology such as computed tomography (CT) scanning (O'Brien et al. 2009) and X-ray microtomography (micro-CT) analysis (Booth et al. 2016), histology (Crowder and Stout 2011), stable isotope analyses, ancient DNA analysis (aDNA), immunology, and parasitology (Reinhard and Araújo 2012) are now at the forefront of paleopathological diagnosis. The fast-paced advances in biogeochemical analyses and molecular biology have pushed bioarchaeological studies in new directions. Stable isotope analyses, for example, increasingly are being used to investigate malnutrition and disease (Beaumont and Montgomery 2016; D'Ortenzio et al. 2015; Katzenberg 2012; Olsen et al. 2014) as well as disease transmission in the past (Kendall et al. 2013; Roberts et al. 2013). Similarly, analysis of aDNA has gone well beyond confirming the presence of particular conditions in pathological skeletons, revolutionizing our understanding of the origins and evolution of disease (Anastasiou and Mitchell 2013; Harkins and Stone 2014; Wilbur and Stone 2012). Research has emphasized the co-evolution of humans and pathogens, including the causative organisms of tuberculosis, leprosy, and plague (e.g., Bos et al. 2011, 2014; Müller et al. 2014; Stone et al. 2009) and investigated the spread of various pathogens both temporally and geographically (e.g., de Melo et al. 2010; Schuenemann et al. 2013). Anthropological geneticists are also analyzing aDNA to investigate disease susceptibility, for example, examining how North American indigenous populations responded and adapted to new diseases and epidemics such as smallpox upon contact (Lindo et al. 2016). Evidence of cytosine methylation also is being recovered from ancient bone (Gokhman et al. 2014; Smith et al. 2015), shedding light on how epigenetic changes could have related to physiological stress in the past and how these changes could alter bone plasticity and growth. Past immunological studies using ELISA to investigate antigens or antibodies of parasites that cause malaria and schistosomiasis, for example, have been critiqued (e.g., Sallares and Gomzi 2001), but biomolecular investigations have progressed to encompass analysis of cortisol levels in ancient hair samples that demonstrate individual experiences of physiological stress (Webb et al. 2009) and experimental work that will aid our understanding of inflammatory responses in past populations

(Crespo et al. 2016). Finally, advances in paleomicrobiology are providing insight into the human microbiome and enhancing dietary reconstruction through extraction of chemical compounds, aDNA, and microfossils from ancient dental calculus and archaeological coprolites (Buckley et al. 2014; Radini et al. 2017; Schnorr et al. 2016; Warinner and Lewis 2015; see also Velsko and Warinner in this issue), applications that will surely continue to expand in the coming several years.

Along with the concerns about demography and differential frailty in archaeological samples, there has been a new critical examination of the representativeness of institutionally housed skeletal samples. For example, bioarchaeologists are looking more closely at issues of racism, violence, and health disparities in documented and cadaveric skeletal samples (de la Cova 2010; Nystrom 2014, 2017). This recent research has revealed aspects of institutionalization and social marginalization historically and has triggered a renewed dialogue on the ethics and scientific use of anatomical collections both in the past and the present. This deep concern for how we study and represent the dead in bioarchaeological research is certainly part of the contemporary landscape of the field well beyond the passage of the Native American Graves Protection and Repatriation Act (NAGPRA) in the United States in 1990, and it forms a new “ethos” of bioarchaeology (Martin et al. 2013:23). Both in North America and globally (Márquez-Grant and Fibiger 2011), bioarchaeology is forging a new commitment to how we engage with repatriation (Kakaliouras 2012, 2017; Pérez 2010) and ethical practice with community stakeholders and the public (Martin et al. 2013:23–55; Roberts 2009:17–34; Turner and Andrushko 2011). While bioarchaeologists still have much work to do to go beyond consent with stakeholders to achieve a truly collaborative practice (Atalay 2006), this recent work demonstrates a new direction in the field toward a larger goal of community-engaged scholarship.

With its focus on criminal and humanitarian issues, forensic anthropology is deeply engaged with the public and local communities. Although forensic anthropology is a methodologically focused and applied specialty, there has been a movement in recent years to ally the practice with bioarchaeology more closely in order to bring a more holistic and anthropological approach to the field (e.g., Crossland and Joyce 2015). Undocumented border crossers, for example, are generally underprivileged people subjected to hardships or maltreatment that may result in death during their journeys (see Kuba 2012 for a recent review). Forensic anthropologists have begun applying bioarchaeological tools such as stable isotope analyses to determine area of origin or evaluate the frequency of skeletal stress indicators to identify

undocumented migrants (Beatrice and Soler 2016; see also review by Kuba 2012). Forensic anthropologists are particularly interested in the study of violence in the recent past and the present day. Because violence afflicts contemporary society, and the human capability for violence continues to capture public attention, a large amount of bioarchaeological research has been devoted to understanding violence in the past. Current bioarchaeological approaches to the study of interpersonal and structural violence (e.g., Harrod and Martin 2014; Knüsel and Smith 2014; Kurin 2016:127–153; Martin et al. 2012; Martin and Tegtmeier 2017; Nystrom 2014, 2017; Redfern 2017) thus are a vital contribution to our understanding of violence throughout human history and in today’s world.

Another trajectory that has driven contemporary research in bioarchaeology is a concern with the reconstruction of social identity in the past. Many contemporary bioarchaeologists have keenly engaged with social theory in their approach to identities based on gender, age, or health (Knudson and Stojanowski 2008, 2009). Theoretically groundbreaking work is grappling with the limitations of the binary nature of biological sex and the traditional use of heteronormative interpretations of gender roles from skeletal remains (Agarwal 2012; Geller 2005, 2009, 2017; Hollimon 2011; Sofaer 2006a). Similarly, life-course and embodiment perspectives continue to push our study of age and growing old in the past (Appleby 2010; Gowland 2009, 2015a). This type of research is part of the rapidly developing theoretical approach to viewing the skeleton as a form of material culture crafted through lived experience, which blurs the division of the biological and social body (Sofaer 2006b). Similar approaches are being taken with the interpretation of skeletal data from preadult skeletons in an attempt to understand the lives of children in the past (e.g., Halcrow and Tayles 2011; Littleton 2011; Thompson et al. 2014; Wheeler 2010; Wheeler et al. 2013). The effort to illuminate group and individual identity is also seen in the recent interest in the bioarchaeology of care (Tilley 2015; Tilley and Schrenk 2017), which considers aspects of illness and caregiving in the past.

A resurgence of research focused on individual identity and the lived experience through osteobiographic approaches pioneered by Frank Saul (1972; Saul and Saul 1989) has also occurred (Baadsgaard et al. 2011; Stodder and Palkovich 2012). This approach is not a move away from population-focused research, which is still very much the basis of contemporary bioarchaeology research. Instead, it is related to the increasing desire for more humanistic approaches in the field and the appreciation of what the lived experiences of individuals within a group can reveal to contextualize our understanding of the population-level responses to biological, cultural, and environmental

factors. A related approach is biohistory (e.g., Stojanowski and Duncan 2016), which involves the investigation of identified historical figures who are often well known, such as Richard III (Buckley et al. 2013; The Greyfriars Research Team with Maev Kennedy and Lin Foxhall 2015) or King Tutankhamun (e.g., Rühli and Ikram 2013). Individual-level research represented by osteobiography and biohistory often is best suited to engagement with students and the public so they can relate to these past people through their own experiences.

Bioarchaeology must incorporate the archaeological contextual analysis of sites and skeletal remains by integrating them within the landscape and through analysis of the spatial organization, grave styles, body position and orientation, grave inclusions, and the relationships to other sites and landmarks. More bioarchaeologists who focus on skeletal remains have begun to recognize that questions concerning identity, for instance, can only be answered fully by considering both archaeological and biological data. For example, intrasite biodistance studies that estimate the degree of relatedness among those interred have embraced spatial analysis to reconstruct cemetery structure and formation and to discern its underlying organizing principles that relate to grave placement, particularly in regard to biological relationships among the deceased. Such research may demonstrate kin-structured organization (e.g., Paul et al. 2013; Pilloud and Larsen 2011; Sciulli and Cook 2016) and permit insight into variation in health and diet within a community and even among families (e.g., Stojanowski 2013). Spatial analysis technology such as geographic information systems (GIS) is now commonly used in archaeological projects, including those focusing on sites containing human remains (e.g., Herrmann 2002; Wilhelmson and Dell'Unto 2015). Recent applications of GIS compare pathology and status within an analytic framework to investigate health and disease patterns in the past (Herrmann et al. 2014; Stojanowski 2013).

Consideration of taphonomic site formation processes and the effects of corpse treatment on the production of archaeological skeletal assemblages is becoming more common and provides new insights into mortuary behaviors in past communities, thereby enhancing our understanding of a community's perceptions of death, transformation, and memory (e.g., Geber et al. in this issue; Robb et al. 2015; Smith and Pérez Arias 2015; Weiss-Krejci 2011). GIS and three-dimensional photogrammetry are proving particularly useful in understanding how site formation factors and body processing (e.g., defleshing, cremation), curation of elements, the reuse of graves, and patterns of purposeful disturbance are linked to ongoing relationships between the living and the dead (e.g., Haddow and

Knüsel in this issue). The lived experiences of individuals embodied in their remains and the performed identities and experiences evidenced in mortuary contexts are instrumental in new approaches to investigating social inequality in the past. Quinn and Beck (2016), for example, propose that the degree of coherence or dissonance found across multiple social dimensions is indicative of social organization, and they present three cases studies that examine institutionalized inequality in prehistoric Europe.

While the preceding types of research are more integrative, much more multidisciplinary collaborative work, particularly research including archaeologists, bioarchaeologists, and others with differing areas of expertise, is needed to advance our understanding of the human experience. There are still too many situations in which the human remains are a low priority, even for projects involving excavation of ancient cemeteries (see Sheridan 2017), and many collections of human remains for which archaeological documentation is lacking for a variety of reasons, thus limiting research potential beyond the bones. Over the last several years, however, many projects have become increasingly collaborative endeavors. Projects may be directed by a bioarchaeologist overseeing a team with differing areas of expertise, have co-directorships of an archaeologist and a bioarchaeologist, integrate bioarchaeologists into both field and lab components of a project, or are partnerships on broad research projects involving previously excavated material that are enriched by cooperation (examples include, among many others, Baker 2016:191–193; Binder and Spencer 2014; Buzon et al. 2016; Carr and Case 2005; and Case and Carr 2008). Recent works on the archaeology of death and burial reflect such collaboration and are more inclusive of archaeological, biological, and cultural perspectives (see, e.g., the representation among chapters in Tarlow and Nilsson Stutz 2013 and Wrobel 2014). These trends are encouraging and point to more cooperative engagement in the future.

### **The Need for *Bioarchaeology International***

The field of bioarchaeology has flourished in the early twenty-first century, accounting for a significant proportion of recent tenure-track academic positions in anthropology in North America (Stojanowski and Duncan 2014:56) and in archaeology departments globally. Numerous graduate and senior researcher grants for bioarchaeological projects are awarded by the National Science Foundation and the Wenner-Gren Foundation for Anthropological Research in the United States, the Social Science and Humanities Research Council in Canada, the Wellcome Trust and the Leverhulme Trust in the UK, and many other

agencies around the world. In North America, bioarchaeologists constitute a substantial portion of the American Association of Physical Anthropologists (AAPA), the Canadian Association of Physical Anthropologists (CAPA), and the Society for American Archaeology (SAA). Bioarchaeology podium sessions have comprised a significant number of the Biological Anthropology Section sessions at the American Anthropological Association annual meetings in the past several years. Meetings of regional bioarchaeological associations in the United States, including the Midwest Bioarchaeology and Forensic Anthropology Association (BARFAA), the Western Bioarchaeology Group (WeBiG), and the Bioarchaeologists' Northeast Regional Dialogue (BNRD), are well attended. Organizations with a substantial focus on bioarchaeology also are prominent in other countries, such as the British Association for Biological Anthropology and Osteoarchaeology (BABAO).

Despite maturation of bioarchaeology as a field of inquiry and its tremendous growth, there is no dedicated, integrative peer-reviewed journal for this field as a whole. Established journals tend to focus on skeletal remains (e.g., *American Journal of Physical Anthropology*, *International Journal of Osteoarchaeology*, *International Journal of Paleopathology*), are archaeology outlets appropriate for articles emphasizing the mortuary context or ritual behavior (e.g., *American Antiquity*, *Antiquity*), or are more methodologically (e.g., *Journal of Archaeological Science*) or theoretically (e.g., *Journal of Archaeological Research*) oriented. Because these traditional divisions between biological and archaeological emphases and even between more theoretical and empirical research persist in our principal journals, integrative work often does not fit well within the scope of one type of journal or the other. Regional journals form another outlet for bioarchaeological research, yet these publications may not be consulted regularly by those working outside that area, hindering the exchange of ideas among scholars investigating related research questions or working in similar environmental or social contexts. Although edited volumes have been a major publication venue for bioarchaeologists since the 1990s, with bioarchaeology book series promulgated by the University Press of Florida, Cambridge University Press, and Springer (see Sheridan 2017 for a valuable summary table), current tenure and promotion criteria in North American and British institutions frequently devalue book chapters in comparison to peer-reviewed journal articles.

*Bioarchaeology International* provides a new outlet for rigorous peer-reviewed publication of substantive articles that will help unify this growing field and provide a global perspective. The overarching goal is to publish studies that are contextually and theoretically

informed and that explore the human condition and ways in which human remains and their funerary contexts can provide unique insight on variation, behavior, and lifestyle of past people and communities. Original research articles, brief reports, and invited commentary essays related to the study of archaeological human remains and mortuary sites will be published quarterly. Occasionally, *Bioarchaeology International* will publish thematic issues. Thematic issues may build upon conference symposia or arise anew. Our well-respected advisory and editorial board members work in seven different countries, helping recruit manuscripts and reviewers because the journal is intended to be global in both content and readership. To facilitate this international perspective, authors are asked to supply their abstracts in a language other than English. This requirement will improve the visibility of the published article, particularly in situations where the alternate-language abstract is that of the country where the author conducted the research or is employed. Publication of theoretical, topical, and data-oriented research spanning different regions and temporal periods will appeal to a broad range of scholars, students, and professionals in the fields of bioarchaeology, archaeology, biological/physical anthropology, anthropology, paleopathology, human biology, history, medicine, geography, and other related fields. Commentary pieces are intended to promote discussion among readers on current issues and themes in the field or to discuss new research directions that may advance the field. Letters to the editors in chief may be submitted to facilitate discussion or alert colleagues to new information concerning collections, methods, projects, and so forth. A feature that sets *Bioarchaeology International* apart is the professional copyediting of accepted manuscripts provided by the University of Florida Press.

Our first issue exemplifies the international reach of the journal. Authors are affiliated with institutions in six countries. The collected research articles include work in Sudan, Turkey, the UK, and Ireland, and our alternate-language abstracts in this issue are in four different languages—Arabic, French, German, and Spanish. The concern with archaeological context pervades the research articles in this issue and illustrates recent developments in bioarchaeology that integrate trends highlighted above in American, British, and French perspectives. For example, Sarah Schrader and Michele Buzon examine enthesal changes and accidental trauma in concert to help understand changes in activities and risk that may have occurred during the period of Egyptian colonization in the New Kingdom to the postcolonial era during which a new state developed in ancient Nubia. While at first glance this article may appear to be a typically skeletally focused contribution, the authors stress the



investigation of lived experiences of groups of people and the insight such studies provide into understanding population resilience during the imposition and subsequent collapse of a colonial empire.

Two articles in this issue explore burial treatment and taphonomy. Jonny Geber and colleagues and Scott Haddow and Christopher Knüsel discuss treatment of the dead by the living and the careful recording during excavation that allows the reconstruction of processes that resulted in the mixing of individuals, reuse of skeletal elements or graves, and the social meaning of these manipulations in very different contexts in Neolithic Ireland and Turkey. The juxtaposition of these articles raises points about information gained through restudy of assemblages excavated long ago (Geber et al.) and through careful stratigraphic analysis of skull retrieval and secondary burial afforded by thorough excavation records, 3D modeling of graves, and GIS spatial analysis (Haddow and Knüsel). These articles should be of interest to scholars investigating body treatment, secondary burial, and retention or reuse of skeletal elements from sites in different regions or periods. Additional discussion of the importance of site stratigraphy in bioarchaeological research is provided by Benjamin Penny-Mason in his study of use of the Harris Matrix and phasing of burials within cemeteries. He indicates the difficulty of reconstructing site stratigraphy from field records but provides evidence to show that it is preferable to undertake such time-consuming work than to group the burials together in one, often long, temporal span. His examples show the impact that lumping and splitting individuals from different phases of cemeteries excavated in the UK has on the interpretation of pathology within that skeletal assemblage. Although Penny-Mason's examples are specific to the UK, his findings are of interest to anyone investigating assemblages from cemetery sites, whether focusing on skeletons or grave architecture and artifacts. Understanding phases of use within a cemetery is integral to any investigation of ritual, identity, pathology, or change through time.

Finally, commentary on bioarchaeology of the oral microbiome transcends geography. This issue's invited essay by Irina Velsko and Christina Warinner highlights new advances in investigating the DNA and proteins of microbes found in dental calculus to gain information on human health and biology, human and pathogen co-evolution, and diet in past peoples.

Recommendations for handling and sampling dental calculus from the field to lab will promote future studies. We hope that the utility of investigations on the oral microbiome will spread by word of mouth!

## Conclusion

Contemporary bioarchaeology is a field with many arms—some focus their research on methodological and technical specialties of bony analysis, or carefully trace mortuary and burial context, while others interpret data with an infusion of social theory and narrative. These branches of the field are no longer disparate. Many of today's scholars are more at ease with, and seek to engage in, multiple modalities of inquiry. The current field is united in its commitment to understand the human experience within a contextual and ethical framework. We are pleased for *Bioarchaeology International* to represent this vision of the field and present a new forum to encompass this expanding and exciting field.

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La bioarchéologie est une discipline relativement jeune qui a pour objectif d'améliorer notre compréhension de la vie, de la mort et des interrelations entre les populations humaines passées à l'échelle du monde entier. Cette discipline est née de l'archéologie processuelle américaine et de l'anthropologie biologique dans les années 1960, et a émergé en tant qu'ostéo-archéologie humaine au Royaume-Uni. Aujourd'hui, la bioarchéologie est un champ d'étude dynamique et interdisciplinaire au croisement de l'anthropologie biologique, de l'archéologie et des

théories sociales. Elle cherche à appréhender les populations humaines passées en tenant compte du contexte biologique, culturel et environnemental. Cette discipline met l'accent non seulement sur l'étude des restes humains, mais également sur l'analyse et l'interprétation intégratives de ces données dans leur cadre archéologique, socioculturel, politique, et environnemental. L'intérêt croissant pour les recherches en bioarchéologie est à l'origine de la nécessité de créer un nouveau journal évalué par les pairs afin d'unifier et de faire progresser cette discipline dans le monde entier. Dans cette introduction à *Bioarchaeology International*, nous retraçons les origines de la discipline et les différentes "écoles" de bioarchéologie qui se sont développées et qui tendent maintenant à fusionner à mesure que la discipline mûrit. Nous décrivons ensuite l'ambition et les intentions de la revue, en soulignant l'adéquation des articles du premier numéro avec ces objectifs. Enfin, en tant que co-rédactrices en chef, nous décrivons notre vision des orientations actuelles et futures de la bioarchéologie. Avec cet aperçu de la discipline et du journal, nous souhaitons encourager la discussion et promouvoir les soumissions internationales. Nous espérons que *Bioarchaeology International* viendra renforcer cette discipline en plein essor et aidera à promouvoir l'intérêt scientifique et public pour notre recherche collective.

ملخص:

علم الآثار البيولوجي (علم آثار العظام البشرية القديمة) هو مجال في مهده نسبياً و يهدف الي تحسين مفهوم الحياة و الموت بالإضافة الي العلاقات الداخلية ما بين قدماء البشر حول العالم. نشأ العلم في ستينيات علم الآثار الحديث الأمريكي و علم دراسة الانسان البيولوجي كما ظهر في المملكة المتحدة باسم علم آثار العظام. يعتبر حالياً علم الآثار البيولوجي علم متجدد و مجال تداخله مع علوم الآثار، علم دراسة الانسان البيولوجي و النظرية الاجتماعية يهدف الي إظهار الشعوب القديمة في ظل ظروفهم البيولوجية و الثقافية و البيئية. لا يركز هذا العلم فقط علي دراسة البقايا البشرية بل التحليل المتكاملة و تفسير سياقاتها متضمنة الظروف الأثرية، الوسط الإجتماعي الثقافي و السياسي بالإضافة الي المحيط البيئي لهذه الجماعات. أدت الرغبة المتزايدة في بحوث علم الآثار البيولوجي الي ضرورة إيجاد مجلة جديدة تستند علي تقييم علمي للمساعدة في توحيد و تطور هذا العلم حول العالم. في هذه المقدمة لعلم الآثار البيولوجي العالمي نفتي أصول ميادين علم الآثار البيولوجي و تطور المدارس المختلفة التي ظهرت حالياً مع نضوج العلم. بعد ذلك نقوم بتوضيح الغرض و الأهداف من المجلة و تسليط بعض الضوء في المقام الأول علي كيفية مساهمة المقالات لتحقيق هذه الاهداف. و أخيراً نوضح رؤيتنا كمحررون للتوجهات الحالية و المستقبلية لعلم الآثار البيولوجي. و نرجوا بهذه النظرة العامة للعلم و المجلة إثراء النقاش و شجيع المشاركات العالمية. و نسعي هنا الي تعزيز مجال علم الآثار البيولوجي العالمي المتطور كما نأمل أن نساعد في التطور البحثي و الفائدة العامة من خلال أبحاثنا الجماعية.

La bioarqueología es un campo de estudio relativamente joven que tiene como objetivo mejorar nuestra comprensión de la vida, la muerte y las interrelaciones entre los humanos del pasado en todo el mundo. La disciplina surgió de la arqueología "procesual" y de la antropología biológica en los EE UU de los años 60, y surgió como osteoarqueología humana en el Reino Unido. Hoy en día, la bioarqueología es un campo de estudio vibrante e interdisciplinario que integra la antropología biológica, la arqueología y la teoría social para situar a las comunidades del pasado en sus contextos biológicos, culturales y ambientales. El campo enfatiza no sólo el estudio de los restos humanos, sino también la integración del análisis e interpretación de sus contextos, incluyendo el arqueológico, sociocultural y político, así como el ambiente en el que vivió la gente. El creciente interés en la investigación ha creado la necesidad de una nueva revista revisada por pares para ayudar a unificar y avanzar esta disciplina en todo el mundo. En esta introducción a *Bioarchaeology International*, trazamos los orígenes del campo y las diferentes "escuelas" de bioarqueología que se han desarrollado y ahora se están fusionando a medida que la disciplina ha madurado. Luego delineamos el propósito y objetivos de la revista, destacando cómo los artículos en la primera edición contribuyen a esos objetivos. Finalmente, como Co-Editores, describimos nuestra visión para las direcciones contemporáneas y futuras en la bioarqueología. Con esta visión general del campo y la revista, deseamos estimular el debate y promover las presentaciones de manuscritos internacionales. Nuestra intención es que *Bioarchaeology International* fortalezca este campo creciente y ayudar a promover el interés académico y público en nuestras investigaciones colectivas.

Bioarchäologie ist ein relativ junges Forschungsgebiet, das die Verbesserung unserer Verständnisse von Leben, Tod und den Verbindungen archäologischer Bevölkerungsgruppen weltweit miteinander zum Ziel hat. Die Disziplin erwuchs aus der nordamerikanischen prozessualen Archäologie und physischen Anthropologie der 1960er Jahre und entstand als Human-Osteoarchäologie in Grossbritannien. Heutzutage ist die Bioarchäologie ein lebendiges, interdisziplinäres Gebiet, das übergreifend die biologische Anthropologie, Archäologie und Sozialtheorie umfasst, um archäologische Bevölkerungen in ihren biologischen, kulturellen und ökologischen Rahmen zu stellen. Die Bioarchäologie beinhaltet nicht nur das Studium menschlicher Überreste, sondern auch die integrative Analyse und Interpretation der Lebensumstände, insbesondere des archäologischen, soziokulturellen und politischen Milieus und der Umwelt, in der die Menschen lebten. Dieses wachsende Interesse an der bioarchäologischen Forschung hat es notwendig gemacht eine neue Peer-Review-Fachzeitschrift zu erschaffen, die helfen soll die Disziplin weltweit zu vereinen und voranzutreiben. In diesem Einführungsartikel zu *Bioarchaeology International* verfolgen wir die Ursprünge und die verschiedenen „Schulen“ der Bioarchäologie, die sich entwickelt haben und die im Zuge der Weiterentwicklung der Disziplin verschmelzen. Desweiteren werden die Zwecke und Ziele der Fachzeitschrift definiert und es wird dargelegt, wie die Beiträge in dieser ersten

Ausgabe zu diesen Zielen beitragen. Abschliessend beschreiben wir als Cefredakteurinnen unsere Vision für zeitgenössische und zukünftige Forschungsrichtungen der Bioarchäologie. Mit diesem Überblick über die Disziplin und die Fachzeitschrift wollen wir Diskussionen anregen und internationale Beiträge fördern. Es ist unsere Absicht für *Bioarchaeology International* dieses wachsende Forschungsgebiet zu stärken und zu helfen, das wissenschaftliche und öffentliche Interesse in unsere gemeinschaftliche Forschung zu unterstützen.

生物考古學是一個比較年輕的領域，其目的是在改善我們對過去地球上人類的生活，死亡及相互間的關係作進一步的瞭解，這個學科是從1960年代美國流程考古學及生物考古學在英國演變而成的人類骨頭考古學。生物考古學現在是一個很活躍跨領域的學科，它蓋括生物考古人類學，考古學，以及社會理論，把過去人類在生物，文化，生活環境的種種情況放在應有的階位上，這個領域不僅僅強調研究人體的遺留物，並且對他們所存在的一切作整體的分析及解釋，這包括考古學上，社會文化上及政治情景上以及人類生活環境上的擺置。因為對生物考古學的研究，有愈來愈多的人有興趣，因此有必要發行一份新的期刊來刊登經過專家審核合格的文章，能這樣的話，對這個學科在全球性的融合及發展會有幫助。在介紹生物考古學這一期，我們追溯到這個領域的源頭以及不同生物考古學派的發展，現在這些學派，已融合成爲一個成熟的學科。然後我們把辦這個刊物的宗旨及目標描述出來並強調刊在這一期的每篇文章都符合我們刊物的目標。最後作為刊物的共同總編輯，我們對現代及未來生物考古學發展的方向也陳述了我們的視野。為這個領域及這刊物的總體觀，我們希望能鼓舞討論及促進國際間投稿。我們有意使國際生物考古學這刊物能加強這個領域的發展以及促進學者及大眾對我們共同研究產生興趣。

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