Bioarchaeology of the Near East, 11:7–28 (2017)

History of and recent trends in bioarcheological research in the Nile valley and the Levant

Jerome C. Rose
Anthropology Department, University of Arkansas,
Old Main 330, Fayetteville, Arkansas 72701 USA
email: jcrose@uark.edu

Abstract: *This history of bioarcheology in the Middle East is divided into six time periods. The earliest time frame of 1870 to 1929 witnessed the development of traditional skeletal studies with a focus on skulls and race, but also saw developments in statistics, age/sex determination, and the birth of paleopathology as an academic discipline. 1930 to 1962 saw slow improvements in the methods introduced earlier, but from 1963 to 1983 there was an explosion of books and articles introducing new analytical methods, the birth of bioarcheology, and a focus on dietary reconstruction and the origins of agriculture. There was a great increase in the sophistication of research methods as well as numerous technical innovations, but there was little to no change in theory beyond problems associated with ancient agriculture and growing settlement complexity. Despite growth in research and publications, the period from 1984 to 2006 was a period of technical maturation without innovation of theory, while archeology was incorporating many advances in social theory. Beginning in 2007, and continuing until today, bioarcheology has increasingly adopted much of the burgeoning archeological and social theory which produced another publication extravaganza on topics such as osteobiography, health and care of the sick, social identity, violence, and research employing ancient DNA. Speculation on the future of bioarcheology presented here follows these trends while focusing on the integration of social theory into the study of skeletons, and the great strides that will be made in understanding the co-evolution of humans, cultures, and pathogens. Further, the refocus on the individual is achieving remarkable results and the future will see the individuals reborn into social groups.*

Key words: Middle East; bioarcheology theory; osteology; teeth; skeletons

Introduction

My thinking and research concerning the Middle East have been shaped by my educational and research background and have greatly influenced my opinions of the history and future directions of bioarcheology presented here in this short personal essay. From graduate school in 1970 through my early academic research in 1995,

Received 24 April 2017; accepted 20 September 2017; published online 2 January 2018 on www.anthropology.uw.edu.pl

I excavated and analyzed skeletons in the USA from the Lower Mississippi Valley and adjacent regions (i.e. the states of Arkansas, Illinois, Louisiana, Oklahoma, and Texas). During this time I developed my skills, methods, and theoretical bioarcheology perspectives. I first visited Egypt in 1989 when I was invited to give an overview of dental anthropology at a workshop titled "The Bioanthropological Sciences in Egypt: An Introductory Seminar" held at the Kasr el Einy Faculty of Medicine, Cairo University. From that time forward I transferred my research efforts toward the excavation and analysis of skeletons from Egypt and Jordan. However, my American education and research experience colored all of my research in the Middle East and consequently this essay is a personal perspective on the development of bioarcheology. Because my own research has been confined to Jordan and Egypt leaving me with little background in the rest of the Middle East I refer readers to recent histories of paleopathology and bioarcheology in the southern Levant (Hershkovitz 2012; Perry 2012a; Sheridan 2017), Mesopotamia (Sołtysiak 2006), and Egypt (Baker & Judd 2012) for more detailed coverage and bibliographies.

I divide my history into six time periods ending each segment where I perceive that the direction of research had changed, significant publications had appeared with new syntheses, or in some instances when the number of publications greatly increased: 1870-1929; 1930-1962; 1963-1983; 1984-2006; 2007-2016; and future directions. The study of ancient mummies from the greater Middle East is not included in this essay because this field followed its own historical pathway beginning with the early introduction of multidisciplinary research by Margaret Murray in 1910, through many descriptive studies of Egyptian mummies (e.g., Smith & Dawson 1924) to the adoption of modern technology and interdisciplinary approaches (e.g., Aufderheide 2003; David 2008; Dodson & Ikram 1998).

1870–1929

My first designated phase of osteological research is characterized by a descriptive and typological approach with archeological reports containing descriptions of skeletons providing information on age, sex, stature, skeletal and dental pathology, and race from Egypt (e.g., Derry 1915); Iraq (e.g., Buxton & Rice 1924; Keith 1927); Palestine (e.g., Macalister 1911); Lebanon (e.g., Chantre 1894); and Syria (e.g. Blake 1872; Chantre 1895). The most significant single event motivating an increase in skeletal studies was the 1912 modification of the Aswan dam, first built in 1889, which spurred three years (1907–1911) of archeological work excavating and analyzing thousands of skeletons (Derry 1909; Reisner et al. 1910; Smith & Wood-Jones 1910). In addition to the publication of osteological and paleopathological data these salvage projects provided training opportunities for a number of anatomists. Subsequent increases in height of the dam produced another flurry of excavation and de-

scriptive skeletal studies (e.g., Batrawi 1935). Dam construction along the Nile and eventually other river systems in the Middle East have played a very important role in the development of bioarcheological research from 1907 until today. During this time numerous physicians and anatomists published paleopathological descriptions (e.g., Fouquet 1896; Ruffer 1913, 1919). Ruffer's work was synthesized, edited, and published posthumously by Roy L. Moodie (1918) who subsequently included much of Ruffer's work in the first American textbook of paleopathology (Moodie 1923). Despite the descriptive nature of these skeletal studies one of the first stirrings of paleoepidemiology and the idea that disease could alter the history of ancient civilizations was put forth by Jones (1907) who considered the role that malaria played in the trajectory of ancient Greece.

One prominent focus of research was to employ cranial typology in assigning racial categories to individual skeletons from sites such as Sidon (Chantre 1894) in modern-day Lebanon to more extensive regional summaries such as the races of early Egypt (Petrie 1901). Early in his career as a statistician, Karl Pearson (1894) proposed to develop a mathematical model of human evolution and to achieve this he amassed and studied large collections of human crania from throughout the world including the Middle East. Another early statistician, Jan Czekanowski (1907), developed a taxonomic method for racial analysis that influenced the racial analysis of crania, not only in Egypt (e.g., Strouhal 1971), but elsewhere for many years (see Czekanowski 1962).

1930–1962

The period from 1930 to 1962 was one of slow change and maturation of both osteological analytical methods and the interpretation of Middle Eastern skeletons. New methods for age determination from the pelvis were developed (Todd 1921); refinements in stature calculation were made (e.g., Trotter & Gleser 1958); and the first manuals for skeletal analysis were being published (e.g., Comas 1957; Krogman 1955 among many others). Young osteologists were being brought to examine skeletons excavated throughout the Middle East such as Angel (1939); Cave (1939); Dzierżykray-Rogalski (1958); and Wierciński (1958). In addition to foreign osteologists young native scholars began studying the skeletons of their own countries such as Kansu (1937) and Şenyürek (1941) in Turkey, and Nathan (1961) in Israel. Paleopathology continued to focus on descriptions of individual cases such as tumors (e.g., Gardner & Urquhart 1930; Salama & Hilmy 1950) and surgery (e.g., Parry 1936), but a large increase in the total number of publications coming from everywhere in the region is notable. Despite the descriptive nature of these analyses there were hints of an epidemiological approach which becomes prominent during the next phase of research. For example, Cave (1939) examined all the evidence for the presence of tuberculosis in the published literature and concluded that this disease was found throughout

the Dynastic Ages of Egypt, but remained unknown during the Predynastic. Slowly researchers were beginning to look for changes in the frequency of diseases over time and attempting to find relationships between these changes and the temporal paths of cultures and civilizations. Despite some changes in theoretical approaches to disease, most skeletal analyses continued to focus upon cranial metrics and typology (e.g., Henckel 1930; Krogman 1937; Şenyürek 1941) with continued use of differences in cranial shape to postulate migrations and explain shifts in the archeological record (e.g., Derry 1956; Petrie 1934).

1963–1983

The next segment of time from 1963 to 1983 saw the birth and maturation of what is now termed bioarcheology. Toward the end of the previous chronological segment there was a considerable increase in the number of young osteologists and paleopathologists whose research and publication productivity created a stimulating research environment for the entire field. I chose this beginning date because there was an increased stream of synthetic paleopathology volumes (e.g., Acsadi & Nemeskeri 1970; Brothwell & Sandison 1967; Jarcho 1966; Wells 1964). A major step forward in interpreting ancient skeletons within their cultural and ecological contexts was Angel's "Porotic hyperostosis, anemias, malarias, and marshes in the prehistoric eastern Mediterranean" (1966) followed by his "Paleoecology, paleodemography and health" (1975). A major push for modification of the theoretical approaches of osteological and paleopathological research came from the development of British and American processual archaeology with its focus upon explanation and hypotheses testing. Consequently archaeological theory was the vehicle that gave birth to the term and perspective of "bioarcheology" (e.g., Buikstra 1977). One question taken up by archeologists was the origin and spread of agriculture which required information about what was eaten in the past and, in particular, the identification of cultigens and animal domesticates. Answers to the archeologists' questions about diet were to be found in the ancient skeletons of the Middle East. This focus on diet by the archeologists provided the stimulus for developing and refining methods that employed skeletons to detect dietary changes over time and space using changes in dental disease (Greene 1972; Hillson 1979); tooth wear (P. Smith 1972); and trace element variation (Sillen & Kavanagh 1982; Schoeninger 1981) among other indicators.

The construction of the Aswan New High Dam (1960–1971) provided opportunity and funds for archeological teams from many nations to survey and excavate the many significant archeological sites and cemeteries scheduled for flooding. Many of these multidisciplinary teams incorporated osteologists to excavate and analyze the skeletons. Once again the Aswan Dam produced large numbers of skeletons and radically changed the pace of analysis and publication of Nile valley skeletons. Many

young osteologists and paleopathologists began work in Egypt during this interval (e.g., Armelagos 1969; Leek 1972; Promińska 1966). In addition to foreign researchers the number of native osteologists increased, for example Özbek (1974), Haas (1963), Nathan (Nathan & Hass 1966), P. Smith (1972), Arensburg (1973; Rak et al. 1976), and Hershkovitz (1981). This increased activity and number of researchers changed the theoretical directions of the field. One significant event was the conference and subsequent publication of "Population Biology of the Ancient Egyptians"; (Brothwell & Chiarelli 1972) which brought together 46 authors and co-authors who contributed 34 chapters. This was one of first major conferences that incorporated a diversity of analytical methods and theoretical approaches contributed by researchers of different nationalities.

1984–2006

From 1984 to 2006 bioarcheology experienced a maturation phase with rapid introduction of new technologies and methods. The initiating date is marked by the seminal publication of "Paleopathology at the Origins of Agriculture" by Cohen and Armelagos (1984) which attempted to document the impact of agriculture using skeletal indicators by charging teams of researchers with the task of synthesizing regional skeletal data that spanned this subsistence transition. The teams were asked to employ all available methods including enamel hypoplasias, stature, skeletal infections, and dental decay among others. Specific to the Middle East, Angel (1984) discussed changes in health in the eastern Mediterranean; Martin and colleagues (1984) looked at the transition in Sudanese Nubia; P. Smith and coworkers (1984) documented archeological and skeletal indicators of this transition in the Levant; while Rathbun (1984) summarized changes in Iran and Iraq. Throughout this phase the focus on dietary and nutritional reconstruction led to the development and continuous refinement of methods that identified changes in diet and nutrition, as well as documented the biological consequences associated with changes in settlement pattern and social organization. This time also saw numerous syntheses of newly developed and refined methods including both authored and edited volumes (e.g., Aufderheide et al. 1998; İşcan & Kennedy 1989; Krogman & İşcan 1986; Ortner 2003; Saunders & Katzenberg 1992).

Looking back on this time segment critically it appears that there were few significant changes in the bioarcheological approach other than increased sophistication of methods and technological advances. There were only sparse advances in theory aside from the problem-solving approaches addressing the origins of agriculture. Goldstein (2006) makes the most critical comments by noting that little collaboration developed between bioarcheologists and archeologists, and that the bioarcheologists treated the archeological record simplistically and ignored recent developments in archeological

method and theory. Meanwhile the development of archeological theory expanded into many areas such as burial customs (Grajetski 2003); mortuary studies and society (Richards 2005); demography (Chamberlain 2006); the human body in the archeological record (Rautman 2000); social behavior and symbolic transitions (Wenke & Olszewski 2007); power symbolism and political identity (Wengrow 2006); economic systems (Pryor 2005; Manning & Morris 2007); development of complex societies (Rothman 2004); urbanization (Bard 1997); and climate change and social response (Rosen 2007) with many focusing on the greater Middle East. However, there are two significant publications that provided a unique integration of method and theory that in my opinion began moving bioarcheology into new directions. Greenblatt and Spigelman (2003) integrated analysis of archeology, ecology, and infectious disease into an approach to understanding the human past. In a volume edited by Little (2007) 12 scholars from a diversity of disciplines from archeology to epidemiology focused upon identifying the plague of Justinian (541–750 A.D.) as bubonic plague which was subsequently confirmed by ancient DNA analysis that found the DNA of *Yersinia pestis* in skeletal remains from this time (Wagner et al. 2014).

2007–2016

I chose 2007 as the beginning of theoretical changes in bioarcheology because from this date forward there were many stirrings of developing bioarcheological theory. The founding of a new journal titled "Bioarcheology of the Near East" (University of Warsaw) and the publication of "Performing Death: Social Analysis of Funerary Traditions in the Ancient Near East and Mediterranean" (Laneri 2007) made this a watershed year. From here forward many bioarcheologists working in the Middle East began incorporating theoretical approaches from archeology and the social sciences into their research and analysis of human skeletons within their archeological contexts. In contrast to the previous period when Goldstein (2006) noted little collaboration between archeologists and bioarcheologists, more research began taking an integrated approach. In addition to the theoretical stimulation of archeologists, the excavation of large numbers of skeletons in Sudanese Nubia also made a significant contribution. The Sudanese-Nubian dam projects beginning in 2004 provided numerous opportunities for archeologists and bioarcheologists to work together excavating and analyzing large numbers of skeletons and incorporating these developing theoretical approaches into their research designs (e.g., Buzon 2008; Buzon et al. 2016). The influence of dam building along the Nile on the entire history of bioarcheology cannot be underestimated.

Publication of numerous edited volumes indicate a firm commitment to these new theoretical directions in bioarcheology of the Middle East and elsewhere. The founding theme of the previous period, the transition to agriculture remained a cen-

tral focus but was incorporating new methods and theoretical approaches. For example, Pinhasi and Stock's (2011) edited volume on the transition to agriculture includes chapters on subsistence transitions, body size and biomechanics, genetic variation and paleodemography. Area specific chapters include discussion of biomechanics and the agricultural transition in the Nile valley (Stock et al. 2011) and paleodemography of the southern Levant (Eshed & Galili 2011). The edited volume titled "Breathing Life into the Evidence of Death: Contemporary Approaches to Bioarchaeology" (Baadsgaard et al. 2012) emphasizes the integration of bioarcheology and archeology using the concepts of embodiment; cultural specific human life course experience; and using the body and material artifacts conjointly to interrogate the subject. Three chapters deal specifically with the Middle East including nuanced interpretations of mortuary practices in Syria (Pollock 2012); social relationships expressed in the physical body and dress in Iraq (Baadsgaard 2012); and personhood and osteobiography in Syria (Boutin 2012). Another edited work The "Bioarchaeology of Violence" (Martin & Harrod 2012) deals with the social and cultural implications of violence and includes a chapter focused on the southern Levant (Montgomery & Perry 2012). The year 2012 also saw publication of "Bioarchaeology and Behavior: the People of the Ancient Near East" (Perry 2012b) where the eight chapters focused on many theoretical topics from burial customs to isotope analysis and on to activity patterns. Going beyond description of mortuary patterns the publication "Remembering the Dead in the Ancient Near East" (Porter & Boutin 2014) integrates mortuary archeology and bioarcheology and contains chapters on individual and group cultural identity, identity and memory, abandoned memories, and individual disability. A recent volume concerning commingled human remains (Osterholtz 2016) has a chapter that integrates changes in burial patterns with the life-course of houses in Neolithic Turkey (Haddow et al. 2016); changes in age, identity and mortuary patterns that occur with epidemic disease during classical times in northern Turkey (Marklein & Fox 2016); and another linking health and marriage patterns during the Bronze Age of the UAE (Baustian & Anderson 2016). These previously mentioned edited volumes demonstrate that as bioarcheology incorporates social and archeological theory into its research designs, new approaches are also being produced by bioarcheologists working in the Middle East.

The literature demonstrates that refined methods and expanded theoretical interpretations are rapidly changing the nature of bioarcheological research in general and specifically in the Middle East. This progress is illustrated by examining a sampling of publications that consider the following themes: stable isotope and trace element analysis; diet reconstruction; paleopathology; biomechanics; paleodemography; biological affinity; mortuary practices; gender; identity and memory; and ancient DNA. Stable isotope and trace element analysis are no longer simply used to determine the

presence or absence of domesticated foods, but now incorporate concepts of social behavior, life course history, political power, and cultural interactions. Buzon and Simonetti (2013) used strontium isotope analysis of human and faunal remains to identify and interpret temporal changes in the sociopolitical interactions of Egyptians and Nubians during the New Kingdom and Nabatan periods. Pearson et al. (2015) identified dietary changes with age from childhood to old adult at Çatalhöyük which demonstrates that age-related dietary variation was reinforcing social identity. Sheridan and Gregoricka (2015) used strontium isotopes to verify the historical assertion of pilgrimage for a Byzantine monastery in Israel, while an earlier study using stable carbon and nitrogen isotopes indicated meat consumption contrary to literary texts (Gregoricka & Sheridan 2013). While we see more sophisticated theoretical use of these chemical analyses, they are still employed in a straight forward demonstration that subsistence patterns changed with climate in ancient Jordan (Sandias & Müldner 2015).

The interpretation of trauma has gone well beyond simple comparisons of frequencies to using the trauma patterns for interpretation and reconstruction of social behavior. For example, a decline in traumatic injuries between the Egyptian Middle Kingdom and the New Kingdom's conquest/occupation of Nubia reflects a change in Egypt's strategy from one of military conquest to political negotiation (Buzon & Richmond 2007). Interpretation of trauma to the cranium, ulna, and radius at the Early Bronze Age site of Bab edh-Dhra' explores the relationship of interpersonal violence and accidents associated with the built environment of multilevel housing, population density, climate change, and competition for scarce resources (Gasperetti & Sheridan 2013). The pattern of trauma and healing within the context of the sociocultural environment enabled Wheeler et al. (2013) to document the earliest case of child abuse in Egypt. Similarly using the fracture and healing pattern of probable weapon wounds within the cultural context of the burial enabled Dabbs and Schaffer (2008) to establish the individual's identity as a probable soldier differentiating him from the 430 other individuals excavated at the site of Amarna, Egypt. More traditional lines of enquiry continue to examine changes in trauma patterns along the agricultural transition in the Levant (Eshed et al. 2010).

Biomechanical analysis employing body size and long bone rigidity of the femora and humeri to reconstruct levels of individual activity has demonstrated a decline and then recovery of body size, reduction in levels of individual activity, and changes in sexual division of labor across the transition from hunting and gathering to agriculture along the Nile Valley (Stock et al. 2011). Biomechanical analyses, as illustrated here, have become more nuanced in their approach to recognizing the complex nature of subsistence change rather than as, in the past, simply establishing that change had occurred. This more sophisticated approach is seen in a study of the transition in

food production which uses biomechanics to show reduction in physical stress and mobility from the Natufian to the PPN in the southern Levant (May & Ruff 2016).

The interpretation of mortuary practices and patterns has also incorporated new theoretical perspectives and seeks answers to both old and new questions. Combining concepts of identity with the length of time after death that heads were removed from the bodies was established using the pattern of cut marks on the skeletons, providing a more nuanced interpretation of PPNA mortuary patterns in the Levant (Kanjou et al. 2015). Regularity of a mortuary pattern and differences in patterns between regional cultures have been used to define cultural boundaries. Pollock (2012) employed the diversity of mortuary patterns within the Halaf period of Turkey, Syria, and Iraq to capture the group's attitude towards the future in respect to both their past and ancestors. Even seemingly traditional approaches to mortuary analysis are becoming more than just seeking explanation for changes over time. For example, Al-Shorman and Khwaileh (2011) interpret the variability in mortuary customs over an extended period of time in Jordan as being prompted by an intertwining of both sociopolitical and environmental factors. Variations in skeletal phenotype that do not match burial locations at Neolithic Çatalhöyük indicated that residence and kinship were not fixed by biological relationships, but were a product of a fluid social structure (Pilloud & Larsen 2011). Eshed & Galili (2011) point out that mortuary variations in mortality profiles by cultural affiliation and sex were impacted by many specific economic, social, and cultural factors and they go on to conclude that it is necessary to understand regional variation before pan-regional patterns can be interpreted within the context of the transition to agriculture.

The concepts of gender and identity are currently being normalized as indicated, for example, by the 2016 special issue of "Near Eastern Archaeology" (vol. 79 issue 3) with its 10 articles devoted to the subject. However, only two of these articles employed sex determinations made from the skeletal remains, and only one goes beyond sex determination to consider workload, health, and demography within the context of the built environment (Cifarelli 2016). Peterson (2010) employed skeletons within their mortuary contexts to consider gender reconstructions and relations in the southern Levant. Multiple sources of evidence were combined to envision a more nuanced picture of gender at Çatalhöyük (Bolger 2010). The concepts of memory and identity were employed to understand the use of human skulls during public rituals in the Levant (Kuijt et al. 2008). The previously mentioned authors and many others have made tremendous strides in employing refined methods that incorporate social theory, and also working collaboratively with archeological colleagues. Further, these achievements are being employed synthetically to reconstruct life in the ancient Middle East. As just one example, the multidisciplinary team examining the skeletons at Neolithic Çatalhöyük report complex interpretation such as employing demography,

diet over the life course, and biological relatedness to reconstruct residence patterns; go on to employ biomechanics and paleopathology to establish changes in mobility and gender roles; and employ multiple indicators of stress to assess quality of life (Larsen at al. 2015).

Future prospects and directions

I have chosen four areas for speculation on the future prospects and directions of bioarcheology: bibliography and meta-analyses; ancient DNA; social theory; and bioarcheology of the individual. I refer the reader to Sheridan (2017) for alternative ideas and a comprehensive bibliography.

In the future bioarcheology is going to move into arenas of research that require access to data from skeletons distributed over long spans of time and large areas of geography. Much of this research will begin with meta-analyses utilizing an extensive and diverse literature such as these two examples: analysis of changes in violent trauma over time in Mesopotamia (Sołtysiak 2017); and the potential appearance and spread of malaria in ancient Egypt (Smith-Guzmán 2015). Consequently, access to skeletal data from the published literature, unpublished manuscripts, and databanks is becoming more important than ever. Knowledge of both past and ongoing research is acquired through each scholar's education, subsequent research, attendance at professional conferences, interaction with colleagues at various research centers located throughout the Middle East, and reading the literature as it is published. Because of the interdisciplinary nature of our field, bioarcheologists are somewhat at a disadvantage, in comparison to colleagues in other disciplines, because they must not only keep abreast of their own specialties by attending their own professional conferences, but must also attend multiple professional meetings of other specialists (e.g., archeologists). In my particular case there is the annual meeting of the Paleopathology Association in North America (with additional annual meetings alternating between Europe and South America), the American Association of Physical Anthropologists, the American Research Center in Egypt annual meeting, and the annual meeting of the American Schools of Oriental Research. There are both bioarcheologists and archeologists giving papers relevant to my particular research at each of these conferences. This does not take into account the professional meetings in Europe and the Middle East such as the International Congress of Egyptologists and Origins – International Conference on Predynastic and Early Dynastic Egypt to name just two. The multiplicity of relevant meetings makes it difficult to keep up with colleagues and their research. Further, keeping track of all the publications concerning skeletal studies is hampered by the large variety of publication venues ranging from archeology to medical and dental journals. Bibliographies focused on bioarcheology are useful (Rose et al. 1996), but quickly become out-of-date and subsequent updates also soon

fall behind (Sabbahy 2012). Web based sources such as the Online Egyptological Bibliography hosted by the Griffith Institute, University of Oxford, are available, but also depend upon continuous updating.

Over the past few years electronic resources have blossomed and they will continue to advance at great speed. Google Scholar is just one of several resources available. As just one example of the great changes in bibliographical research provided by electronic resources, I was able to confirm the possibility of a relationship between eating dates and dental decay in ancient Egypt by identifying and obtaining articles demonstrating this relationship in modern Saudi Arabia in less than an hour while never leaving my office rather than the days and weeks this task would have taken in the past (Al-Malik et al. 2001; Salako & Al-Bagieh 1994; Wyne & Khan 1995). Successful searches of the older literature frequently provides access to the complete text found in university library or publishers's archives (e.g., Fouquet 1896; Moodie 1923; Murray 1910). Weaknesses yet remain in the use of online searches especially finding publications written in various languages. This can be partially overcome by skilled use of Google Scholar search parameters and familiarity with the terminology used by various nationalities working in the area of interest. In addition, reference librarians are skilled in designing custom search engines that can access all web resources including the curriculum vitae of scholars posted on university websites and the proceedings of professional meetings (Stephen Perry, personal communication, 2016). Another avenue for researching specific information is the increasing number of Facebook groups devoted to specific topics such as the "paleopathology group" with 4,555 members who post recent discoveries and initiate discussions of diagnosis. All of these online resources will continue to develop rapidly and become more user-friendly.

Ancient DNA analyses have recently confirmed diagnoses originally made using traditional paleopathology techniques such as in the case of tuberculosis (Crubézy et al. 1998) and to identify diseases not observable by traditional paleopathology methods, such as malaria (Hawass et al. 2010). Ancient DNA has also been used to confirm the cause of epidemics reconstructed using a multidisciplinary approach (Little 2007; Wagner et al. 2014). Calculus taken from teeth offers the microbiological/biochemical equivalent of an archeological site. In one recent example ancient DNA and protein analysis identified specific foods eaten by the individual such as pig/boar, bread wheat, and dairy products as a byproduct of reconstructing the ancient oral microbiome ecology (Warinner et al. 2014). Ancient DNA analysis was used to identify changes in the microbiology of the mouth and explained the complex interaction between changes in human diet, oral microbiology, and dental disease over time (Adler et al. 2013). They sampled teeth ranging in time and subsistence patterns from hunter gatherer Mesolithic to modern industrial diets and demonstrated that

a great decline in oral microbial diversity occurred in the modern industrial samples with a great increase in *Streptococcus mutans*, the cause of rampant dental decay associated with modern industrial diets containing refined grains and sugar. Both of these studies show the use of complex technology to identify specific food items and oral microbes, and then proceed to consider the complex interaction of humans, culture, oral micro-ecology, and the co-evolution of both human and microbiological ecologies. This technical capability when combined with the developing social theoretical perspectives promises a great future for bioarcheological research and the potential to better understand the complexities and causes of the of ebb and flow of cultures and empires across the complex Middle East landscape.

Archeologists working in the greater Middle East are increasing their efforts to incorporate advances in archeological and social theory from all areas of academia. Expansion of archeological theory has been increasing at a greater rate during the recent past. Perusing any archeology journal you will likely find concerns with socioeconomic change; transition to imperial capital from city state; a change to more centralized decision-making; or obtain an understanding of economic changes (Stone & Zimansky 2016:258). The literature demonstrates that archeologists are examining both the individual and social groups interacting at the ancient sites they are excavating. It is anticipated that in the future the human remains encountered will be considered an important data source rather than a hindrance to excavation and research, such as the burials in room seven at Ur that "slowed our work and prevented us from getting below the Isin-Larsa material" (Stone & Zimansky 2016:254).

Bioarcheologists are freely incorporating these new theoretical social concepts and merging them with the full range of advancing biological theory. Possibly for the first time the skeletons will become "persons" who are embodied actors on the archeological stages. It is easy to find this ongoing process of theoretical advancement in all regions of the Middle East. For example, Schrader (2015), working in the Sudan "investigates the skeletal embodiment of social inequality"; in Israel Gregoricka et al. (2017) takes the "opportunity to develop detailed dietary life histories"; and in Turkey Larsen et al. (2015) "characterize patterns of life conditions at the community level". Bioarcheologists have widely embraced these new developments as evidenced by the initiation of a new book series by Springer International Publishing, edited by Debra Martin, and titled "Bioarchaeology and Social Theory."

The birth of bioarcheology was characterized by moving from the individualistic descriptive approach to focus on an entire excavated skeletal sample, and interpreting the data within the concepts of culture, disease and environment from a group perspective (Armelagos 1969). Bioarcheology is running full circle and has most recently been achieving considerable success with a return to the individual level with life course history, concepts of personhood, gender, and osteobiography. As ever ad-

vancing technology and theoretical perspectives enable us to more fully understand the individual, the time will come again for a sophisticated grouping of these individual biographies into osteo-archeo-ethnography. The next decade of bioarcheological research in the Middle East promises to be extremely exciting, and even more so than the period of the 1970s.

Acknowledgements

I am grateful to the Polish Centre of Mediterranean Archaeology and the Institute of Archaeology of the University of Warsaw for their invitation to present my ideas on the history of bioarcheology at their conference entitled "Research on human remains from Polish excavations in Africa and the Near East" that eventually resulted in this short review essay. I thank Brenda Baker, Clark Larsen, Megan Perry, and especially Sue Sheridan for sharing with me their ideas, publications, and especially papers in press. They shaped my thinking, but all errors and misunderstandings in this essay are mine alone. My thanks to the reviewers who made many critical suggestions.

References

Acsadi G., Nemeskeri J. (1970), *History of human life span and mortality*, Budapest: Akademiai Kiado.

Adler C.J., Dobney K., Weyrich L.S., Kaidonis J., Walker A.W., Haak W., Bradshaw C.J., Townsend G., Sołtysiak A., Alt K.W., Parkhill J. (2013), *Sequencing ancient calcified dental plaque shows changes in oral microbiota with dietary shifts of the Neolithic and Industrial revolutions*, Nature Genetics 45(4):450-455.

Al-Malik M.I., Holt R.D., Bedi R. (2001), *The relationship between erosion, caries and rampant caries and dietary habits in preschool children in Saudi Arabia*, International Journal of Paediatric Dentistry 11(6):430-439.

Al-Shorman A., Khwaileh A. (2011), *Burial practices in Jordan from the Natufians to the Persians*, Estonian Journal of Archaeology 15(2):88-108.

Angel J.L. (1939), *The Babaköy skeleton*, Archiv für Orientforschung 13(1-2):28-32.

Angel J.L. (1966), *Porotic hyperostosis, anemias, malarias, and marshes in the prehistoric eastern Mediterranean*, Science 153:760-763.

Angel J.L. (1975), *Paleoecology, paleodemography and health* [in:] "Population, ecology, and social evolution", S. Polgar (ed.), The Hague: Mouton Publishers, pp. 167-190.

Angel J.L. (1984), *Health as a crucial factor in the changes from hunting to developed farming in the eastern Mediterranean* [in:] "Paleopathology at the origins of agriculture", M. Cohen, J. Armelagos (eds.), New York: Academic Press, pp. 51-74.

Arensburg B. (1973), *The people in the land of Israel from the Epipaleolithic to present times: A study based on their skeletal remains*, unpublished PhD thesis, Tel-Aviv University, Israel.

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

Aufderheide A.C. (2003), *The scientific study of mummies*, Cambridge: Cambridge University Press.

Aufderheide A.C., Rodríguez-Martín C., Langsjoen O. (1998), *The Cambridge encyclopedia of human paleopathology*, Cambridge: Cambridge University Press.

Baadsgaard A. (2012), *Mortuary dress as material culture: A case study from the Royal Cemetery of Ur* [in:] "Breathing new life into the evidence of death: Contemporary approaches to bioarchaeology", A. Baadsgaard, A.T. Boutin, J.E. Buikstra (eds.), Santa Fe: School for Advanced Research Press, pp. 179-200.

Baadsgaard A., Boutin A.T., Buikstra, J.E. (2012), *Breathing new life into the evidence of death: Contemporary approaches to bioarchaeology*, Santa Fe: School for Advanced Research Press.

Baker B.J., Judd M. (2012), *Development of paleopathology in the Nile valley* [in:] "The global history of paleopathology: Pioneers and prospects", J.E. Buikstra, C. Roberts (eds.), Oxford: Oxford University Press, pp. 209-234.

Bard K.A. (1997), *Urbanism and the rise of complex society and the early state in Egypt* [in:] "Emergence and change in early urban societies", L. Manzanilla (ed.), New York: Springer, pp. 59-86.

Batrawi A.M. (1935), *Report on the human remains*, Cairo: Service des antiquites de l'Egypte.

Baustian K., Anderson C. (2016), *Linking health and marriage practices among commingled assemblages: A case study from Bronze Age Tell Abraq, UAE* [in:] "Theoretical approaches to analysis and interpretation of commingled human remains", A.J. Osterholtz (ed.), New York: Springer International Publishing, pp. 207-218.

Blake C.C. (1872), *Notes on human remains from Palmyra*, Journal of the Anthropological Institute of Great Britain and Ireland 1:312-320.

Bolger D. (2010), *The dynamics of gender in early agricultural societies of the Near East*, Signs: Journal of Women in Culture and Society 35(2):503-531.

Boutin A.T. (2012), *Crafting a bioarchaeology of personhood: Osteobiographical narratives from Alalakh* [in:] "Breathing new life into the evidence of death: Contemporary approaches to bioarchaeology", A. Baadsgaard, A.T. Boutin, J.E. Buikstra (eds.), Santa Fe: School for Advanced Research Press, pp. 109-133.

Brothwell D.R., Sandison A.T. (1967), *Disease in Antiquity*, Springfield: Charles C. Thomas.

Brothwell D.R., Chiarelli B.A. (1972), *Population biology of the ancient Egyptians*, New York: Academic Press.

Buikstra J.E. (1977), *Biocultural dimensions of archeological study: a regional perspective* [in:] "Biocultural adaptation in prehistoric America", R.L. Blakely (ed.), Athens GA: Southern Anthropological Society, pp. 67-84.

Buxton L.H.D., Rice D.T. (1924), *On the human remains excavated at Kish*, Excavations at Kish 1:115-125.

Buzon M.R. (2008), *A bioarchaeological perspective on Egyptian colonialism in Nubia during the New Kingdom*, Journal of Egyptian Archaeology 94:165-181.

Buzon M.R., Richman R. (2007), *Traumatic injuries and imperialism: The effects of Egyptian colonial strategies at Tombos in Upper Nubia*, American Journal of Physical Anthropology 133(2):783-791.

Buzon M.R., Simonetti A. (2013), *Strontium isotope ($^{87}Sr/^{86}Sr$) variability 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.

Buzon M.R., Smith S.T., Simonetti A. (2016), *Entanglement and the formation of the ancient Nubian Napatan State*, American Anthropologist 118(2):284-300.

Cave A.J.E. (1939), *The evidence for the incidence of tuberculosis in ancient Egypt*, British Journal of Tuberculosis and Diseases of the Chest 33:142-152.

Chamberlain A.T. (2006), *Demography in archaeology*, Cambridge: Cambridge University Press.

Chantre E. (1894), *Crâne de la nécropole de Sidon*, Bulletin de la Société d'Anthropologie de Lyon 13:12.

Chantre E. (1895), *Reserches antropologiques, Asie occidentale, Transcaucasie, Asie Mineure et Syria*, Lyons: Société d'Anthropologie.

Cifarelli M. (2016), *Masculinities and militarization at Hasanlu, Iran: A view from the burials*, Near Eastern Archaeology 79(3):196-204.

Cohen M.N., Armelagos G.J. (1984), *Paleopathology at the origins of agriculture*, Orlando: Academic Press.

Comas J. (1957), *Manual de antropología física*, Ciudad de México: Universidad Nacional Autónoma de México, Instituto de Investigaciones Históricas.

Crubézy E., Ludes B., Poveda J.D., Clayton J., Crouau-Roy B., Montagnon D. (1998), *Identification of Mycobacterium DNA in an Egyptian Pott's disease of 5400 years old*, Comptes Rendus de l'Académie des Sciences. Series III. Sciences de la Vie 321 (11):941-951.

Czekanowski J. (1907), *Untersuchungen über das Verhältnis der Kopfmaße zu den Schädelmaßen*, Braunschweig: F. Vieweg und Sohn.

Czekanowski J. (1962), *The theoretical assumptions of Polish anthropology and the morphological facts*, Current Anthropology 3(5):481-494.

Dabbs G.R., Schaffer W.C. (2008), *Akhenaten's warrior? An assessment of traumatic injury at the South Tombs cemetery*, Paleopathology Newsletter 142:20-29.

David R. (2008), *Egyptian mummies and modern science*, Cambridge: Cambridge University Press.

Derry D.E. (1909), *Anatomical report (B)*, Archaeological Survey of Nubia Bulletin 3:29-52.

Derry D.E. (1915), *Note on skulls from Shurafa* [in:] "Heliopolis, Kafr Amr and Shurafa", W.M.F. Petrie, E. Mackay (eds.), London: Hazell, Watson and Viney, Ld., pp. 45-48.

Derry D.E. (1956), *The dynastic race in Egypt*, Journal of Egyptian Archaeology 42:80-85.

Dodson A., Ikram S. (1998), *The mummy in ancient Egypt: Equipping the dead for eternity*, London: Thames and Hudson.

Dzierżykray-Rogalski T. (1958), *Z badań nad strukturą morfologiczną starożytnych mieszkańców Oazy Siwah (Egipt)*, Roczniki Akademii Medycznej w Białymstoku 4:173-187.

Eshed V., Galili E. (2011) *Palaeodemography of Southern Levantine Pre-Pottery Neolithic populations: Regional and temporal perspectives* [in:] "Human bioarchaeology of the transition to agriculture", R. Pinhasi, J.T. Stock (eds.), Chichester: Wiley-Blackwell, pp. 403-428.

Eshed V., Gopher A., Pinhasi R., Hershkovitz, I. (2010), *Paleopathology and the origin of agriculture in the Levant*, American Journal of Physical Anthropology 143(1):121-133.

Fouquet D. (1896), *Note sur les squelettes d'El-'Amrah* [in:] "Recherches sur les origines de l'Egypte l'age de la pierre et les metaux," J. de Morgan (ed.), Paris: Ernest Leroux, pp. 241-270.

Gardner R.A., Urquhart A.L. (1930), *Two cases of bone tumour from Ancient Egypt*, British Medical Journal 2(3631):211.

Gasperetti M.A., Sheridan S.G. (2013), *Cry havoc: Interpersonal violence at Early Bronze Age Bab edh-Dhra'*, American Anthropologist 115(3):388-410.

Goldstein L. (2006), *Mortuary analysis and bioarchaeology* [in:] "Bioarchaeology: The contextual analysis of human remains", J.E. Buikstra, L. Beck (eds.), New York: Academic Press, pp. 375-387.

Grajetski W. (2003), *Burial customs in ancient Egypt: Life in death for rich and poor*, Bristol: Bristol Classical Press.

Greene D.L. (1972), *Dental anthropology of early Egypt and Nubia*, Journal of Human Evolution 1:315-324.

Greenblatt C.L., Spigelman M. (2003), *Emerging pathogens: The archaeology, ecology, and evolution of infectious disease*, Oxford: Oxford University Press.

Gregoricka L.A., Sheridan S.G. (2013), *Stable isotope analysis of Byzantine diet in an urban monastic community*, Journal of Anthropological Archaeology 32:63-73.

Gregoricka L.A., Sheridan S.G., Schirtzinger M. (2017), *Reconstructing life histories using multi-tissue isotope analysis of commingled remains from St Stephen's Monastery in Jerusalem: Limitations and potential*, Archaeometry 59(1):148-163.

Haas N. (1963), *Human skeletal remains in two burial caves*, Israel Exploration Journal 13(2):93-96.

Haddow S.D., Sadvari J.W., Knüsel C.J., Hadad, R. (2016), *A tale of two platforms: commingled remains and the life-course of houses at Neolithic Çatalhöyük* [in:] "Theoretical approaches to analysis and interpretation of commingled human remains", A. Osterholtz (ed.), New York: Springer International Publishing, pp. 5-29.

Hawass Z., Gad Y., Ismail S., Rabab Khairat R., Fathalla D., Hasan N., Ahmed A., Elleithy H., Ball M., Gaballah F., Wasef S., Fateen M., Amer H., Gostner P., Selim A., Zink A., Pusch C. (2010), *Ancestry and pathology in King Tutankhamun's family*, Journal of the American Medical Association 303(7):638-647.

Henckel K.O. (1930), *Zur Kraniologie Palästinas*, Zeitschrift für Morphologie und Anthropologie 28:236-243.

Hershkovitz I. (1981), *The Neolithic population of south Sinai and its relation to other Mediterranean groups: An anthropological study*, unpublished MA thesis, Tel Aviv University, Israel.

Hershkovitz I. (2012), *Paleopathology in Israel: Nicu Haas and his successors* [in:] "The global history of paleopathology: Pioneers and prospects", J. Buikstra, C. Roberts (eds.), Oxford: Oxford University Press, pp. 426-434.

Hillson S.W. (1979), *Diet and dental disease*, World Archaeology 2:147-162.

İşcan M.Y., Kennedy K.A. (1989), *Reconstruction of life from the skeleton*, New York: Alan R. Liss.

Jarcho S. (1966), *Human paleopathology*, New Haven, CT: Yale University Press.

Jones W.H.S. (1907), *Malaria: A neglected factor in Greek history*, Cambridge: Macmillan and Bowes.

Kanjou Y., Kuijt I., Erdal Y.S., Kondo O. (2015), *Early human decapitation, 11,700–10,700, cal. BP, within the Pre-Pottery Neolithic village of Tell Qaramel, North Syria*, International Journal of Osteoarchaeology 25(5):743-752.

Kansu S.A. (1937), *Etude anthropologique de quelques squelettes d'Alaca Höyük*, L'Anthropologie 47:35-39.

Keith A. (1927), *Report on the human remains* [in:] "Al-'Ubaid, Ur excavations, Vol. 1", H.R. Hall, C.L. Wooley (ed.), Oxford: Oxford University Press, pp. 214-240.

Krogman W.M. (1937), *Cranial types from Alishar Hüyük and their relations to other racial types, ancient and modern, of Europe and Western Asia 4* [in:] "The Alishar Hüyük seasons of 1930-1932, part III", H.H. von der Osten (ed.), Researches in

Anatolia, vol. 30, Chicago: Oriental Institute Publications, pp. 213-293.
Krogman W.M. (1955), *The human skeleton in forensic medicine, I*, Postgraduate Medicine 17(2), A-48.
Krogman W.M., İşcan M.Y. (1986), *The human skeleton in forensic me- dicine*, Springfield MO: Charles C. Thomas.
Kuijt I., Belfer-Cohen A., Goring-Morris N., Clark J.E., Fowler C., Goldstein L., Mizoguchi K., Riel-Salvatore J., Kuijt I. (2008), *The regeneration of life: Neolithic structures of symbolic remembering and forgetting*, Current Anthropology 49(2):171-197.
Laneri N. (2007), *Performing death: social analyses of funerary traditions in the ancient Near East and Mediterranean*, Chicago: Oriental Institute Press.
Larsen C.S., Hillson S.W., Boz B., Pilloud M.A., Sadvari J.W., Agarwal S.C., Glencross B., Beauchesne P., Pearson J., Ruff C.B., Garofalo E.M. (2015), *Bioarchaeology of Neolithic Çatalhöyük: lives and lifestyles of an early farming society in transition*, Journal of World Prehistory 28(1):27-68.
Leek F.F. (1972), *Bite, attrition and associated oral conditions as seen in ancient Egyptian skulls*, Journal of Human Evolution 1:289-295.
Little L.K. (2007), *Plague and the end of antiquity: The pandemic of 541-750*, Cambridge: Cambridge University Press.
Macalister R.A.S. (1911), *The excavations of Gezer (1902-1905 and 1907-1909)*, London: John Murray.
Manning J.G., Morris I. (2007), *The ancient economy: Evidence and models*, Redwood City, CA: Stanford University Press.
Marklein K.E., Fox S.C. (2016), In morbo et in morto*: transforming age and identity within the mortuary context of Oymaagaç Höyük, Northern Turkey* [in:] "Theoretical approaches to analysis and interpretation of commingled human remains", A. Osterholtz (ed.), New York: Springer International Publishing, pp. 185-206.
Martin D.L., Armelagos G.J., Goodman A.H., Van Gerven D.P. (1984), *Effects of socioeconomic change in prehistoric Africa: Sudanese Nubia as a case study* [in:] "Paleopathology at the origins of agriculture", N. Cohen, G. Armelagos (eds.), New York: Academic Press, pp. 193-214.
Martin D.L., Harrod R.P. (2012), *The bioarchaeology of violence*, Gainsville: University Press of Florida.
Montgomery R., Perry M. (2012), *The social and cultural implications of violence at Qasr Hallabat* [in:] "The bioarchaeology of violence", D.L. Martin, R.P. Harrod (eds.), Gainsville: University Press of Florida, pp. 83-110.
May H., Ruff C. (2016), *Physical burden and lower limb bone structure at the origin of agriculture in the Levant*, American Journal of Physical Anthropology 161(1):26-36.

Moodie R.L. (1918), *Studies in paleopathology*, New York: PB Hoeber.
Moodie R.L. (1923), *Paleopathology: An introduction to the study of ancient evidence of disease*, Urbana IL: University of Illinois Press.
Murray M.A. (1910), *The tomb of two brothers*, Manchester: Sherratt & Hughes.
Nathan H. (1961), *The skeletal material from Nahal Hever: Cave No. 8 – the "cave of horror"*, 'Atiqot (English Series) 3:165-175.
Nathan H., Haas N. (1966), *"Cribra orbitalia." A bone condition of the orbit of unknown nature*, Israel Journal of Medical Sciences 2(2):171-191.
Ortner D.J. (2003), *Identification of pathological conditions in human skeletal remains*, New York: Academic Press.
Osterholtz A.J. (2016), *Theoretical approaches to analysis and interpretation of commingled human remains*, New York: Springer.
Özbek M. (1974), *Etude de la déformation crânienne artificielle chez les Chalcolithiques de Byblos (Liban)*, Bulletins et Mémoirs de la Société d'Anthropologie de Paris, série 13 1:455-481.
Parry W. (1936), *Three skulls from Palestine showing two types of primitive surgical holing; being the first skulls exhibiting this phenomenon that have been discovered on the mainland of Asia*, Man 36(234):170-171.
Pearson K. (1894), *Contributions to the mathematical theory of evolution*, Philosophical Transactions of the Royal Society of London A, 185:71-110.
Pearson J.A., Haddow S.D., Hillson S.W., Knüsel C.J., Larsen C.S., Sadvari J.W. (2015), *Stable carbon and nitrogen isotope analysis and dietary reconstruction through the life course at Neolithic Çatalhöyük, Turkey*, Journal of Social Archaeology 15(2): 210-232.
Perry M.A. (2012a), *Paleopathology in Lebanon, Syria, and Jordan* [in:] "The global history of paleopathology: Pioneers and prospects", J. Buikstra, C. Roberts (eds.), Oxford: Oxford University Press, pp. 451-469.
Perry M.A. (2012b), *Bioarchaeology and behavior: The people of the ancient Near East*, Gainesville: University Press of Florida.
Peterson J. (2010), *Domesticating gender: Neolithic patterns from the southern Levant*, Journal of Anthropological Archaeology 29(3):249-264.
Petrie W.F. (1901), *The races of early Egypt*, Journal of the Anthropological Institute of Great Britain and Ireland 31:248-255.
Petrie S.F. (1934), *The races of south Palestine* [in:] "Proceedings of the First International Congress of Prehistoric and Protohistoric Sciences", F.W.F. von Bissing (ed.), London: Oxford University Press, pp. 176-177.
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.

Pinhasi R., Stock J.T. (2011), *Human bioarchaeology of the transition to agriculture*, Chichester U.K.: Wiley-Blackwell.

Pollock S. (2012), *Making a difference: mortuary practices in Halaf times* [in:] "Breathing new life into the evidence of death: Contemporary approaches to bioarchaeology", A. Baadsgaard, A.T. Boutin, J.E. Buikstra (ed.), Santa Fe, NM: School for Advanced Research Press, pp. 29-54.

Porter B.W., Boutin A.T. (2014), *Remembering the dead in the ancient Near East: Recent contributions from bioarchaeology and mortuary archaeology*, Boulder: University Press of Colorado.

Promińska E. (1966), *The jawbones and teeth of the Pachoras Bishops excavated in 1961-1962 in Faras, Sudan*, Etudes et Travaux 1:217-222.

Pryor F.L. (2005), *Economic systems of foraging, agricultural, and industrial societies*, Cambridge: Cambridge University Press.

Rak Y., Arensburg B., Nathan H. (1976), *Evidence of violence on human bones in Israel, first and third centuries C.E.*, Palestine Exploration Quarterly 108(1-2):55-58.

Rathbun T.A. (1984), *Skeletal pathology from the Paleolithic through the Metal Ages in Iran and Iraq* [in:] "Paleopathology at the origins of agriculture", N. Cohen, G. Armelagos (eds.), New York: Academic Press, pp. 137-168.

Rautman A. (2000), *Reading the body: Representations and remains in the archaeological record*, Philadelphia: University of Pennsylvania Press.

Reisner G.A., Smith G.E., Jones F.W. (1910), *The archaeological survey of Nubia: report for 1907-1908*, Cairo: National Printing Department.

Richards J. (2005), *Society and death in ancient Egypt: Mortuary landscapes of the Middle Kingdom*, Cambridge: Cambridge University Press.

Rose J.C., Tucker T.L., Lovell N., Filer J. (1996), *Bioarchaeology of ancient Egypt and Nubia: A bibliography*, London: The British Museum.

Rosen A.M. (2007), *Civilizing climate: Social responses to climate change in the ancient Near East*, New York: Altamira Press.

Rothman M.S. (2004), *Studying the development of complex society: Mesopotamia in the late fifth and fourth millennia BC*, Journal of Archaeological Research 12(1):75-119.

Ruffer M.A. (1913), *Studies in palaeopathology in Egypt*, Journal of Pathology 18(1): 149-162.

Ruffer M.A. (1919), *Studies in palaeopathology. Arthritis deformans and spondylitis in Ancient Egypt*, Journal of Pathology 22(2):152-196.

Sabbahy L.K. (2012), *Paleopathology of the ancient Egyptians: Annotated bibliography: 1998–2011*, Cairo: AUC Press.

Salako N.O., Al-Bagieh N.H. (1994), *In vitro pH changes and acid profile obtained during metabolism of dates by oral flora*, Saudi Dental Journal 6(1):21-26.

Salama N., Hilmy A. (1950), *A case of an osteogenic sarcoma of the maxilla in an ancient Egyptin skull*, British Dental Journal 88:101-102.

Sandias M, Müldner G. (2015), *Diet and herding strategies in a changing environment: Stable isotope analysis of Bronze Age and Late Antique skeletal remains from Ya'amun, Jordan*, Journal of Archaeological Sciences 63:24-32.

Saunders S.R., Katzenberg M.A. (1992), *The skeletal biology of past peoples: Research methods*, New York: Wiley-Liss.

Schoeninger M.J. (1981), *The agricultural "revolution": its effect on human diet in prehistoric Iran and Israel*, Paléorient 7:73-91.

Schrader S.A. (2015), *Elucidating inequality in Nubia: An examination of entheseal changes at Kerma (Sudan)*, American Journal of Physical Anthropology 156(2):192-202.

Şenyürek M.S. (1941), *A craniological study of the Cooper Age and Hittite populations of Anatolia*, Belleten 19(5):219-253.

Sheridan S.G. (2017), *Bioarchaeology in the ancient Near East: Challenges and future directions for the southern Levant*, American Journal of Physical Anthropology 162(S63):110-152.

Sheridan S.G., Gregoricka J.A. (2015), *Monks on the move: Evaluating pilgrimage to Byzantine St. Stephen's monastery using strontium isotopes*, American Journal of Physical Anthropology 158:581–591.

Sillen A., Kavanagh M. (1982), *Strontium and paleodietary research: A review*, American Journal of Physical Anthropology 25(S3):67-90.

Smith G.E., Dawson W.R. (1924), *Egyptian mummies*, London: Keagan Paul International.

Smith G.E., Wood-Jones F. (1910), *The archaeological survey of Nubia: Report for 1907–1908, volume II: Report on human remains*, Cairo: National Printing Department.

Smith P. (1972), *Diet and attrition in the Natufians*, American Journal of Physical Anthropology 37:233-238.

Smith P., Bar-Yosef O., Sillen A. (1984), *Archaeological and skeletal evidence for dietary change during the Late Pleistocene/Early Holocene in the Levant* [in:] "Paleopathology at the origins of agriculture", N. Cohen, G. Armelagos (eds.), New York: Academic Press, pp. 101-136.

Smith-Guzmán N.E. (2015), Cribra orbitalia *in the ancient Nile Valley and its connection to malaria*, International Journal of Paleopathology 10:1-12.

Sołtysiak A. (2006), *Physical anthropology and the "Sumerian problem"*, Studies in Historical Anthropology 4:145-158.

Sołtysiak A. (2017), *Ante mortem cranial trauma in ancient Mesopotamia*, International Journal of Osteoarchaeology 27:119-128.

Stock J.T., O'Neill M.C., Ruff C.B., Zabecki M., Shackleford L., Rose J.C. (2011), *Body size, skeletal biomechanics, mobility and habitual activity from the Late Paleolithic to the Mid-Dynastic Nile Valley* [in:] "Human bioarchaeology of the transition to agriculture", R. Pinhasi, J.T. Stock (eds.), Chichester: Wiley-Blackwell, pp. 347-367.

Stone E.C., Zimansky P. (2016), *Archaeology returns to Ur: A new dialog with old houses*, Near Eastern Archaeology 79(4):246-259.

Strouhal E. (1971), *Evidence of the early penetration of Negroes into prehistoric Egypt*, Journal of African History 12(1):1-9.

Todd T.W. (1921), *Age changes in the pubic bone*, American Journal of Physical Anthropology 4(1):1-70.

Trotter M., Gleser G.C. (1958), *A re-evaluation of estimation of stature based on measurements of stature taken during life and of long bones after death*, American Journal of Physical Anthropology 16(1):79-123.

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. (2014), Yersinia pestis *and the Plague of Justinian 541–543 AD: A genomic analysis*, The Lancet Infectious Diseases 14(4):319-326.

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., Barkow-Oesterreicher S., Teoh K.Y., Kelstrup C.D., Olsen J.V., Nanni P., Kawai T., Willerslev E., von Mering C., Lewis C.M. Jr, Collins M.J., Gilbert M.T., Rühli F., Cappellini E. (2014), *Pathogens and host immunity in the ancient human oral cavity*, Nature Genetics 46(4):336-344.

Wells C. (1964), *Bones, bodies, and disease: Evidence of disease and abnormality in early man*, London: Thames and Hudson.

Wengrow D. (2006), *The archaeology of early Egypt: Social transformations in North-East Africa, c. 10,000 to 2,650 BC*, Cambridge: Cambridge University Press.

Wenke R.J., Olszewski D. (2007), *Patterns in prehistory: Humankind's first three million years*, Oxford: Oxford University Press.

Wheeler S.M., Williams L., Beauchesne P., Dupras T.L. (2013), *Shattered lives and broken childhoods: Evidence of physical child abuse in ancient Egypt*, International Journal of Paleopathology 3:71-82.

Wierciński A. (1958), *Introductory remarks concerning the anthropology of ancient Egypt*, Bulletin de la Société de Géographie d'Égypte 31:73-84.

Wyne A.H., Khan N. (1995), *Use of sweet snacks, soft drinks and fruit juices, tooth brushing and first dental visit in high DMFT 4-6 year olds of Riyadh region*, Indian Journal of Dental Research 6(1):21-24.