New Perspectives in the Study of ancient Egyptian Bioarchaeology

*Sonia R. Zakrzewski**

Abstract

This paper presents a summary of the current 'state of the art' in bioarchaeology in Ancient Egypt. Bioarchaeology has, in the past, been seen as a handmaiden to historical archaeology (including Egyptology), but current bioarchaeological research places the study of human remains at the forefront of major research questions. Bioarchaeology has moved beyond simply providing an inventory of skeletons or mummies recovered from sites, complete with descriptions of their pathological lesions, and is moving towards answering more theoretical questions about past people and their lives. In this paper, some of these major current theoretical issues in bioarchaeology are briefly discussed. The rest of the paper provides discussion and exemplars of some current approaches to bioarchaeology in Egypt and highlights future directions for potential research. Due to issues of space and the actual practicality of working in Egypt, unfortunately not all current avenues of bioarchaeological research are discussed (e.g. use of ancient DNA analyses).

Key-words: Life course; identity; embodiment; osteobiography; disability; diet; migration

*Southampton University. E-mail: srz@soton.ac.uk Recibido: 12/04/2010, Aceptado: 10/07/2020

Nuevas perspectivas en el estudio de la bioarqueología del antiguo Egipto

Resumen

El presente artículo ofrece una panorámica sobre el estado actual de las investigaciones en bioarqueología aplicadas al Egipto antiguo. La bioarqueología ha sido considerada hasta hace poco como una mera disciplina auxiliar de la arqueología histórica (sin que la Egiptología constituya una excepción), aunque las investigaciones bioarqueológicas recientes sitúan, por el contrario, el estudio de los restos humanos a la vanguardia de algunos temas de investigación cruciales. Esto es así porque la bioarqueología ha avanzado desde el simple establecimiento de repertorios de esqueletos o de momias hallados en los yacimientos, acompañados de descripciones de sus lesiones patológicas, hacia la formulación de respuestas a cuestiones de carácter más teórico acerca de las poblaciones del pasado y de las vidas que experimentaron. Es por ello que este artículo discute brevemente algunos de los temas teóricos de mayor relevancia en bioarqueología. El resto del mismo analiza por medio de ejemplos algunos enfoques actuales de los estudios bioarqueológicos en Egipto y señala vías prometedoras para futuras investigaciones. Sin embargo, por razones de espacio y de los límites actuales que afectan al trabajo de campo en Egipto no será posible presentar la totalidad de las principales líneas de investigación en bioarqueología (como, por ejemplo, el uso de análisis de ADN antiguo).

Palabras clave: Ciclo vital; identidad; manifestación corporal; osteobiografía; minusvalía; dieta; migración

What is bioarchaeology?

Human remains form a tangible link between the present and the past. They *are* the people who lived and created the world that we recognise as ancient Egypt and thus bring us face to face with the ancient Egyptian past. As a result, they are more than simply a physical bridge between the present and some romanticised past of Egypt, but rather encode information not only about themselves, but also about their contemporaries. Bioarchaeology comprises the methodological and theoretical framework for the study of such human remains from archaeological contexts. Egyptian bioarchaeology

blends archaeology and Egyptology with aspects of biological and social anthropology, through the use of analytical methods and theoretical research frameworks drawn from biology, chemistry, statistics, history, social sciences and demography. Most commonly, bioarchaeologists study the patterning of health, disease and trauma in human remains. Through careful analysis, bioarchaeologists can "read" the stories of these past people written in their bodies, and use this information to flesh out the Egyptological, historical and archaeological understanding. This paper provides an overview of the current state-of-the-art in bioarchaeology, focusing on its use in the study of ancient Egypt, and suggests potential directions for future research.

What are human remains?

Human remains are unique in the archaeological record as they are more than simply links to past people, but are tangible and material bodies. They are symbolic and emotional. Human remains are not simply artefacts, they are also material culture (Sofaer 2006). The human body thus is both a biological entity but also a social construction. Throughout the life course, the human body dynamically changes, through both intentional and unintentional human action. "The materiality of the body forms a common axis between the body and objects, facing the body within the sphere of ecological investigation" (Sofaer 2006: xv).

Human remains are thus than simply objects or artefacts. As such, they are imbued with additional meanings. In ancient Egypt, human remains comprise mummies, whether intentional or accidental, fragments or larger (potentially articulating) quantities of human bone, and bodily organs. Most obviously, the latter include remains found in canopic jars, but also include hair and blood residues. This paper focuses on the potential of current and future research in the study of skeletal remains, and to a lesser extent, mummies.

There is no single ethical prescription guiding the treatment of human remains, but it is imperative that questions regarding ethical practices are highlighted at the foreground of all bioarchaeological work. When considering the ethics surrounding working with such tangible personifications of the past, it is the relational or situational, rather than the procedural, that are foremost. Of course, procedural ethics must be followed, such as all rules as currently imposed by the Egyptian Ministry of Antiquities, and obviously artefacts have not been permitted to leave Egypt since 1983. Given the

current paucity of suitable analytical equipment in Egypt, this means that the limits of bioarchaeological research differ when studying human remains excavated from current fieldwork as compared with those exported legally to collections prior to the changes in Egyptian antiquities legislation. Obviously, it goes without saying that all bioarchaeological research should follow the protocols set down in the Vermilion Accord (WAC 1989) The ethics I wish to raise here, however, relates to relational or situational ethics, where "skeletal research can really only be justified ethically if it generates knowledge about the human condition throughout time" (Zuckerman et al. 2014: 514). This is important as a great deal of bioarchaeological study in Egypt still is largely descriptive, arising as reports from excavations (primarily for human skeletons) or from museums trying to find novel mechanisms by which to engage the public (primarily for mummies), rather than deriving from either hypothesis testing or some broad theoretical approach (cf. Armelagos & van Gerven 2003; Hens & Godde 2008; Zuckerman et al. 2014). Such descriptive human bone reports are vital, both for conservation and museum display purposes, but comprise simply a starting point for bioarchaeological research. Given the lack of suitable scientific equipment in Egypt for many bioarchaeological methods of analysis, at the time of writing, this means that such research often requires the synthesis of recently recovered human remains with those residing in museums dispersed around the world. This, in itself, is ethically problematic as it engrains a colonialist approach and reduces the opportunity for Egyptian bioarchaeologists to undertake such research. Many current excavation projects have attempted to decolonise at least the data collection stage of research by training Egyptian archaeologists in bioarchaeology (e.g. Ancient Egypt Research Associates (AERA) and the American University in Cairo (AUC) field program in Giza and the Egypt Exploration Society program in Quesna). At present, however, further theoretical and technical development in bioarchaeological research by Egyptians in Egypt itself is at least partially impeded by the huge financial investment required to install and maintain the multiplicity of equipment required for high resolution destructive analyses.

The Vermillion Accord comprises a set of six clauses adopted by the World Archaeological Congress (WAC) concerning science and the treatment of the dead. The rules state that human remains, of any age or provenance must be treated with care and dignity, that such human remains should only be studied or viewed for legitimate purposes, such as the production of human bone reports after excavation, or for analysis and research in universities and other similar institutions, that human remains may be viewed

differently in other countries at local, regional or national levels, and that biological remains should not be considered as private property. This last clause is of particular note as there are implications for ethical practices associated. Wherever possible, bioarchaeological data thus should be shared to avoid repetitive collection of the same data from the same human bodies. Furthermore, whenever possible, access to such human remains for research analyses, by ethical researchers, should be facilitated as long as that research is framed around ethically sound questions and hypotheses, complete with theoretical underpinning.

Embodiment

Humans have lived experiences. They are born, grow, and, at some point, die. During the life course, each person eats food, they drink, they experience periods of health and disease, and go through periods of stress. The experience of everyday life affects the human body, and, as such, may become "embodied" in the hard and soft tissues. The human body is therefore a "site of lived experience, a social body, and site of embodied agency" (Joyce 2005: 139). The body is not simply a scene for display, nor is it simply an artefact, but rather the human body is contextually dependent and hence is an embodiment of the biological, cultural, and historical forces that it has experienced during its life course. There is synergistic interplay between different parts of bodies, between different bodies, and between bodies and their local environments. Embodiment acts on all these levels, with the outcomes of such (often social) interplays being seen in different biological characteristics. Taking an embodiment approach to bioarchaeology enables us to move beyond just building a biological profile to think about the person and the people themselves. This is an area ripe for future development within Egyptian bioarchaeology, where the duality of the body being both biological and cultural entities can clearly be seen. When viewed through the lens of activity related skeletal change, it is obvious that the body is the outcome of social, economic and political forces. But the body is also performed (cf. Butler 1990, 1993) as gender and social roles are clearly repeatedly performed and transformed (Joyce 2005). And hence the body is "constituted and produced" (Zuckerman et al. 2014: 515).

Egyptian bioarchaeology is moving beyond the construction of biological profiles to include synthesis with the funerary complex, mortuary treatment and burial rites. Although early studies focused on description and cata-

logues of the royal mummies (e.g. Elliot Smith 1912), later studies placed scientific analyses of these bodies into an Egyptological context (Harris & Wente 1980), and the most recent studies have attempted to understand their actual lives (Habicht et al. 2016; Hawass & Saleem 2016). The foci of skeletal studies have tended to differ from those of mummies, with the latter more commonly viewing the body as part of an artefactual assemblage. Such research projects tend to be interdisciplinary, and comprise analyses of the mummy's wrappings, the coffin and cartonnage, as well as the methods of mummification and excerebration (David 1979; Raven & Taconis 2005; Szymańska & Babraj 2001; Taylor & Antoine 2014). Recent studies of the Egyptian human remains, by contrast, tend to take a more embodied approach, synthesising the human bodies with other aspects of the local archaeology (Austin 2015, 2017; Austin & Gobeil 2016; Buzon 2006, 2014; Buzon & Richman 2007; Gibbon & Buzon 2018; Kemp et al. 2013; Schrader & Buzon 2017; Stevens et al. 2019). Such approaches move bioarchaeology out of the appendix of an excavation report and enable analysis of the people themselves to lead the archaeological questions.

Death and burial: the synthesis with burial rites

The richness of Egypt's burial record means that tombs and graves provide a large portion of our knowledge of Egyptian society and social organisation, but despite so much attention in Egyptian archaeology being placed on funerary and religious practices, the focus of the ancient Egyptians was on maintaining ma'at rather than an obsession with death. It is also important to remember that death and the physical process of dying were likely much more socially visible than in current Western society. The dead do not bury themselves, and hence the funerary archaeology found represents the living rather than for the deceased. The process of burial, thus, was about ma'at for the living. As a result, the relationship between the deceased and the funerary archaeology, the mortuary rites, the tomb and the grave goods found is not necessarily straightforward. The preservation of the physical body was an essential part of Dynastic Egyptian funerary practice as it was to the body of the deceased that the soul, primarily the *ka*, would have to return. This is the premise upon which mummification developed. Similarly, the implicit assumption has been that, during the Predynastic, the integrity of the physical body was also of great importance and affected the transfor-

mation of the body and rites of passage (cf. van Gennep 1960) associated with the body moving from its cadaveric state to state.

Archaeothanatology (or *Anthropologie de terrain*) is an approach pioneered in France (cf Duday 2009), which places the cadaver at the centre of enquiry. This bioarchaeological approach, most commonly starting to be used in Predynastic contexts, takes a body focused approach to look at the death course, with the burial feature being viewed as a dynamic entity. *Anthropologie de terrain* uses the dynamics of skeletal disarticulation to look at burial positioning, the space of decomposition, the mode of burial, the wrappings and clothing associated with body preparation and any post burial skeletal manipulations. In Egyptian burial contexts where mummification has not taken place, positioning and movement of both the bones of the deceased and any amulets etc. buried with the body will inform about the actual burial process that that person experienced. When bodies have been mummified, however, *anthropologie de terrain* approaches are harder to employ, but may be able to inform on the tightness of wrapping or whether a coffin was originally used, or indeed the order of placing of burials within the funerary context. Further research is required to evaluate the efficacy of such approaches with skeletonised remains of mummies.

Moving on from building a biological profile

Bioarchaeological analysis typically starts with calculation of the minimum number of individuals found, their ages and sexes, and identification of any pathological conditions. In most Egyptian situations, the standard traditional methods for adult sex estimation, i.e. morphoscopic analysis of the pelvis, is sufficient. Although metric sex determination methods for Egyptian samples have been developed (Ahmed Mohamed et al. in press; Dabbs 2010; Darwish et al. 2017; El Dine & El Shafei 2015; Kandeel & Habib 2019; Marlow 2016; Marlow & Kozieradzka-Ogunmakin 2016), when skeletal material is fragmented, plotting out bone dimensions may enable separation of the sample into two different size cohorts which may be assumed to be reasonably representative of the two sexes. Where teeth are preserved, enamel peptides may be used to determine sex via the surface etching of tooth enamel using acid followed by identification of sex chromosome-linked isoforms of amelogenin by nanoflow liquid chromatography mass spectrometry (Stewart et al. 2017). By using tooth enamel, this enables sex determination of juvenile remains.

A standard bioarchaeological report provides information regarding the demographic composition of the sample and the pathological conditions experienced. Such reports provide basic syntheses and may consider life expectancy (Zakrzewski 2015a), but do not place the burials into any sort of context. Current research generally attempts to integrate these data with other aspects of the archaeology, such as the funerary archaeology and aspects of burial ritual. In its simplest form, this might comprise moving from sex to gender, but could also include the recognition of other social categories such as childhood. In Egyptian bioarchaeology, however, most complementary analyses are of the mummification processes. Bodies that have been at least partially skeletonised or defleshed prior to embalming, such as the Old Kingdom mummy of Idu II (Pelizaeus Museum at Hildesheim no. 2639), might be identifiable from their higher sodium (i.e. natron) concentrations using atomic emission spectrometry (Koller et al. 1998). Embalming agents have been identified from bodily wrappings, such as from the Badarian site of Mostagedda (Jones et al. 2014) and Turin Mummy S. 293 (RCGE 16550), likely from Gebelein, Qena or Thebes (Jones et al. 2018), using thermal desorption/pyrolysis gas chromatography-mass spectrometry ([TD/Py]-GC-MS). With some few notable exceptions, Egyptian bioarchaeology rarely seems to elicit more theoretical treatments of human remains analysis. Given that palaeopathological analysis and evaluation of activity-related markers are both commonly included in standard bioarchaeology, these will not be discussed here[1] and instead the remainder of this paper will briefly describe some other new perspectives in the study of ancient Egyptian human remains and will highlight their potential future directions for Egyptian bioarchaeological study.

Diet and subsistence: "Dis-moi ce que tu manges, je te dirai ce que tu es"[2]

Although the most direct way of identifying the items consumed by past Egyptian populations is by analysing the archaeological remains of their actual meals, such as from desiccated faeces (commonly referred to as coprolites) or stomach contents, plant remnants or animal bones, data derived from both skeletons and mummies may add detail. Individual diets and food

[1] Many of these possibilities are described and explored in the text and cases studies in Zakrzewski et al. (2016).

[2] Brillat-Savarin 1826: Aphorism 4, p IX.

are important to understand because social hierarchies are often maintained through differential control over and access to food (Goody 1982). Food is thus a basic element in the construction and maintenance of social relations of power and inequality and groups differ in their concepts of what constitutes food (Simoons 1994). "While the old axiom 'you are what you eat' is a physiological fact, the statement encompasses a significant social dimension as well. How and what we eat is one of the fundamental ways we define ourselves as social beings and members of a given group" (Bray 2003: 3). So-called coprolites may be preserved in natural mummies or ancient latrines, and, as they are the remains of actual meals, they may offer unique information regarding diet, disease, parasites, ecological adaptation and resource use, human behaviour, palaeoclimate and seasonality (Fry 2003). The Predynastic mummy known as Gebelein Man B (British Museum EA 32754), a young male, was found with the remains of a partially digested meal in the location where his intestines and colon once were (Taylor & Antoine 2014), and may be suitable for future analysis to determine his last meal. Indeed, melon seeds, dates and unidentified starch grains have also been found in the viscera of other Predynastic burials (Fahmy 2003:101).

Basic bioarchaeological analysis of diet usually comprises analysis of teeth in association with skeletal markers of metabolic disease. As soon as teeth have erupted into the oral cavity, they are subjected to mechanical, chemical, and pathogenic stresses that are strongly affected by dietary factors. Dental wear, i.e. the erosion of tooth enamel, is the natural result of masticatory stress on the dentition and comprises both attrition, from direct tooth on tooth contact, and abrasion, from contact between the enamel and foreign substances including foodstuffs. In contrast, dental caries is a pathological condition where the structures of the tooth are locally dissolved by acids of bacterial origin. Carbohydrate rich food, especially those with soft textures, are associated with increased metabolic activity by these cariogenous bacteria (Hillson 1996). Factors that influence cariogenicity include the number, diversity and texture of the carbohydrates consumed, and the fats and proteins that accompany (or precede or follow) such carbohydrates, and, as a result, daily patterns of consumption and the orders in which foods are consumed will affect the composition of the dental plaque (Lucas-Powell 2003). This means that some foods that are consumed and are high in cariogenic sugars but which require active mastication, such as some hard fruits, may actually be less cariogenic than more porridge-like foods whose sticky textures might make them more resistant to the natural cleaning mechanisms of the mouth (Lucas-Powell 2003). Dental wear thus

provides a general measure of the coarseness of the diet and the frequency and extent of dental caries provides a general measure of the carbohydrate and textural composition of the diet.

Stable isotope analysis provides much more specific and direct data about the diet of the person studied. As a person grows and/or and their bodily tissues remodel, the isotopes contained in the foods and drinks consumed are incorporated into the body, including the skeleton. Most typically this involves analysis of the carbon and nitrogen compositions of the collagen in bone, but may include analysis of hair or dentine of teeth (Eriksson 2013). The nitrogen concentration (δ^{15}N) provides an indicator of the amount of protein in the diet, whereas the carbon value (δ^{13}C) provides an indicator of the type of plant material being consumed by the by the person or by the animals upon which that person subsisted. Adults are divided into two photosynthetic pathways, C3 and C4, with the former comprising temperate plants, such as emmer wheat and barley, and the latter more arid-loving tropical grasslike plants, including sorghum and millet. Temporal differences in dental wear and caries severity have been noted repeatedly in Egyptian samples, including over the period of Egyptian state formation (Greene 2007; Zakrzewski 2008). In contrast, few temporal differences have been found in isotopic values, with most individuals having high δ^{13}N ratios, potentially due consumption of freshwater fish, and δ^{13}C values suggesting diets heavily based on C3 plants (Dupras et al. 2001; Iacumin et al. 1996, Thompson et al. 2005, Zakrzewski 2008). These apparently contradictory results imply that although the actual components of the diet remained constant across the period of state formation, the ways in which the foodstuffs were processed and consumed must have changed (Zakrzewski 2008). Greater integration and synthesis by bioarchaeologists with other aspects of Egyptian archaeology, such as amalgamation with analysis of food in artistic representations, would facilitate deeper understanding of food and its consumption. Indeed "While nutrition is important, the kind of food eaten, its manner of preparation, and the modes of consumption have a social significance that transcends biological necessity and relates more to the construction of identity and status" (Tyson Smith 2003: 40). Isotopic analyses of individuals from the Dakhleh oasis Roman period site of Kellis indicate that wheat, barley, and millet were consumed, in association with both dairy and non-dairy animals such as goat and pig (Dupras et al. 2001; Wheeler et al. 2018). Differences in isotopic composition of the different bodily tissues, such as differences between ribs and hair, indicate seasonal patterning in the diet (Wheeler et al. 2018) which may have additional social impacts.

Similarly, despite the fact that almost half of the juveniles and adults from the Dakhleh Oasis Roman period site of Kellis exhibiting cribra orbitalia, this is a lower frequency than in the neighbouring Late Period Ein Tirghi site. Cribra orbitalia has multiple aetiologies, with stress and dietary deficiencies being among the causative agents. At the Roman period site, many of the older juveniles show evidence of healed cribra orbitalia, thereby indicating that they were overcoming at least some of the stressors that had contributed to their formation (Wheeler et al. 2018). Although there are multiple causes of cribra orbitalia, these authors argue that it is likely that the reduction in political instability and conflict, along with changes in food consumption, to a C4 based diet associated with either consumption of millet or millet-consuming animals, led to the temporal reduction in cribra orbitalia prevalence (Wheeler et al. 2018).

Migration and Mobility: making dead people move

In Egyptian archaeology, migration has been linked to colonialist and very racist explanations for the Egyptian civilisation (e.g. Petrie 1887, 1888, Petrie & Quibell 1896, Derry 1956, see discussions in Riggs 2014; Challis 2016). Migration and individual mobility, however, remain important parts of human activity and thus merit study. Unfortunately much of the archaeological discourse regarding migration and mobility in the Nile Valley remains steeped in a culture-history approach and associates typologies of material culture, such as ceramic vessels, with their manufacturers to form culturally-defined groups. But people do not map straight onto such typologically-defined groups and may move from one to another; furthermore, people are not necessarily buried with material culture that demarcates their group membership. Although identification of ethnicity (and similar aspects of identity) is an important focus of bioarchaeology, this section concentrates on bioarchaeology approaches to the recognition of mobility and migration rather than of differential identities. Identification of foreign objects demonstrates some form of interaction with that foreign region, but it does not demonstrate migration from that region. Similarly, artistic representations of Nubians or Libyans, such as on funerary stelae, do not prove the burial of such peoples. They do, however, demonstrate interaction with groups residing in such locations. Additionally, they also demonstrate the importance of the use of stereotype in communication.

In nondestructive bioarchaeological forms of analysis, migration and mobility in Egypt have been identified from traditional skeletal metric traits (Keita & Boyce 2008; Williams et al. 2005; Zakrzewski 2007), nonmetric skeletal and dental traits (Godde 2009, 2013, 2018; Irish 2005; Schillaci et al. 2009), and, most recently, using geometric morphometric methods (Maaranen 2020). Such biodistance approaches are based on phonetics (classification according to morphological similarity), and rests on the implicit assumption that morphology is, at least to some extent, an indicator of biological affinity and hence that morphological similarity may be associated with biological proximity. These approaches rely on identifying patterning in morphological diversity, and build putative morphologically similar and hence biologically proximate groups. Such analyses differ from earlier racist morpho-type approaches as current studies focus on fluidity and diversity in populations rather than employing fixed types. Such computed 'biological' morpho-distances can be compared with actual geographic distances between samples, such as when using isolation-by-distance models for cemeteries (Zakrzewski 2007) in order to identify potential migration.

Where destructive analyses are permitted, radiogenic isotope analysis, such as $^{87}Sr/^{86}Sr$, may be employed. First-generation migrants can be identified if the isotopic signatures of local bedrock, water and foods differ from that of their dental enamel (which represents the isotopic signature of their childhood location during tooth formation). Furthermore, oxygen isotope ratios ($\delta^{18}O$) are related to the composition of water sources. In addition to being distinct from the composition of aquifer water, the water in the Nile differs along its length as evaporation affects the δ^{18} O values. At Tombos, 20 of 53 individuals were found to have $^{87}Sr/^{86}Sr$ signatures from outside the local range (Buzon 2016; Buzon & Simonetti 2013), which Buzon (2016) suggests derive from colonists from Egypt settling at Tombos and inter-marrying with local Nubians. The $\delta^{18}O$ values at Tombos are variable with the mean being similar to values found at Egyptian sites near Thebes but others having higher values similar to those found in Nubia (Buzon 2016). Similarly, oxygen isotopes have been used to identify potential migrants to Roman Kellis (Dupras & Schwarcz 2001). All but two individuals had δ^{18} O values consistent with local water, likely obtained from underground aquifers. Both outliers had values consistent with Nubian samples, and one was diagnosed with lepromatous leprosy and was argued to potentially have migrated to the oasis because of this disease (Dupras & Schwarcz 2001). Strontium isotope analysis has been used to elucidate the origins of the Hyksos (Stantis et al. 2020a). Analysis of 75 different individuals

demonstrated that, during the Hyksos period, the majority the population buried at Tell el-Dab'a lived their childhood in the Delta region, an influx of non-locals could be observed in the pre-Hyksos period (12th and 13th Dynasties) (Stantis et al. 2020a). During the period of transition between the 13th through 15th Dynasties, noted at Tell el-Dab'a for its increase in burial differentiation and settlement growth, some fluctuation in dental non-metric traits was observed (Maaranen et al. in press). Both these strontium and dental non-metric trait analyses imply that, although the ruling class may have had Near Eastern origins, it comprised primarily internal dominance and takeover of the foreign elite. Furthermore, the authors argue that as there was a higher proportion of non-local females patrilocal residence likely prevailed. Further sex-specific (or age-specific) analyses of patterning in migration in other Egyptian samples might demonstrate other aspects of residential mobility or kinship.

As noted above, differences in $\delta^{18}O$ values reflect the relative aridity of the environment. Although as yet and exploited in Egypt, this has the potential to distinguish animals which browse (such as cows and sheep) from those that graze (such as goats) (Malainey 2011). Future bioarchaeological research in Egypt might synthesise such faunal data with that from the human populations to elucidate seasonal mobility, particularly in nomadic or herding groups, such as during the Predynastic.

Children and childhood

"Until the 1990s children had largely been excluded, or certainly marginalized, within human bioarchaeological discourse. Observations of children were primarily concerned with their under-representation at archaeological cemetery sites and likely high mortality rates in the past" (Mays et al. 2017: 38). Bioarchaeologically, children are frequently simply identified by their non-adult nature. But at what point does a child become a person? In contrast to art historical work, the social recognition of childhood has rarely been studied from an Egyptian bioarchaeological perspective. Despite the excellent preservation of juvenile remains at cemeteries such as Adaïma (Crubézy et al. 2002), Mirgissa (Boyaval 1981) and Naga-ed-Dêr (Lythgoe 1965; Podzorski 1990), the study of childhood has thus far focused commonly on their artistic identification, from their nakedness, their side locks of hair, finger pointing towards the mouth. Children are, however, not 'sub-adults' but are individuals in their own right. The bioarchaeol-

ogy of children in ancient Egypt, therefore, is only now starting to move beyond their practical identification and recognition into a more nuanced understanding of ancient Egyptian childhood and the treatment of children in ancient Egypt. As a result, the interactions between the growing bodies of children and infants and cultural understandings of the ancient Egyptian life course are only now starting to be studied. The life course framework enables the cumulative experience of each body, and thus each body's childhood growth phase, to be considered. Given that the treatment of hair was a means of constructing identity, the arrangement of the hair was one of main indicators of the passage from childhood to adulthood. The cartonnage case decoration and hairstyle of Tjayasetimu (British Museum EA 20744), a 22nd Dynasty girl, implies that she is of marriageable age but biologically she had not yet passed puberty and most of her permanent teeth had yet to erupt at time of death (Taylor & Antoine 2014). Such synthesis of social and biological aspects of childhood identification and the distinction from childhood identity are only now starting to be explored.

During the childhood growth process, children undergo a series of bodily and social transformations. The bodily changes may be easier to recognise through bioarchaeology than the social transitions associated with rites of passage (sensu van Gennep). During the growth process, children pass through a series of ordered physiological stages that may correspond with social age categories, such as puberty and adolescence. These biological changes start with the process of weaning, and this transition may be identified through isotopic analysis of teeth, nails, bone and/or hair (Fuller et al. 2006; Stantis et al. 2020b; Tsutaya & Yoneda 2015). Because breast-fed infants receive their protein intake from breastmilk, following the standard trophic effect, the δ^{15}N values of that infant's skeletal and dental tissues will be approximately 2-3% higher than the tissues of their mother (Fogel et al. 1989). At Kellis, in the Dakhleh Oasis, the nitrogen values peaked at about six months of age so that they were one trophic level above the mean value for adult females (Dupras 2016; Dupras et al. 2001). The nitrogen values then fell steadily until they approached those of the adults at between three and six years of age. Such analyses demonstrate exclusive dependence on breastmilk for the first six months of life for Roman period children at Kellis. The δ^{13}C values are also enriched, likely as a result of pearl millet, and so it is likely that these infants were fed complementary foods containing either pearl millet or derived from animals (such as milk from cows or goats) that consumed pearl millet (Dupras 2016). Isotopic analysis, in association with more traditional bioarchaeology analyses, can elucidate the social customs

associated with the weaning process. The bread found in the digestive tract of adults appears to be relatively coarse, whereas that found in the guts of children comprised pure starch grains, potentially suggesting the use of specific forms of 'baby food' (Fahmy 2000:19). Although as yet uncommon in Egyptian contexts, integration with lipid analysis of the internal surfaces of ceramic vessels from such sites might further allow us to identify the actual milks being consumed (cf Evershed et al. 2008; Mirabaud et al. 2007). The timing and age of weaning has implications for changes in the biological dependency of an infant on its mother and on the availability of both complementary foods for the infant and more general foodstuffs for the mother (Perry 2005), and hence has social implications on the local community.

Disease processes and children reflect the interaction between the child and their local environment. By their very nature as children, the local environment of each child incorporates their adult carer(s). When negative interactions occur early in life, profound long-term biological consequences on the child may result, as exemplified by the Developmental Origins of Health and Disease (DOHaD) hypothesis. For babies and young infants, poor maternal health can have long term consequences impacting on the child even as they move into old age themselves (Barker 2012). Furthermore, inter-generational consequences of childhood adversity may result from epigenetic mechanisms (Landecker & Panofsky 2013; Wadhwa et al. 2009) and are only now starting to be understood biologically. There are thus clear social and biological interactions between disease susceptibility and the physiological stages of childhood, such as the weaning process or the pubertal growth spurt. The prolonged and temporally-continuous usage of ancient Egyptian cemeteries might permit further exploration of such interactions.

Where were children buried? Published cemetery data rarely include significant numbers of child and infant burials, yet infant mortality was high. While some ancient Egyptian adults may have been able make some decisions regarding their own burial, it is highly unlikely that ancient Egyptian children were able to make such decisions themselves. As a result, the burials of children should be considered as resulting from a suite of adult decisions and actions. "Examination of how the bodies of the youngest members of the community were treated in death or whether they received the same kinds of graves, body treatment, and burial inclusions as their adult counterparts may reflect community perceptions of personhood or status in the past" (Wheeler et al. 2018: 330). In some locations, age mediation of burial positioning appears, such as at Deir el-Medina where the lowest part of the cemetery slope appears to have been reserved for infants and perinates

(Meskell 1994). Indeed, foetuses, perinates and infants were also placed in foundation deposits, such as in the houses of both Abydos North and South (Baines & Lacovara 2002). Furthermore, in addition to direct interment in the ground, children, infants and foetuses were commonly buried in pot burials. Power & Tristant (2016) provide an excellent theoretical framework for disentangling the meaning in such burials, including ideological links to both eggs and the gravid uterus. Between the early Dynastic and the Middle Kingdom, just over 40% of known juvenile burials were within some form of container. Metaphorical associations have been noted globally of pots at funerals not being containers of food but rather acting as containers of souls (Parker Pearson 1999). Indeed Power & Tristant (2016) argue that pots were deliberately selected and reused as funerary containers for both symbolic and pragmatic reasons. Further synthesis with the funerary context, grave goods, disease processes, and diet, etc. may enable further nuance to be added to studies of ancient Egyptian children and both their social and biological bodies.

Dis/Ability: "Laugh not at a blind man, nor tease a dwarf, nor mar the design of a lame man"[3]

Within Egyptian bioarchaeology, palaeopathological study has commonly stopped with differential diagnoses of potential diseases and linked severe expression of disease with potential disability. Recent wider theoretical developments in bioarchaeology have attempted to move beyond such lists of diseases in order to understand the implications both for the individuals concerned and their contemporaries (Byrnes & Muller 2017; Tilley & Schrenck 2017). Given that the World Health Organisation defines disability as "an umbrella term, covering impairments, activity limitations, and participation restrictions" (WHO, nd), I have argued elsewhere (Zakrzewski 2015b, 2018) that, rather than simply describing or listing the palaeopathological conditions affecting each individual, we should consider people with skeletal disorders or pathological lesions as living along some continuum of varying ability. If disability is viewed in terms of the social restrictions placed upon people with bodily impairment, following Oliver (1983), disability is simply a form of limited activity. As a result, individuals with some form of

[3]Instruction of Anenemope (Griffith 1926: 221)

bodily impairment may move forwards and backwards along a dis/ability continuum through their lifecourses, and disability thus is a complex series of phenomena that reflect the interactions between the person and their local community (Zakrzewski 2015b, 2018).

Such an approach has particular potential in Egyptian contexts as there are frequent depictions of individuals with what colloquially, in modern terms, might be viewed as disability. These include individuals of abnormally short stature (Dasen 1993; Robins 1994), potential representations of Pott's disease (Halioua and Ziskind, 2005; Ziskind and Halioua, 2007), and talipes equinus or poliomyelitis (Halioua and Ziskind, 2005; Nunn, 1996). Furthermore, forms of bodily difference that modern groups might consider as a disability, such as blindness, are sometimes represented in positive terms, as in the case of Raia, the Ramesside chief of singers from the temple of Ptah at Memphis (Dasen 1993; Wilkinson 2007). Despite the Greco-Roman papyri from Egypt, a major issue with such depictions and classical texts regarding disability is the lack of first-hand accounts of what it was like to be 'disabled' or to have what might have been considered an 'abnormal' body (Draycott 2015). Bioarchaeology, through focusing on the embodied lived experience, permits such the linkage between corporeal bodies and the social world in which they lived.

A couple of burials from the Greco-Roman cemetery at Quesna in the Delta exemplify this approach. One is the well-preserved burial of an elderly female (Rowland 2008, Zakrzewski 2015b). She was edentulous, and exhibited both osteoporosis and osteoarthritis. That she survived to old age despite her lack of teeth and lesions indicative of osteoarthritis suggests that she was a 'cared for' and valued member of the local community. Despite her arthritic lesions, she appears not to have been seen as disabled, but rather was viewed as a 'person', and probably as an 'older woman' or 'old lady' (Zakrzewski 2015b). Another burial at the site exhibited scoliosis (Rowland 2008). Given the effects of spinal curvature on the rib cage and hence lungs, this might affect breathing and thus the ability to work. But this individual was also buried in a similar manner to others at the site and so appears to have been viewed no differently than the putatively "normal" individuals. Furthermore, there are several examples of anomalously tall individuals with unfused epiphyses. Although these individuals are subject to further research, it appears that they were buried either in normative fashion or with additional grave goods (Haddow et al. 2017). This might imply some recognition of difference, whether viewed positively or negatively by their peers.

Providing physical or other care for individuals along the dis/Ability continuum does not necessarily imply compassion (Dettwyler 1991), but may simply demonstrate parenting. Two infants from the Kellis 2 cemetery at Dakhleh Oasis display skeletal characteristics consistent with occipital encephalocele, a lethal neural tube defect, thereby implying significant care-giving (Wheeler et al. 2018). Similarly one young child from the same site potentially had acute lymphocytic leukaemia, and the magnitude of the skeletal changes suggested long-term care of the child, which Wheeler and co-authors (2018) suggest might have required additional care-giving support (cf. Tilley 2015). That this child was given a similar burial to all others in the cemetery implies that this child, despite their young age and severe health condition, was considered as a complete social person. This is in direct contrast to the two putative child abuse cases from the same cemetery, thereby highlighting the personal and individual natures of people and their surrounding communities (Wheeler et al. 2013; 2018).

Moving beyond bioarchaeology as handmaiden to Egyptology and Egyptian archaeology?

Perry (2007) has, using the Roman and Byzantine Near East as an exemplar, argued that historical bioarchaeology can add considerably to historical-based narratives for the region. Through her work, she has demonstrated that the large-scale and contextual perspective needed for the interpretation of historical bioarchaeology reinvigorates wider archaeological study of the region. Bioarchaeology can thus be complementary to text-based Egyptology or more traditional material culture based Egyptian archaeology, and "bioarchaeology needs to provide a strong component to archaeological and historical research without becoming a 'handmaiden' to history or archaeology" (Perry 2007: 489). With its focus normally being on the non-elite sectors of the Egyptian population, at least during the Dynastic and later periods, bioarchaeological results may not coincide with written sources and hence may contextualise such communities rarely fully represented in elite-dominated Egyptological sources.

I have tried to demonstrate here some of the future potential directions for Egyptian bioarchaeology. Such approaches are easier in well funded large-scale research projects, such as the Amarna or Dakhleh Oasis projects. Within the latter project, the Kellis 2 cemetery has been very well studied using such a nuanced and contextualised bioarchaeological approach. Cases

of neural tube defects, such as spina bifida occult and anencephaly, have both been described and considered in relation to both the local environment and levels of consanguinity (Wheeler et al. 2018). But the bioarchaeology has also been used to understand other factors structuring life in the oasis.

Seasonality structured ancient Egyptian life through the organisation of the agricultural cycle. As a result, seasonality also affected disease incidence through its effects on diet and other resource availability, host-pathogen interactions through its effects on changing contacts with other people, domesticates and wild animals, and other changes in immune function and response (Nelson et al. 2002; Rau 2007; Wheeler et al. 2018). The Roman period burials at Kellis 2 have a West–East orientation, and, assuming that all deceased are buried within a four day period of death, almost all of the graves of adults and juveniles are aligned within the azimuth of the rising sun (Wheeler et al. 2018). By combining the solar alignment data with isotopic analysis of the hair, the season of death could be approximated. The most common period for death was March and April, with the steepest increase in mortality occurring in mid-March, whereas seasonality mortality dipped from October to December (Wheeler et al. 2018). The mortality pattern at the site appears seasonal and linked with seasonal fluctuations in diet and disease, and likely exacerbated by the location of Kellis in the arid desert environment of the Dakhleh Oasis. Bioarchaeological study of mortality patterning can thus inform as to seasonal social organisation.

Bioarchaeology in Egypt thus has the potential to integrate further theoretical frameworks into its practice (cf. Cheverko et al. 2021). One method, albeit not yet widely adopted in Egyptian bioarchaeology, is the use of osteobiography. Osteobiographies enable insight into individual lives, placing the individual into their social context (Hosek & Robb 2019). Such approaches must not simply be tacked on to more traditional population level study, but through the focus on individuals, may clarify the reasons behind variability in population-level data. Furthermore, depending on their format and presentation[4], osteobiographies have the capacity to both explain bioarchaeology to wider audiences.

Using an osteobiographical approach relies on the centrality of the corporeal body as the locus for expression of lifetime experience and biocultural change within the social world (Hosek & Robb 2019; Schrader & Torres-Rouff 2021). As undertaken in larger research projects, osteobiographies may be written following both specific normative or anomalous individuals

[4]Alexis Boutin (2011) has pioneered the use of the fictive narrative as a mechanism for dissemination of osteobiographical research.

or be undertaken on wider scales to provide almost population-based approaches (Zakrzewski 2015b). Synthesis of multiple osteobiographies with archeothanatology (Duday 2009) might additionally facilitate emic understandings of personhood in Egypt. Given that social conceptions are encoded in Egyptian art (Robins 1994; Riggs 2010; Riggs and Baines 2012), the multiplicities of differentiation facilitate the contextualistation of osteobiographical variability (Zakrzewski 2015b). At Amarna, such large-scale osteobiographical study has been theorised in an ethnographic framework to develop osteoethnography as a mechanism to explore both the city and the lifeways of those who constructed and inhabited it (Bandy 2019). Through close contextualisation of human groups, ethnography enables similarities and differences between study groups to be explored. Employing such an osteoethnographic approach in Egyptian bioarchaeology might enable further nuance to be added to osteobiography and archaeological analyses through the synthesis with sociocultural anthropology and narrative styles.

By necessity, I have been forced to focus on only some of many future potential directions for the ancient Egyptian bioarchaeology. It is clear that bioarchaeology in ancient Egypt exists as a hybrid discipline bridging biological anthropology, archaeology and Egyptology. It is currently experiencing a fluorescence of different approaches, embedded in different theoretical frameworks. These different theoretical frameworks are key to the recognition and interpretation of our varying datasets. In the Nile Valley, the move to integrate a biocultural approach to skeletal analysis was pioneered by Armelagos, Goodman and colleagues (Baker & Judd 2012; Zuckerman & Armelagos 2011). Bioarchaeology in Egypt is finally moving from the archaeological appendix to the centre of understanding of past Egyptian populations. Within this wider sphere, Egyptian bioarchaeology is fully part of a broader shift occurring to break down both boundaries between the body and society and our disciplinary boundaries. Many further directions and opportunities beckon for Egyptian bioarchaeology!

Bibliography

AHMED MOHAMED, Mennatallah et al. (2020) "Reliability of internal metacarpal measurements for sex determination using multi-detector computed tomographic imaging in a sample of Egyptian population", *Australian*

Journal of Forensic Sciences, 1-20.

ARMELAGOS, Georges & VAN GERVEN, Denis (2003) "A century of skeletal biology and paleopathology: contrasts, contradictions, and conflicts", *American Anthropologist* 105: 51–62.

AUSTIN, Anne (2015) "Accounting for Sick Days: A scalar approach to health and disease at Deir el-Medina", *Journal of Near Eastern Studies* 74(1): 75-85.

AUSTIN, Anne (2017) "The Cost of a Commute: A multidisciplinary approach to osteoarthritis in New Kingdom Egypt", *International Journal of Osteoarchaeology* 27(4): 537-550.

AUSTIN, Anne & GOBEIL, Cédric (2016) "Embodying the Divine: A tattooed female mummy from Deir el-Medina", *Bulletin de l'Institut Français d'Archéologie Orientale* 116: 23-46.

BAINES, John & LACOVARA, Peter (2002) "Burial and the dead in ancient Egyptian society: respect, formalism, neglect", *Journal of Social Archaeology* 2(1): 5-36.

BAKER, Brenda & JUDD, Margaret (2012) "Development of paleopathology in the Nile Valley", in: Buikstra J.E. & Roberts C. (eds.), *The Global History of Paleopathology: pioneers and prospects*. Oxford: Oxford University Press, pp. 209-234.

BANDY, Alissa (2019) *Death on the Horizon: Osteoethnography of the People of Akhetaten*. Unpublished doctoral thesis, University of Arkansas, Fayetteville.

BARKER, David (2012) "Developmental Origins of Chronic Disease", *Public Health* 126: 185–189

BOUTIN, Alexis (2011) "Crafting a bioarchaeology of personhood: osteobiographical narratives from Alalakh", in: Baadsgaard A., Boutin A. & Buikstra J. (eds.), *Breathing New Life into the Evidence of Death: Contemporary Approaches to Bioarchaeology*. Santa Fe: School for Advanced Research Press, pp. 109-133.

BOYAVAL, Bernard (1981) "Quelques remarques démographiques sur les

nécropoles de Mirgissa", *Cahier de Recherches de l'Institut de Papyrologie et d'Egyptologie de Lille* 6: 191–206.

BRAY, Tamara (2003) "The Commensal Politics of Early States and Empires", in: Bray T. (ed.), *The Archaeology and Politics of Food and Feasting in Early States and Empires*. New York: Kluwer Academic / Plenum Publishers, pp. 1-13.

BRILLAT-SAVARIN, Anthelme (1826) *Physiologie du Gout, ou Méditations de Gastronomie Transcendante*. Ed. Gabriel de Gonet.

BUTLER, Judith (1990) *Gender Trouble: Feminism and the Subversion of Identity*. New York: Routledge.

BUTLER, Judith (1993) *Bodies That Matter: On the Discursive Limits of "Sex"* New York: Routledge.

BUZON, Michele (2006) "Health of the non-elites at Tombos: Nutritional and disease stress in New Kingdom Nubia", *American Journal of Physical Anthropology* 130(1): 26-37.

BUZON, Michele (2014) "Tombos during the Napatan period (∼750–660 BC): Exploring the consequences of sociopolitical transitions in ancient Nubia", *International Journal of Paleopathology* 7: 1-7.

BUZON, Michele (2016) "Investigating Ancient Egyptian Migration in Nubia at Tombos using Strontium (87Sr/86Sr) and Oxygen (δ18O) Isotope Analysis", in: Zakrzewski S., Shortland A. & Rowland J. (eds.), *Science in the study of Ancient Egypt*. New York: Routledge, pp.204-207.

BUZON, Michele & RICHMAN, Rebecca (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, Michele & SIMONETTI Antonio (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: 1-9.

BYRNES, Jennifer & MULLER, Jennifer (eds.) (2017) *Bioarchaeology of Impairment and Disability: Theoretical, ethnohistorical, and methodological*

perspectives. New York: Springer.

CHALLIS, Debbie (2016) "Skull Triangles: Flinders Petrie, Race Theory and Biometrics", *Bulletin of the History of Archaeology* 26(1), p.Art. 5.

CHEVERKO, Coleen; *Prince-Buitenhuys*, Julia, & *Hubbe*, Mark (eds.) (2020) *Theoretical Approaches in Bioarchaeology*. London: Routledge.

DABBS, Gretchen (2010) "Sex determination using the scapula in New Kingdom skeletons from Tell El-Amarna", *Homo* 61(6): 413-420.

DARWISH, Ragaa et al. (2017) "Sex determination from chest measurements in a sample of Egyptian adults using Multislice Computed Tomography", *Journal of Forensic and Legal Medicine* 52: 154-158.

DASEN, Véronique (1993) *Dwarfs in Ancient Egypt and Greece*. Oxford Monographs in Classical Archaeology. Oxford: Clarendon Press.

DAVID, Rosalie (ed.) (1979) *The Manchester Museum Mummy Project: multidisciplinary research on ancient Egyptian mummified remains*. Manchester: Manchester University Press.

DERRY, Douglas (1956) "The Dynastic Race in Egypt", *The Journal of Egyptian Archaeology* 42: 80-85.

DETTWYLER, Katheryn (1991) "Can paleopathology provide evidence for "compassion"?", *American Journal of Physical Anthropology* 84(4): 375-384.

DRAYCOTT, Jane (2015) "Reconstructing the lived experience of disability in antiquity: a case study from Roman Egypt", *Greece and Rome* 62(2): 189-205.

DUDAY, Henri (2009) *The Archaeology of the Dead: Lectures in Archaeothanatology*. Oxford: Oxbow.

DUPRAS, Tosha (2016) "Breastfeeding and Weaning Practices in Ancient Kellis: the stable isotope evidence", in: Zakrzewski S., Shortland A. & Rowland, J. (eds.) *Science in the Study of Ancient Egypt*. New York: Routledge, pp. 144-148.

DUPRAS, Tosha & SCHWARCZ, Henry (2001) "Strangers in a strange land: stable isotope evidence for human migration in the Dakhleh Oasis,

Egypt", *Journal of Archaeological Science* 28(11): 1199-1208.

DUPRAS, Tosha; SCHWARCZ, Henry; & FAIRGRIEVE, Scott (2001) "Infant feeding and weaning practices in Roman Egypt", *American Journal of Physical Anthropology* 115(3): 204-212.

EL DINE, Fatma & EL SHAFEI, Mohamed (2015) "Sex determination using anthropometric measurements from multi-slice computed tomography of the 12th thoracic and the first lumbar vertebrae among adult Egyptians", *Egyptian Journal of Forensic Sciences* 5(3): 82-89.

ERIKSSON, Gunilla (2013) "Stable isotope analysis of humans", in: Tarlow, S. & Nilsson-Stutz, L. (eds.) *The Oxford Handbook of the Archaeology of Death and Burial*. Oxford: Oxford University Press, pp. 123-146.

EVERSHED, Richard et al. (2008) "Earliest date for milk use in the Near East and southeastern Europe linked to cattle herding", *Nature* 455(7212): 528-531.

FAHMY, Ahmed (2000) "What they ate: plant remains from HK43", *Nekhen News* 12: 19.

FAHMY, Ahmed (2003) "Palaeoethnobotanical studies of Egyptian Predynastic cemeteries: new dimensions and contributions", in: Neumann K., Butler A. & Kahlheber S. (eds.), *Food, Fuel and Fields: progress in African archaeobotany*. Köln: Heinrich Barth Institut, pp. 95-106.

FOGEL, Marilyn; TUROSS Noreen and OWSLEY, Douglas (1989) "Nitrogen isotope tracers of human lactation in modern and archaeological populations", *Carnegie Institution of Washington Yearbook* 88: 111-117.

FRY, Gary (2003) "Analysis of Fecal Material", in: Bray, T. (ed.), *The Archaeology and Politics of Food and Feasting in Early States and Empires*. New York: Kluwer Academic / Plenum Publishers, pp. 127-154.

FULLER, Benjamin et al. (2006) "Detection of breastfeeding and weaning in modern human infants with carbon and nitrogen stable isotope ratios", *American Journal of Physical Anthropology* 129(2): 279-293.

GIBBON, Victoria and BUZON, Michele (2018) "A diachronic examination of biomechanical changes in skeletal remains from Tombos in ancient

Nubia", HOMO 69(4): 158-166.

GODDE, Kanya (2009) "An examination of Nubian and Egyptian biological distances: Support for biological diffusion or in situ development?", *Homo* 60(5): 389-404.

GODDE, Kanya (2013) "An examination of the spatial–temporal isolation model in a Nilotic population: variation across space and time in Nubians using cranial discrete traits", *International Journal of Osteoarchaeology* 23(3): 324-333.

GODDE, Kanya (2018) "A new analysis interpreting Nilotic relationships and peopling of the Nile Valley", HOMO 69(4): 147-157.

GOODY, Jack (1982) *Cooking, Cuisine and Class: a study in comparative sociology*. Cambridge: Cambridge University Press.

GREENE, Tammy (2007) *Diet and Dental health in Predynastic Egypt: a comparison of Hierakonpolis and Naqada*. Saarbrücken: VDM Verlag Dr. Muller.

GRIFFITH, Francis Llewellyn (1926) "The Teachings of Amenophis son of Kanakht, Papyrus B.M. 10474", *The Journal of Egyptian Archaeology* 12(3/4): 191-231.

HABICHT, Michael et al. (2016) "Queen Nefertari, the royal spouse of Pharaoh Ramses II: a multidisciplinary investigation of the mummified remains found in her tomb (QV66)", *PLoS One* 11(11): p.e0166571.

Haddow, Scott; Zakrzewski, Sonia and Rowland, Joanne (2017) "Two Potential Cases of Eunuchism from a Ptolemaic-Roman Cemetery in the Western Delta of Egypt: Differential Diagnosis and Social Implications", *American Journal of Physical Anthropology* 162: 206.

HALIOUA, Bruno and ZISKIND, Bernard (2005) *Medicine in the Days of the Pharaohs*. Cambridge: Harvard University Press.

HARRIS, James and WENTE, Edward (1980) *An X-Ray Atlas of the Royal Mummies*. Chicago: University of Chicago Press.

HAWASS, Zahi and SALEEM, Sahar (2016) *Scanning the Pharaohs: CT imaging of the New Kingdom Royal Mummies*. Cairo: AUC Press.

HENS, Samantha and GODDE, Kanya (2008) "Skeletal biology past and present: are we moving in the right direction?", *American Journal of Physical Anthropology* 137: 234–9.

HILLSON, Simon (1996) *Dental Anthropology.* Cambridge: Cambridge University Press.

HOSEK, Lauren and ROBB, John (2019) "Osteobiography: A Platform for Bioarchaeological Research", *Bioarchaeology International* 3(1): 1-15.

IACUMIN, Paola; BOCHERENS, Hervé; MARIOTTI, André, and LONGINELLI, Antonio (1996) "An isotopic palaeoenvironmental study of human skeletal remains from the Nile Valley", *Palaeogeography, Palaeoclimatology, Palaeoecology* 126: 15-30.

IRISH, Joel (2006) "Who were the ancient Egyptians? Dental affinities among Neolithic through postdynastic peoples", *American Journal of Physical Anthropology* 129(4): 529-543.

JONES, Jana et al. (2014) "Evidence for prehistoric origins of Egyptian mummification in Late Neolithic burials.", *PLoS One* 9(8): e103608.

JONES, Jana et al. (2018) "A prehistoric Egyptian mummy: Evidence for an 'embalming recipe' and the evolution of early formative funerary treatments", *Journal of Archaeological Science* 100: 191-200.

JOYCE, Rosemary (2005) "Archaeology of the body", *Annual Review of Anthropology* 34: 139-158.

KANDEEL, Fatma and HABIB, Rehab (2019) "Sex Estimation from Transverse Breadth of Talus Bone in Egyptian Population", *The Egyptian Journal of Forensic Sciences and Applied Toxicology* 19(3): 65-76.

KEITA, Shomarka and BOYCE, Anthony (2008) "Temporal variation in phenetic affinity of early Upper Egyptian male cranial series", *Human biology* 80(2): 141-159.

KEMP, Barry et al. (2013) "Life, death and beyond in Akhenaten's Egypt: excavating the South Tombs Cemetery at Amarna", *Antiquity* 87(335): 64-78.

KOLLER, Johann et al. (1998). "Embalming was used in Old Kingdom."

Nature 391(6665): 343-344.

LANDECKER, Hannah and PANOFSKY, Aaron (2013) "From Social Structure to Gene Regulation, and Back: a critical introduction to environmental epigenetics for sociology", *Annual Review of Sociology* 39: 333-357.

LUCAS POWELL, Mary (2003) "The Analysis of Dental Wear and Caries for Dietary Reconstruction", in: Gilbert, R. and Mielke, J. H. (eds.), *The Analysis of Prehistoric Diets*. New York: Academic Press, pp. 307-338.

MAARANEN, Nina (2020) *Ties that bind: investigating Hyksos provenance and migration using dental morphology*. Unplublished PhD, Bournemouth University.

MAARANEN, Nina; ZAKRZEWSKI, Sonia and SCHUTKOWSKI, Holger (in press) "Who were the Hyksos? Investigating provenance from dental nonmetric traits", *Current Anthropology*.

MALAINEY, Mary (2011) *A Consumer's Guide to Archaeological Science*. Heidelberg: Springer.

MARLOW, Emily (2016) "Metric sex estimation of ancient Egyptian skeletal remains. Part I: Testing of published methods", *Bioarchaeology of the Near East* 10: 1-25.

MARLOW, Emily and KOZIERADZKA-OGUNMAKIN, Iwona (2016) "Metric sex estimation of ancient Egyptian skeletal remains. Part II: Testing of new population-specific methods", *Bioarchaeology of the Near East* 10: 27-46.

MAYS, Simon; GOWLAND, Rebecca; HALCROW, Sian et al. (2017) "Child bioarchaeology: Perspectives on the past 10 years", *Childhood in the Past* 10(1): 38-56.

MESKELL, Lynn (1994) "Dying young: the experience of death and burial at Deir el Medina", *Archaeological Review from Cambridge* 13: 35-45.

MIRABAUD, Sigrid; ROLANDO, Christian and REGERT, Martine (2007) "Molecular criteria for discriminating adipose fat and milk from different species by NanoESI MS and MS/MS of their triacylglycerols: application to archaeological remains", *Analytical Chemistry* 79(16): 6182-6192.

NELSON, Randy; DEMAS, Gregory; KLEIN, Sabra and KRIEGSFELD, Lance (2002) *Seasonal Patterns of Stress, Immune Function, and Disease*. Cambridge: Cambridge University Press.

NUNN, John (1996) *Ancient Egyptian Medicine*. London: British Museum Press.

OLIVER, Michael (1983) *Social Work with Disabled People*. Basingstoke: Macmillan.

PARKER PEARSON, Mike (1999) *The Archaeology of Death and Burial*. Stroud: Sutton Publishing.

PERRY, Megan (2005) "Redefining childhood through bioarchaeology: Toward an archaeological and biological understanding of children in antiquity", *Archeological Papers of the American Anthropological Association* 15(1): 89-111.

PERRY, Megan (2007) "Is bioarchaeology a handmaiden to history? Developing a historical bioarchaeology", *Journal of Anthropological Archaeology* 26(3): 486-515.

PETRIE, William M. Flinders (1887) *Racial Photographs from the Egyptian Monuments*. British Association for the Advancement of Science. London: R.C. Murray.

PETRIE, William M. Flinders (1888) "The earliest racial portraits" *Nature* 39: 128-130.

PETRIE, William M. Flinders and QUIBELL, James (1896) *Naqada and Ballas, 1895*. British School of Archaeology in Egypt. London: Bernard Quaritch.

POWER, Ronika and TRISTANT, Yann (2016) "From refuse to rebirth: repositioning the pot burial in the Egyptian archaeological record", *Antiquity* 90(354): 1474-1488.

RAU, Roland (2007) *Seasonality in Human Mortality: a demographic approach*. Berlin: Springer-Verlag.

RAVEN, Maarten and *Taconis*, Wybren (eds.) (2005) *Egyptian Mummies: Radiological atlas of the collections of the National Museum of Antiq-*

uities in Leiden. Turnhout: Brepols.

RIGGS, Christina (2010) "Body", in: Frood, E. and Wendrich, W. (eds.), *UCLA Encyclopedia of Egyptology*, Los Angeles. Available at `http://digital2.library.ucla.edu/viewItem.do?ark=21198/zz0025nqg2`

RIGGS, Christina (2014) *Unwrapping Ancient Egypt*. London: Bloomsbury.

RIGGS, Christina and BAINES, John (2012) "Ethnicity", in: Frood, E. and Wendrich, W. (eds.), *UCLA Encyclopedia of Egyptology*, Los Angeles. Available at `http://digital2.library.ucla.edu/viewItem.do?ark=21198/zz002bpmfm`

ROBINS, Gay (1994) *Proportion and Style in Ancient Egyptian Art*. Austin: University of Texas Press.

ROWLAND, Joanne (2008) "The Ptolemaic–Roman Cemetery at the Quesna Archaeological Area", *The Journal of Egyptian Archaeology* 94(1): 69-94.

SCHILLACI, Michael; IRISH, Joel and WOOD, Carolan (2009) "Further analysis of the population history of ancient Egyptians", *American Journal of Physical Anthropology* 139(2): 235-243.

SCHRADER, Sarah and BUZON, Michele (2017) "Everyday life after collapse: A bioarchaeological examination of entheseal change and accidental injury in postcolonial Nubia", *Bioarchaeology International* 1: 19-34.

SCHRADER, Sarah and TORRES-ROUFF, Christina (2021) "Embodying bioarchaeology: theory and practice", in: Cheverko, C.; Prince-Buitenhuys, J. and Hubbe, M. (eds.), *Theoretical Approaches in Bioarchaeology*. London: Routledge, pp. 15-27.

SIMOONS, Frederick (1994) *Eat Not This Flesh: food avoidances from prehistory to the present*. Madison: University of Wisconsin Press.

SOFAER, Joanna (2006) *The Body as Material Culture: a theoretical osteoarchaeology*. Cambridge: Cambridge University Press.

STANTIS, Chris et al. (2020a) "Who were the Hyksos? Challenging traditional narratives using strontium isotope (87Sr/86Sr) analysis of human remains from ancient Egypt", *PLoS One* 15(7): e0235414.

STANTIS, Chris; SCHUTKOWSKI, Holger and SOŁTYSIAK, Arkadiusz (2020b) "Reconstructing breastfeeding and weaning practices in the Bronze Age Near East using stable nitrogen isotopes", *American Journal of Physical Anthropology* 172(1): 58-69.

STEWART, Nicolas et al. (2017) "Sex determination of human remains from peptides in tooth enamel", *Proceedings of the National Academy of Sciences* 114(52): 13649-13654.

SZYMAŃSKA, Hanna and BABRAJ, Krzysztof (eds.) (2001) *Mummy: Results of interdisciplinary examination of the Egyptian mummy of Aset-iri-khet-es from the Archaeological Museum in Cracow.* Kraków: Polish Academy of Arts and Sciences.

TAYLOR, John and ANTOINE, Daniel (2014) *Ancient Lives, New Discoveries: eight mummies, eight stories.* London: British Museum Press.

THOMPSON, Alexandra et al. (2005) "Isotopic palaeodiet studies of ancient Egyptian fauna and humans", *Journal of Archaeological Science* 32(3): 451-463.

TILLEY, Lorna and SCHRENCK, Alecia (eds.) (2017) *New developments in the bioarchaeology of care.* New York: Springer.

TSUTAYA, Takumi and YONEDA, Minoru (2015) "Reconstruction of breastfeeding and weaning practices using stable isotope and trace element analyses: A review", *American Journal of Physical Anthropology* 156: 2-21.

TYSON SMITH, Stuart (2003) "Pharaohs, Feasts, and Foreigners: Cooking, foodways, and agency on ancient Egypt's southern frontier", in: Bray, T. (ed.), *The Archaeology and Politics of Food and Feasting in Early States and Empires.* New York: Kluwer Academic / Plenum Publishers, pp.39-64.

VAN GENNEP, Arnold (1960) *The rites of passage*, transl. MB. Vizedom & GL. Caffee. Chicago: University of Chicago Press.

WORLD ARCHAEOLOGY CONGRESS [WAC] (1989) *The Vermillion Accord on Human Remains. Adopted in 1989 at WAC Inter-Congress*, South Dakota, USA. Avialable at `https://worldarch.org/code-of-ethics/`

WADHWA, Pathik et al. (2009) "Developmental origins of health and

disease: brief history of the approach and current focus on epigenetic mechanisms", *Seminars in Reproductive Medicine* 27(5): 358-368.

WHEELER, Sandra et al. (2013) "Shattered lives and broken childhoods: Evidence of physical child abuse in ancient Egypt", *International Journal of Paleopathology* 3(2): 71-82.

WHEELER, Sandra, WILLIAMS, Lana and DUPRAS, Tosha (2015) "Bioarchaeological Analyses of Children and Childhood from the Kellis 2 Cemetery, Dakhleh Oasis, Egypt", in: Beauchesne, P. and Agarwal, S. (eds.), *Children and Childhood in Bioarchaeology.* Gainesville: University of Florida Press, pp. 330-371.

WORLD HEALTH ORGANIZATION (WHO), nd. *Disabilities.* Available at `http://www.who.int/topics/disabilities/en/`.

WILLIAMS, Frank; BELCHER, Robert and ARMELAGOS, George (2005) "Forensic misclassification of ancient Nubian crania: implications for assumptions about human variation", *Current Anthropology* 46(2): 340-346.

WILKINSON, Toby (2007) *Lives of the Ancient Egyptians.* London: Thames & Hudson.

ZAKRZEWSKI, Sonia (2007) "Population continuity or population change: Formation of the ancient Egyptian state", *American Journal of Physical Anthropology* 132(4): 501-509.

ZAKRZEWSKI, Sonia (2008) "Assessing the potential for dietary reconstruction from skeletal and isotopic data", in: Midant-Reynes, B., Tristant, Y.; Rowland, J. and Hendrickx, S. (eds.), *Egypt at its Origins 2.* Orientalia Lovaniensia Analecta; No. 172. Leuven, BE: Peeters, pp. 369-382.

ZAKRZEWSKI, Sonia (2015a) "Life Expectancy", in: Frood, E. and Wendrich, W. (eds.), *UCLA Encyclopedia of Egyptology*, Los Angeles. Available at `http://escholarship.org/uc/item/21198/zz002k5vrt`.

ZAKRZEWSKI, Sonia (2015b) "'Behind every mask there is a face, and behind that a story'. Egyptian bioarchaeology and ancient identities", in: Ikram, S.; Kaiser, J. and Walker, R. (eds.), *Egyptian Bioarchaeology: Humans, Animals, and the Environment.* Leiden: Sidestone Press, pp. 157-167.

ZAKRZEWSKI, Sonia (2018) "Matryoshki, masks and identities: bioarchaeology and the body", in: Holst, M. and Alexander, M. (eds.) *Trends in Biological Anthropology* (Vol. 2). Oxford: Oxbow Books Limited, pp. 1-8.

ZAKRZEWSKI, Sonia; SHORTLAND, Andrew y ROWLAND, Joanne (2016) *Science in the Study of Ancient Egypt.* New York: Routledge.

ZISKIND, Bernard and HALIOUA, Bruno (2007) "La tuberculose en ancienne Égypte", *Revue des Maladies Respiratoires* 24: 1277-1283.

ZUCKERMAN, Molly and ARMELAGOS, George (2011) "The origins of biocultural dimensions in bioarchaeology", in: Agarwal, S. and Glencross, B. (eds.) *Social Bioarchaeology.* Oxford: Wiley-Blackwell, pp. 15-43.

ZUCKERMAN, Molly; KAMNIKAR, Kelly and MATHENA, Sarah (2014) "Recovering the 'Body Politic': a Relational Ethics of Meaning for Bioarchaeology", *Cambridge Archaeological Journal* 24:513–522.