

SKELETAL EVIDENCE OF STRUCTURAL VIOLENCE:
A BIOARCHAEOLOGICAL ANALYSIS OF AFRICAN-AMERICAN FEMALES DURING
THE 19TH CENTURY UNITED STATES

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Chapter 1: INTRODUCTION

Drawing from skeletal evidence, archaeological context, historical context and ethnography, anthropological bioarchaeology uses multiple lines of inquiry to better understand the lived experience of past peoples. Evidence of lived experience is exhibited in many ways, including pathology and trauma (Juengst 2020). Disease and violence leave their marks on bones in myriad ways, however, their origins are of particular interest to bioarchaeologists. These skeletal markers demonstrate not only that disease and/or trauma occurred, but also the interactions and processes that caused them. Was the individual as a passive victim, or someone with agency, acting via their own power?

Integrating social theory with bioarchaeological inquiry makes the lived experience picture more complex and multidimensional (Stone 2020). While many (bio)archaeologists employ top-down Foucauldian power theories of institutional dominance and subjugation, Spencer-Wood (2010) offers a heterarchical model of power dynamics that goes beyond hierarchical power structure and oppositional dichotomy. Spencer-Wood's model allows for power dynamics that can coexist: powers over others (dominating); powers under other (subordinate resistance); powers with others (cooperative); and powers to (affecting change) (Spencer-Wood 2020:503). This polychotomy of power broadens the schema to be more inclusive of power dynamics at play when examining marginalized societies or segments of society.

In conjunction with theories of power, structural violence is important to understand when investigating marginalized individuals. Structural violence reveals how cultural stressors act as agents to create disparities in lived experiences across societies. These disparities have a profound effect on health outcomes as seen in skeletal remains. At its core, structural violence

involves the subjugation of an individual or group of people by an oppressive agent/group who keeps the oppressed from reaching their biological, economic, and or social potential (Klaus 2012). The concept of structural violence was developed in the 1960's by Johan Galtung (1969). Galtung's theory describes "social structures that suppress agency and prevent individuals, groups and societies from reaching their social, economic, and biological potential. Promotes the avoidable impairment of fundamental human needs or the impairment of human life, which lowers the actual degree to which someone is able to meet their needs below that which would otherwise be possible", which Klaus applied to bioarchaeology (Galtung 1993:106). Systems of structural violence remove the autonomy of a group of people and subject them to various hardships in order to control the balance of power, ensuring the oppressed are subject to the oppressor (Klaus 2012).

The enslavement of African men and women in the United States during the 17th, 18th, and 19th centuries is a clear example of structural violence. The United States' economy and infrastructure was built upon the backs of the enslaved people brought here from across the Atlantic Ocean from Africa beginning in 1619 (Horn 2018). The institution of slavery in the United States from the 17th to the 19th centuries is most notably associated with physical violence through accounts of beatings, whippings, and hard labor, and structural violence through poor living conditions, and overt dehumanization (White 1991; Turner 2017; Shuler 2009; King 1996; Jacobs 2001; Cade 1395).

Structural violence subjected on enslaved people came from all aspects of their daily lives including nutritional deficiencies in adulthood and childhood, disease exposure, hard and manual labor, forced reproduction, interpersonal violence, and harsh and unclean living conditions. These factors impact the human skeleton and may be interpreted through

bioarchaeological analysis, as a record of structural violence in the forms of cribra orbitalia, porotic hyperostosis, linear enamel hypoplasia, periosteal reactions, osteoarthritis, and skeletal fractures (Juengst 2020). Investigating the skeletal remains of enslaved people of African descent thus provides another perspective on the daily lived experiences of these individuals that may not have been captured in written or oral histories. There is a paucity of bioarchaeological research on enslaved populations in the United States because there are few assemblages available to analyze. Many of the studies that do exist came about because of chance discoveries on historic properties or from Cultural Resource Management projects engaged when commercial projects discovered remains during development (Rathbun 1987; Owsley et al 1987). There are many historical and cultural historiographies and analyses specifically written about enslaved African and African American women in the United States that provide historical accounts of all aspects of their lives (Jones 2009; Berry 2007; Bernard 2018; Bush 1996; Camp 2004; Morgan 2004). Enslaved African and African American women are also included in the bioarchaeological record; however, few studies center the health of enslaved females, limiting our understanding of how embodied experience of slavery for this particular group.

Franklin (2001:114) argues the importance of Black feminist research in the archaeology of enslaved people because of the enormous roles that enslaved African American women played in the shaping of cultural practices and survival strategies in their “gendered and racialized identities.” Keeping these women at the center of research in projects such as this highlights the socio-cultural structural hierarchies that existed, while demystifying race/ethnicity and gender. As Franklin (2001:114) states, “by not doing so we essentially normalize these differences and unwittingly provide the fuel needed to further reproduce them in the present.”

The structural violence that was basis for slavery in the United States is the focus of this thesis as it relates to skeletal evidence in African American women born in the first half of the 19th century and housed in the Terry Collection at the Smithsonian Institute in Washington, D.C.. I will investigate five specific skeletal markers that are attributable to structural violence: cribra orbitalia (CO), porotic hyperostosis (PO), linear enamel hypoplasia (LEH), trauma and periosteal reactions on cranial and long bones. These markers are of particular interest because CO, PH, and LEH likely indicate non-specific biological stresses experienced in childhood but are evident in adult remains, and periosteal reactions indicate interpersonal violence, infection and disease, and occupational and/or other stressors experienced in adulthood. I will record and analyze additional pathology as it is presented.

ENSLAVED FEMALE EXPERIENCES

The experience of enslavement differed over time, space, and individual identity. For example, the experience of enslaved women likely differed from that of enslaved men because women more often experienced sexual exploitation, the dangers of pregnancy, childbirth, and motherhood, sexual violence from enslavers, working for her enslavers, as well as the work of domestic duties in her own quarters (White 1991). White (1991,1999) and Franklin (2001) call attention to the juxtaposition of the dual feminine ideals of enslaved women, namely as Jezebel and Mammy, the promiscuous and the matron. This misconceived notion finds its roots at the beginning of the transatlantic slave trade when European men first encountered African women in Africa's hot climate, and African women's style of dress that exposed much of their bodies which ran counter to the culture of prudish and pious dress of European women (White 1991). An article published in 1736 in the *South Carolina Gazette* referred to "African Ladies" of

“strong and robust constitution” who were “not easily jaded out” but able to serve their lovers “by Night as well as Day” (White 1991:102).

Throughout the enslavement era in the United States, African and African-descended enslaved women were considered as very valuable commodities to the U.S. economy because they were strong workers in both agriculture and domestic roles, and because producing children was a low cost method of obtaining new enslaved individuals (Morgan 2004). This was particularly true after the international slave trade ended with the enactment of the Act of Prohibiting the Importation of Slaves of 1807 (Burnard 2018). Subsequent to this act, the only legal avenue for an enslaver to increase his number of slaves was through the birth of enslaved children. Enslavers considered enslaved women to be ‘increasers’ or ‘producers’, often bearing more monetary value than a male enslaved person because of the economic potential women possessed in their childbearing (White 1999; Berry 2007; Turner 2017). Enslaved women’s bodies contained a valuable potential economic value that enslaved men did not (Jones-Rogers 2018). Women were seen as both labor machines devoid of sexual context, as well as sexual bodies who controlled reproduction on plantations. To illustrate the sentiment that aligned enslaved women with livestock, a Virginia slave owner who purchased two-15 year old African girls wrote of their value, “(n)othing is more to the Advantage of my son than young breeding negroes” (Morgan 2004:86). The dual impact of hard labor and regular reproduction would be left as skeletal markers of occupation and stress, detailed below.

IMPACTS OF ENSLAVEMENT ON NUTRITION AND INFECTION

Nutrition

The nutrition of enslaved peoples in the United States varied from plantation to plantation. Several factors impacted the quantity and quality of food provided to enslaved

workers including the geographical location of plantation, size of the plantation or farm, ability of enslaved adults to raise/procure their own/additional food, food preparation facilities, and frequency of food distribution (Gibbs 1980). For example, smaller farms were not as well positioned to provide as wide a variety, quantity or quality of food as larger plantations, while farms and plantations near coastal areas had access to fish and other marine animals for consumption.

All enslavers provided food to their workers; however, some owners also allowed their enslaved people to supplement the basic food allotment with hunting, foraging, and harvest from small vegetable garden plots. Chicken and eggs were rare, but salted pork, pork fat back, and some beef were commonly provided (Gibbs 1980). Sutch (1976) indicates that pork and corn dishes, such as cornbread, hominy, corn meal, porridges. were the main foodstuffs of enslaved diet (Cade 1935:299-302). Unless these diets were supplemented with additional vegetables, they were deficient in essential micronutrients like calcium, vitamin A, vitamin B12, vitamin B9, thiamine, riboflavin, niacin, and vitamin C (Gibbs 1980; Walker et al 2009). Fatty pork and corn satisfied the macronutrient requirements (fat, carbohydrates, and protein), yet were often deficient in other micronutrients. In general, foodstuffs were more heavily reliant on carbohydrates that were more economical to provide and more easily accessible. Carbohydrate rich diets prevent starvation and allow the body to appear more generally healthy, which is misleading (Sutch 1976). Cade (1935) recorded interviews with former enslaved men and women regarding their diets, and accounts varied between having ample amounts of food to constant hunger.

Lallo et al (1977:474) indicate that diets high in maize have an increased potential for nutritional deficiencies. In particular, maize contains phytic acid, which acts as a chelating agent

that prevents metals from absorbing during digestion; in this case, iron (El-Najjar et al 1975; Vashishth et al 2017; Gibson et al 2018). Vashishth et al (2017) indicated that phytic acid also has a chelating effect on calcium, zinc, and magnesium, as well. Unless other foods are consumed that contain phytase, the enzyme that counteracts phytic acid, then the iron in corn will not be absorbed, which can lead to iron deficiency if corn and corn-based products are main components of a diet. Unprocessed grains such as rice, oats, and millet, and legumes such as black-eyed peas/cowpeas are good sources of phytase (Gibson et al 2018). Historical sources indicate these foods were available during the study's time period, however, their accessibility was impacted by the region, size of farm/plantation, and prosperity and inclination of the enslaver (Cade 1935; Olmstead 1856).

Nutrition and Infectious Disease Synergy

An interesting argument about the relationship of malnutrition and iron deficient anemia comes from several researchers (Coelho and McGuire 2000; Walker et al 2009; Wapler et al 2004) who postulate that it is infectious disease acting in concert with nutritional deficiency that causes an anemic response, which is the precursor to skeletal responses such as porotic hyperostosis and cribra orbitalia. Coelho and McGuire (2000) and Rathbun and Scurry (1991) suggest several pestilential diseases were prevalent in the southern subtropical climate and sandy soil, including malaria, yellow fever, dengue fever, dysentery, geohelminths, schistosomiasis, and smallpox. Morgan (2004) discusses the dangers of smallpox, malaria, dysentery, yellow fever, dengue fever, and helminth infestations like hookworms. Other diseases cited in the literature that were common amongst enslaved men and women were pulmonary and lymphatic tuberculosis, leprosy, and treponemal diseases (yaws, bejel, venereal syphilis, congenital

syphilis) (Shuler 2009). Rathbun and Scurry (1991) indicate that diarrheal diseases accounted for the major cause of childhood deaths, and tuberculosis for adults during the late 19th century.

Coelho and McGuire (2000) focus on malaria and hookworm infections because both of these are hemolytic (destroy RBCs) and can lead to bone marrow hypertrophy (expansion) as a counteractive response. Also, intestinal parasites that cause diarrhea can cause vitamin B₁₂ deficiencies by causing damage to small intestine mucosal lining which reduces vitamin B₁₂ absorption (Walker et al 2009). Malabsorption and chronic diarrhea acting in concert with vitamin deficiency could likely create megaloblastic anemia (Paerregaard et al 1990). Crowded and unsanitary living conditions can also cause diarrheal diseases. These diarrheal diseases contribute to the depletion of nutrients such a B vitamins, vitamins C and E, iron, and selenium.

Infectious diseases likely worsened the problem of nutrient deficiency due to the “synergistic interaction” between the nutrition and disease (Lallo et al. 1977: 434). The disease acts as a RBC destroying agent, hemolysis, and causes subsequent responses that further increase the ill effects of the nutritional deficiencies. The synergistic effect manifests in two ways: one, when the infection worsens the malnutrition, or two, when the malnutrition prevents the body from having a hearty immune response to the infection, which becomes a cycle (Scrimshaw et al. 1959).

Figure 1 Nutrition and Infection Cycle (Scrimshaw et al. 1959)



SLAVERY AND CHILDHOOD HEALTH

Bioarchaeological evidence of non-specific stress indicators likely began to form during childhood because the nature of immature bone makes it more plastic and susceptible to alterations. Children are very susceptible to health stresses from many sources including maternal iron deficiency and malnutrition during pregnancy, unhygienic living conditions, early weaning, and macro and micronutrient malnutrition (Turner 2017). The poor health of infants and young enslaved children at least partially came from nutritional deprivation, particularly in terms of protein. Enslavers did not give children meat prior to entering the labor force because there was no observed benefit to such an investment (Steckel 1986). Once children entered the workforce between seven and 11 years of age, they ingested larger amounts of more substantively nutritious foods, most importantly, animal protein (Steckel 1986, 1996; Turner 2017).

Babies born to enslaved women were initially breastfed, which is nutritionally ideal if the breastfeeder is adequately nourished. However, enslavers forced enslaved women to wean their babies at an early age so that they were able to return to work and remain a profitable asset (Turner 2017). Weaning began around three months of age, which required nutritional supplementation. Supplementation usually involved more solid foods such as pap and gruel, both porridge-like foods in consistency and made from corn and/or other grain (Steckel 1979). This resulted in elevated rates of illness and infant mortality because the grain was difficult for immature digestive systems to process and was likely thinned with contaminated water (Steckel 1986:732). Weaning infants living in nutrient deficient and unsanitary conditions can develop a chronic diarrheal syndrome due to the combination of factors including their environment and supplementation of contaminated foods of low nutritional value. The diarrhea causes a similar

condition as described in the section above where the lining of the small intestine is unable to absorb B vitamins, leading to megaloblastic anemia. This could result in marrow hypertrophy causing porotic hyperostosis (Walker et al 2009). One of the most significant impacts to infant mortality was a disease the enslaved and enslavers called tetanus, but was likely tetany, which is caused by maternal calcium deficiency during pregnancy. These conditions are easily confused as both produce convulsions (Bush 1996; Kiple and Kiple 1981).

LIFELONG STRESS, LABOR, AND SLAVERY

Occupational stress markers on the skeleton differ between labor activities because the repetitive movements vary between roles and environments. It is important to note that skeletal changes in bone and joints are not solely associated with repetitive movement and overuse. Factors such as genetic predisposition, environmental impacts, variability in diet, use of certain drugs, and unassociated trauma are also to be considered as having potential causative impacts (Larsen 1997; Roberts and Manchester 2007).

Skilled Labor

Berry (2007) noted that while the majority of enslaved laborers toiled in the fields, a select few became skilled tradespeople. Accordingly, the vast majority of women worked in the fields, while few had skilled roles (Cody 1996). Enslaved women worked in trades seen as specialized or skilled, including nurses, cooks, seamstresses, laundresses, and midwives.

Additionally, when enslaved field workers aged out of being highly productive, they were moved into semi-skilled roles like seamstresses, weavers, gardeners, stock minders, and childminders (Steckel 1996). Trades such as carpentry, blacksmithing, coopering, driving, and wheelwrights were only for enslaved men (Cody 1996; Barrett and Blakey 2011).

Roles that involved frequent bending, squatting, kneeling, and heavy use of the hands for manipulating tasks would potentially exhibit postcranial skeletal markers such as joint modifications in the metatarsal-phalangeal joint articulations and metacarpal-phalangeal joint articulations (Larsen 1997). Activities like food preparation, washing laundry, cleaning floors, grinding grain involve these habitual postures, which place added pressures on joints for extended periods of time per episode, and continue regularly for many years leading to these joint modifications (Larsen 1997).

Field labor and skilled labor were both crucial to the financial gains of the enslavers. For those who toiled as agricultural laborers, two types of labor systems managed the work: a task system and a gang system. The task system was based on workers accomplishing an established goal in a day, for instance, sowing seed in a 105 square foot area. After accomplishing the daily goal, the worker was done for the day. The gang system, on the other hand, was based on groups, or gangs, laboring together on a particular job from sunrise to sunset. The goal was temporal, not quantitative. These types of labor systems are important to understand as they would have different impacts on the skeleton. Skeletal markers will be discussed below in regards to each type of crop production.

Notably, different plantations worked on these systems depending on the type of crop prominently grown. Rice cultivation depended on the task system, while cotton and sugar cultivation is a gang system. For rice cultivation, the task system was employed because the tasks assigned were more individualized and differentiated, and not conducive to gang labor (Faust 1991). Both cotton and rice cultivation were year round endeavors, often involving heavily physical work (Morgan 2004; Cody 1996).

Rice Production

Rice agriculture involved heavy labor to create the environment suitable for rice production. The wet low country of the Carolinas was an ideal environment for rice production. Rice cultivation labor was not gendered, thus enslaved men and women, equally, had to create complicated water management systems, digging ditches, building dams and dikes, which allowed for control of flooding and drainage of the rice fields (Morgan 2004). From January to February, land was cleared of brush and trees, cleaning ditches, preparing swamp land, and general preparation of the land for planting. Spring time was the planting season, which involved hoeing narrow ditches approximately 18 inches long and three inches deep, sowing seed, and letting in the water from the dike system. Summer time was the growing season, which involved tedious hoeing of the rice and weeding the grass that grew around the rice shoots, in between intentional flooding and drawing off the water (Trinkley and Fick 2003). Harvest occurred between August and November, when the water was drained out and the field workers cut the rice stalks with sickles. The cut rice sheaves were bound together and hauled back to the workers tasked to perform threshing, which involved beating the sheaves with wooden sticks until the rice grain separated from the husk (Joyner 1991). The hardest and most arduous work of the year came with the commencement of pounding the rice (Morgan 2004; Cody 1996). Pounding of rice involved the use of a mortar and pestle type assemblage, with the mortar carved from tree logs, and a pestle carved with a sharp end that removed the husk, and a flat end to polish the rice grain (Joyner 1991). One aspect of rice cultivation that will be discussed in a later section involves diseases like helminth infections, malaria, and other insect-borne fevers all due to the wet and swampy environment in which the enslaved spent long hours for months at a time (Cody 1996).

Cotton and Tobacco Production

Cotton and tobacco cultivation were similar in nature, needing large tracts of land to plant the hearty crops. Only larger and wealthier plantations in the upper South could plant these crops because tobacco and cotton leach out nutrients from the soil, rendering it depleted for the next planting cycle. Crop rotations with other nutrient enriching crops were required before cotton or tobacco could be planted in a following season (Gibbs et al 1980). Enslaved workers performed this work completely manually with hoes, plows, and their hands during harvest season (Cody 1996). Work such as this could potentially be seen skeletally with osteoarthritis in shoulders, knees, hips, ankles and hands, vertebral degeneration, and enlarged muscle attachment sites (Rathbun and Steckel 2002).

Sugar Production

Sugar production and its effects on the body were different from those of rice, tobacco, and cotton production. By the end of the 1700s, women comprised the majority of field workers on Jamaican sugar estates (Turner 2017; Burnard 2018). During the first quarter of the year, gangs of workers would perform the most demanding of the work preparing the land for planting by felling trees, digging cane holes, planting stalks (Joyner 1991). Sugar grew rapidly throughout the summer months, and required careful hoeing and weeding. Harvest ran from September through October when the gangs of workers cut and carried the cane back for processing (Turner 2017). Wielding rudimentary tools like axes, hoes, machetes, and shovels stressed enslaved women's bodies though they proved to be completely capable (Morgan 2004).

The next phases of sugar production were task based and increasingly dangerous within the processing mills and factories. Heavy lifting of baskets, stooping to pick up the baskets, and carrying baskets could have caused joint and vertebral damage. The most devastating injuries

came from the rollers that pulled the cane through the mill feeders. Loss of limbs, mutilations, and death from these machines were real dangers, as was falling into open gutters through which cane juice ran to the boiling houses (Turner 2017; Shuler 2009).

According to Morgan (2004), women worked in the sugar mills in the evenings after a full day of field work. Accidents that caused maiming or death were common among enslaved women because the mill work required precision when feeding cane into the processors, and evenings spent in the mill after long days in the cane fields increased the danger as their minds and bodies were fatigued (Morgan 2004; Mathieson 1926; Barrett and Blakey 2011). This is well captured by Mathieson (1926), “those who fed the mill were liable, especially when tired or half-asleep, to have their fingers caught between the rollers. A hatchet was kept in readiness to sever the arm, which in such cases was always drawn in; and this no doubt explains the number of maimed watchmen” (63). Shuler (2009) indicates that there were high rates of traumatic injuries on Barbadian sugar plantations that resulted from working the cane fields, including lacerations from sharp tools, frequent leg abrasions, and other external lesions that became infected from environmental dangers like kneeling in the dirt during cane planting. Subsequent infections resulted in skeletal periosteal/infectious lesions in 41% of the skeletons examined at Newton Plantation, Barbados (Shuler 2009:74).

Impacts of Occupational Stress on Women

Enslavers were determined to mete out as much of their female laborers as possible. The value of enslaved women was based on their work capacity, not by their gender/sex. By the end of the 18th century, enslavers started to value women more for their ability to reproduce. Abolitionists influenced attitudes and regulations that eventually led to the end of the importation of slaves, leaving birth as the only way to increase the number of enslaved people. Pregnancy

detracted from a woman's ability to perform work at peak capacity, as they slowed their rate of production as the pregnancy progressed (Burnard 2018). As adults, women were expected to reproduce young and work her share of plantation labor. Women's bodies suffered from lack of prenatal and postnatal care, devaluing with each subsequent birth (Jones 2009). Eventually, enslavers deduced that women who performed less strenuous work were more likely to have viable pregnancies and successful birth outcomes. Finding the balance between protecting the unborn child and getting the most labor out of the mother was a difficult equation for enslavers (Turner 2017).

BIOARCHAEOLOGY OF STRESS

Skeletal indicators of non-specific stresses and nutrient deficiencies of childhood include but are not limited to anemia, dental enamel hypoplasias, skull base height, pelvic brim index, tibial bowing, and cranial hyperostosis (cribra orbitalia and porotic hyperostosis). The origins of these markers are all associated with the individual's inability to access adequate amounts of food, food with adequate nutrients, and exposure to infectious diseases through the environment. Anemia, cranial hyperostosis and enamel hypoplasias are discussed below in reference to other bioarchaeological studies from the enslavement and Post-Reconstruction era.

Erythropoiesis and Anemia

The period in utero is critical for proper growth and development of embryos and fetuses. Specifically related to this study, this is when erythropoiesis and dental enamel formation begin. Erythropoiesis, or red blood cell (RBC) production, begins in utero in the yolk sac, then moves to the liver and spleen, and finally in the bone marrow (Walker et al 2009). After birth, erythropoiesis occurs in medullary cavities of long bones and the diploë of the cranial vault in

subadults. In adults, erythropoiesis occurs in the spongy bone of the axial skeleton (Hoffbrand and Lewis 1981).

Hemoglobin is required for RBC production, with iron as the key component of hemoglobin. If a woman is iron-deficient in pregnancy, this can impact the fetus's ability to adequately produce RBC. Subsequently, if a child suffers from malnutrition resulting from iron-deficient nutrition or iron malabsorption they are considered anemic (World Health Organization 2004).

Anemia and Porotic Hyperostosis

Anemia is a general term meaning there is a reduced amount of hemoglobin (protein in red blood cells) present. Hemoglobin carries oxygen throughout the body, and as a result of this hypoxic state the body responds by stimulating erythropoiesis centers to generate more red blood cells to compensate (World Health Organization 2004). There are three main causes of anemia: blood loss, impaired erythropoiesis, and increased hemolysis (Walker et al 2009:110). These can occur contemporaneously. There are two types of anemia: genetic and acquired. Genetic anemias are thalassemia and sickle cell, and are rather rare. Acquired anemias are caused by blood loss and nutritional deficiencies. There are several nutrients required for RBC homeostasis including: essential amino acids, iron, vitamin A, B vitamins, and folic acid.

Anemia caused by blood loss can come from iron deficient diets and iron malabsorption in the gastrointestinal tract. The body's response to anemia is to excrete erythropoietin, a hormone made in the kidneys that stimulates and accelerates RBC production. If this is inadequate the hemopoietic marrow begins to overproduce RBC as a response. This is when the diploë (cranial hemopoietic marrow) in the cranial vault expands beyond the outer table (hyperostosis) and is gradually reabsorbed. It is the reabsorption that causes the porotic appearance of porotic

hyperostosis (PH) (Walker et al 2009). Anemic response often results in the development of conditions like porotic hyperostosis (PH) and cribra orbitalia (CO). However, according to Walker et al (2009) this is only true if there are other external variables contributing to the health stress like infectious disease. Given the location of subadult RBC production in the diploë of the cranial vault, Stuart-Macadam (1985) and Walker et al (2009) argue that PH and CO are likely to reflect anemia occurred during childhood. Active PH lesions in archaeological collections are almost exclusively seen in subadults, while adults usually exhibit healed lesions (Stuart-Macadam 1985; Walker et al 2009; Brickley 2018).

Cribra Orbitalia

Cribra orbitalia (CO) is evidenced by the thickening of the orbital roof, thinning of outer compact bone, and changes in the orbital rim as lacy or porous (Stuart-Macadam, 1985). CO is considered to be caused by a similar pathophysiological process as porotic hyperostosis, however, anemia-induced marrow hypertrophy is only one cause of cribriform areas on the orbital roof (Brickley 2018). Other processes associated with inflammation, scurvy, rickets, hemangiomas, and trauma that produces subperiosteal hematomas can all lead to orbital roof lesions (Walker et al 2009:115). Wapler et al (2004) contend that inflammation originating from the orbital roof periosteum transmits into the bone, or inflammation originated in the socket. Since the etiology of CO is difficult to deduce and is similar in pathophysiological nature to PH, I will consider this to be a non-specific stress indicator.

At Remley Plantation in Charleston, South Carolina, Rathbun (1987) found that approximately 43% of individuals showed some degree of CO. In comparison to Cedar Grove (Rose 1985), where 33.3% of males and 23.8% of females exhibited some degree of healed CO. Owlsely et al (1987) noted that CO and PH at their urban site in New Orleans was at 12.5% of

the total sample, much less than noted by Angel et al (1987), Rose (1985) and Rathbun (1987), indicating that perhaps the environment of urban versus rural has a positive impact on nutrition.

Linear Enamel hypoplasia

Further evidence of periods of childhood stress are found on dentition in the form of linear enamel hypoplasia (LEH). These are transverse lines on teeth that show periods of interrupted growth during childhood (Stuart-Macadam 1985). Barrett and Blakey (2011) liken LEH analysis to dendrochronology, where presence of the lines indicate stresses at different ages during tooth crown development: prenatally to 12 months for deciduous teeth, and birth to 7 years for permanent teeth (Goodman et al 2002:23). There are nearly 100 possible causes of LEH indicating that enamel is highly sensitive to metabolic and physiological stresses (Cutress and Suckling 1982). Since the etiology of LEH is difficult to deduce, I will consider this to be a non-specific stress indicator.

At the New York African Burial Ground, Barrett and Blakey (2011) found 70.8% of the cases with LEH present on permanent dentition. At Remley Plantation, Rathbun (1987) indicated 100% of males/71% of females exhibited LEH on one tooth, and 92% of males/50% females with two teeth with LEH. LEH was found in 46% of individuals at Catoctin (Kelley and Angel 1987), while in Newton Plantation in Barbados, LEH was found in 97% of anterior teeth and 99% of posterior teeth (Corruccini et al 1982).

OTHER SKELETAL STRESS MARKERS

Trauma and Periosteal Lesions

De la Cova (2012:61) examined 256 African American and Euro-American females from the Terry Collection at the Smithsonian Institute for the presence and patterning of trauma on individuals born during three time periods: Antebellum (1800-1860), Civil War (1861-1864),

and Reconstruction (1866-1877). De la Cova (2012:64) found that 93.4% of the sample had one or more fractures with no significant difference between African American and Euro-Americans. The African American individuals had higher rates of skull, nasal, upper arm bones and phalanx fractures as compared to the Euro-American, which conforms to the pattern of interpersonal violence. De la Cova noted that women of lower socioeconomic status are more likely to be battered by their partners (2012:65). Also noted were depression fractures which are another indicator of interpersonal violence (De la Cova 2012:65).

Fractures of long bones, ribs, and vertebrae are the most common sites of traumatic lesions (Goodman et al 2002). New bone formation begins within a few days of the fracture. Calcium salts are released by the bone ends and form a callous matrix at the site to bind and ensheath the fractured ends. Calcification begins and the bone remodels the bone callus. The entire process can take up to several months in adults, and is much quicker in subadults (Goodman et al 2002). Cade (1935) includes many accounts from former enslaved individuals regarding brutal corporal punishment/interpersonal violence received on a regular basis during their years of enslavement, however, these are not accounted for in medical literature.

Periosteal reactions occur when cortical bone experiences insult from a variety of sources such as trauma, tumors, infection, arthritic conditions, and in response to certain drugs (Rana et al 2009). Osteomyelitis and periostitis can cause a localized periosteal reaction in any location but primarily on long bones (Goodman et al 2002). Subperiosteal inflammation lifts the periosteum which then lays down new layers of bone running parallel to the bone shaft (Rana et al 2009). Bioarchaeologically, only severe responses to insults result in periosteal reactions that leave markers on the skeleton, because short-term infections either kill the individual quickly or they recover before the bone is impacted (Goodman et al 2002). It is the lower level and chronic

infections that leave a more lasting mark on skeletal remains. Trauma induced periosteal reactions tend to be localized and unilateral, while reactions due to systemic infection tend to be diffuse and bilateral (Ornter and Putschar 1981).

At Remley Plantation, 70% of individuals presented with periosteal lesions along the shafts of long bones stemming from non-specific infections (Rathbun 1987). At Cedar Grove, Rose (1985) found that 60% of adult males and 52.4% of adult females had healed lesions on the lower limbs. Individuals at the African Burial Ground in New York reported 71% prevalence (Null 2004). Newton Plantation, Barbados, also reported high rates of periosteal lesions 41% periosteal inflammation, with males having slightly more lesions than females (Shuler 2009). Shuler (2009) also reports that historic data indicates that infectious diseases were the most common causes of death for those living at Newton Plantation in the 18th century.

METHODS AND MATERIALS

This section will cover specifics regarding the methods and materials I will use to complete the research. The topics include data collection, background of the collection, and the methods of analysis used for pathophysiological diagnosis.

I will collect data from skeletal remains stored at the National Museum of Natural History, Smithsonian Institution (Washington, D.C.). Using the Robert J. Terry Anatomical Collection, I will analyze approximately 48 individuals with complete skeletal assemblage. These individuals were selected based upon sex (Female), ethnicity (Black/African-American), and year of birth (pre-1865). The focus of skeletal elements will consist of the crania and long bones as they are the most common bones where porotic hyperostosis, cribra orbitalia, linear enamel hypoplasia, periosteal reaction lesions, and trauma would occur.

The collection of these skeletons began in 1898 by Robert J. Terry in St. Louis, Missouri. Dr. Terry began the collection for research and educational purposes, and continued collecting while he was part of the Anatomy Department of Washington University, until he retired in 1941. Terry obtained these cadavers for study from morgues and institutions who turned over the bodies after they had remained unclaimed for 36 hours, by order of State Statute. His colleague and successor, Margaret Trotter, continued collecting skeletal remains, and made efforts to add ethnic diversity to the collection. When she retired in 1967, the collection was moved to the National Museum of Natural History as part of the Smithsonian Institute in Washington, D.C. (Hunt and Albanese 2004)

The entire collection contains 1,728 individuals, with birth years from 1828-1943. These individuals range in age at death from 14-102 years (Hunt and Albanese 2004). Utilizing the dataset of the Terry Collection, I was able to sort specifically for individuals who are Female, Black/African American, and with the birth year prior to 1865. This resulted in 48 individuals that I will examine at the NMNH. The Terry Collection Dataset also includes death certificate information for all selected individuals indicating other contextual information including: cause of death, duration of primary cause of death, occupation at death, location of birth, and marital status. The collection is viable for this research as I am looking for evidence of structural violence experienced by women who had previously been enslaved.

Methods for analysis will be based on the presence or absence of non-specific stress skeletal markers, founded on methods used by Steckel, Sciulli, and Rose (2002) for assessing cribra orbitalia, porotic hyperostosis, linear enamel hypoplasia, periosteal lesions and trauma. This will be accomplished by: 1). Observing crania macroscopically and microscopically with a magnifying glass for evidence of cribra orbitalia , porotic hyperostosis, and trauma; 2) Observing

dentition macroscopically and microscopically with a magnifying glass for evidence of linear enamel hypoplasia; 3) Observing the cortical bone morphology of long bones macroscopically and microscopically with a magnifying glass for periosteal lesions and trauma. The indices for each stress marker is listed below.

Cribriform Lesions (CO) and Porotic Hyperostosis (PH)

Steckel, Scullin, and Rose (2002) indicate that CO and PH must be scored separately, though do seem to share a pathophysiological similarity. CO is observed in the eye orbits, and PH is observed on the parietals. Porotic pitting, which is a scattering of fine pitting, is not considered an observable CO or PH lesion. Below are the scales for observation as a hybrid of scoring by Steckel, Scullin and Rose (2002) and Buikstra et al (1994). Activity will also be noted in terms of 1) Active at time of death, 2) Healed, or 3) Mix of active and healed.

Score	Hyperostosis Lesion	Score	Cribriform Lesion
0	No parietals observed	0	No orbits observed
1	Absent on at least 1 observable parietal	1	Absent on at least 1 observable orbit
2	Presence of a lesion - porosity only or porosity with coalescence of foramina, no thickening	2	Presence of a lesion - porosity only or porosity with coalescence of foramina, no thickening
3	Gross lesions with excessive expansion and large area of diploe exposed and/or coalescing foramina with increased thickening	3	Gross lesions with excessive expansion and large area of diploe exposed and/or coalescing foramina with increased thickening

Linear Enamel Hypoplasia (LEH)

According to Steckel, Scullin, and Rose (2002), LEH is to be observed on the maxillary incisors and either the maxillary or mandibular canines of deciduous or permanent teeth. For this project, I will only use permanent dentition since my subjects are all adults. Hypoplasias that are visible

by the naked eye (macroscopically) and are linear groove in shape are to be recorded for LEH. Only left sided teeth are used, however, right sided teeth may be used if left are not present.

Below is the scale for observation:

Score	Linear Enamel Hypoplasia
0	None observable (missing dentition, incomplete, excessively worn)
1	No hypoplasia present
2	1 hypoplasia present
3	2+ hypoplasias present

Periosteal Lesions

Steckel, Sculli, and Rose (2002) indicate that tibiae are to be used for observation because they are the most common site of infectious lesions. Roberts and Manchester (2007) indicate that periosteal lesions are most often seen on tibiae because tibiae are lie close to the skin surface, have a cooler surface temperature than other long bones which makes them more susceptible to infection, and the fact that the surface of the tibia is physiologically inactive and that blood tends to stagnate in the lower legs makes tibiae more susceptible to bacteria proliferation. Other long bones are also potential sites for finding periosteal lesions, however, for this project I will focus on tibiae. Below are the scales for observation as a hybrid of scoring by Stekel, Sculli and Rose (2002) and Buikstra et al (1994). Activity will also be noted in terms of 1) Active at time of death, 2) Healed, or 3) Mix of active and healed.

Score	Periosteal Lesions
0	No tibia present
1	No infectious lesions with at least 1 tibia available
2	Slight, small discrete patches of reactive woven or sclerotic bone involving less than 1/4 of tibia on 1 or both

3	Moderate woven or sclerotic bone involving less than 1/2 of tibia on 1 or both
4	Severe periosteal reaction involving greater than 1/2 tibia (osteomyelitis)

Trauma

Evidence of trauma helps to interpret an individual's interaction with others and the environment.

Determining whether trauma is intentional or accidental can be difficult to discern. Steckel, Scullin, and Rose (2002) created indices for assessing trauma in arms (humerus, radius, ulna), legs (femur, tibia, fibula), nasal and nasal process, other facial bones, skull vault, and hand fractures. Below are the scales for observation as a hybrid of scoring by Stekel, Scullin and Rose (2002) and Buikstra et al (1994). Activity will also be noted in terms of 1) Antemortem fracture (healed), 2) Perimortem (occurred at or near the time/absence of healing), or 3) Postmortem fracture. Antemortem fractures exhibit evidence of healing. Perimortem fractures exhibit hinging at fracture site, or radiating fracture lines without evidence of healing. Perimortem fractures will also exhibit the same coloring at the broken edges as the external bone surfaces. Postmortem fractures/damage exhibit light colored edges, which occurred as a result of curation or mishandling after skeletonization.

Score	Arm Trauma	Score	Leg Trauma
0	No long bones observable (must have humerus and at least one bone of the forearm to be scored)	0	No long bones observable (must have femur and tibia or fibula)
1	Not fractured	1	No fracture or other trauma
2	Antemortem fracture	2	Antemortem fracture
3	Perimortem fracture	3	Perimortem fracture

4	Postmortem fracture/damage		4	Postmortem fracture/damage
Score	Nasal and Nasal Process Trauma		Score	Face other than Nasal
0	No bones to be observed		0	No bones to be observed
1	No fracture		1	No fracture
2	Antemortem fracture		2	Antemortem fracture
3	Perimortem fracture		3	Perimortem fracture
4	Postmortem fracture/damage		4	Postmortem fracture/damage
Score	Skull Vault		Score	Hand Fractures
0	No bones to be observed		0	No bones to be observed
1	No fracture		1	No fracture
2	Antemortem fracture		2	Antemortem fracture
3	Perimortem fracture		3	Perimortem fracture
4	Postmortem fracture/damage		4	Postmortem fracture/damage

Conclusion

The presence of CO, PH, LEH, periosteal reactions, and trauma will help create the health narrative of this population of women who were born during enslavement, and spent their childhoods in enslavement. The number of years spent in enslavement as a subadult range from months through full sub-adulthood (birth through 20 years of age), yet the childhood stresses experienced by enslaved people did not immediately end at the issuing of the Emancipation Proclamation in January 1863, nor the abolishment of slavery in the state of Missouri in 1865. Rose (1985) highlights how the post-Reconstruction Era was as significantly harsh on the health and development of children as it was during enslavement. Each of these skeletal markers that I will measure are significant singularly, and even more so when viewed together. I anticipate finding at least two markers to show significant childhood stresses, because nutritional and

environmental stresses act systemically and thus I expect to see lesions in multiple locations per individual. Evidence of childhood stress markers will help illuminate the impacts of structural violence on enslaved women through lasting impacts evidenced on their bones. These markers will aid in the ability for me to confidently discuss structural violence impacts on these women, specifically, and enslaved women more broadly.

Bibliography

- Angel, J.L., Kelley, J.O., Parrington, M., and Pinter, S. (1987). Life Stresses of the Free Black Community as Represented by the First African Baptist Church, Philadelphia, 1823-1841. *American Journal of Physical Anthropology* 74:213-229.
- Berry, D.R. (2007). *"Swing the Sickle for the Harvest is Ripe" - Gender and Slavery in Antebellum Georgia*. University of Illinois Press.
- Barrett, A.R. and Blakey, M.R. (2011). Life Histories of Enslaved Africans in Colonial New York: A Bioarchaeological Study of the New York African Burial Ground. In Agarwal, S.C. and Glencross, B.A. (eds.) *Social Bioarchaeology*. Wiley-Blackwell.
- Blakey, M.L., Leslie, T.E. and Reidy, J.P. (1994). Frequency and Chronological Distribution of Dental Enamel Hypoplasia in Enslaved African Americans: A Test of the Weaning Hypothesis. *American Journal of Physical Anthropology* 95:371-383.
- Brickley, M.B. (2018). Cribra orbitalia and porotic hyperostosis: A biological approach to diagnosis. *American Journal of Physical Anthropology* 167(4):896-902.
- Haas, J., Buikstra, J., Ubelaker, D., & Aftandilian, D. (1994). *Standards for data collection from human skeletal remains : proceedings of a seminar at the Field Museum of Natural History, organized by Jonathan Haas* . Arkansas Archeological Survey.
- Burnard, T. (2018) Toiling in the Fields: Valuing Female Slaves in Jamaica, 1674-1788. In Berry, D.R., & Harris, L.M. (eds.) (2018). *Sexuality and Slavery: Reclaiming Intimate Histories in the Americas*. The University of Georgia Press.
- Bush, B. (1996) Hard Labor: Women, Childbirth, and Resistance in British Caribbean Slave Societies In Gaspar, D.B. and Hine, D.C. (eds.) *More than Chattel: Black Women and Slavery in the Americas*. Indiana University Press.
- Cade, J.B. (1935). Out of the Mouths of Ex-Slaves. *The Journal of Negro History* 20:294-337.
- Camp, S.M.H. (2004). *Closer to Freedom: Enslaved Women and Everyday Resistance in the Plantation South*. Chapel Hill, University of North Carolina Press.
- Cody, C.A. (1996). Cycles of Work and Childbearing: Seasonality in Women's Lives on Low Country Plantations. In Gaspar, D.B. and Hine, D.C. (eds.) *More than Chattel: Black Women and Slavery in the Americas*. Indiana University Press. 61-78.
- Coelho, P.R.P. and McGuire, R.A. (2000). Diets versus Diseases: The Anthropometrics of Slave Children. *The Journal of Economic History* 60(1):232-246.

- Corruccini, R.S., Handler, J.S., Mutaw, R.J., and Lange, F.W. (1982). Osteology of a slave burial population from Barbados, West Indies. *American Journal of Physical Anthropology* 59:443-459.
- Cutress, T.W. and Suckling, G.W. (1982). The assessment of non-carious defects of enamel. *International Dental Journal* 32:117-122.
- De la Cova, C. (2012). Patterns of Trauma and Violence in 19th Century born African-American and Euro-American Females. *International Journal of Paleopathology* 2:61-68.
- De la Cova, C. (2019). Marginalized bodies and the construction of the Robert J. Terry anatomical skeletal collection : a promised land lost. In Mant, M.L and Holland, A.J. (eds.) *Bioarchaeology of Marginalized People*. Elsevier Science & Technology.
- El-Najjar, M.Y., Lozoff, B., and Ryan, D. (1975). The paleoepidemiology of porotic hyperostosis in the American Southwest: radiological and ecological considerations. *American Journal Roentgenology Radium Therapy and Nuclear Medicine* 125:918-924.
- Erickson, P.A. and Murphy, L.D. (2017). *A History of Anthropological Theory*, Fifth Edition. University of Toronto Press.
- Faust, D.G. (1991). Slavery in the American Experience. In Campbell, Jr., E.D.C. and Rice, K.S. (eds.) *Before Freedom Came: African-American Life in the Antebellum South*. The Museum of the Confederacy. 1-19.
- Franklin, M. (2001). A Black Feminist-inspired archaeology? *Journal of Social Archaeology* 1(1):108-125.
- Galtung, J. (1969). Violence, Peace and Peace Research. *Journal of Peace Research* 6: 167-191.
- Gibbs, T. , Cargill, K., Lieberman, L.S. & Reitz, E.(1980) Nutrition in a slave population: An anthropological examination, *Medical Anthropology*, 4:2, 175-26.
- Gibson, R.S., Raboy, V., and King, J.C. (2018). Implications of phytate in plant-based foods for iron and zinc bioavailability, setting dietary requirements, and formulating programs and policies. *Nutrition Reviews* 76(11):793-804.
- Goodman, A.H. and Martin, D.L. (2002). Reconstructing Health Profiles from Skeletal Remains. In Steckel, R.H. and Rose, J.C.(eds.) *The Backbone of History: Health and Nutrition in the Western Hemisphere*. Cambridge University Press.
- Hoffbrand, A., and Lewis, S. (1981). *Postgraduate Haematology*. London: William Heinemann Medical Books Limited.

- Horn, J. (2018). *1619: Jamestown and the Forging of American Democracy*. Basic Books.
- Hunt, D.R. and Albanese, J. (2004). History and Demographic Composition of the Robert J. Terry Anatomical Collection. *American Journal of Physical Anthropology* 127:406-417.
- Jacobs, H., & Miles, T. (2021). *Incidents in the Life of a Slave Girl*. Random House Publishing Group.
- Jones, Jacqueline. (2009). *Labor of Love, Labor of Sorrow: Black Women, Work, and the Family, from Slavery to the Present*. Basic Books.
- Joyner, C. (1991). The World of Plantation Slaves. In Campbell, Jr., E.D.C. and Rice, K.S. (eds.) *Before Freedom Came: African-American Life in the Antebellum South*. The Museum of the Confederacy. 51-99.
- Juengst, S. (2020). Introduction: The Bioarchaeology of Cooperation and Non-Hierarchical Power. *American Anthropologist* 122(4):891-896.
- Kelley, J.O. and Angel, J.L. (1987). Life Stresses of Slavery. *American Journal of Physical Anthropology* 74(2):199-211.
- Kemble, F. A. (1984). *Journal of a residence on a Georgian plantation in 1838 - 1839*. Univ. of Georgia Press.
- Kiple, K.F. and Kiple, V.H. (1977). Slave Child Mortality: Some Nutritional Answers to a Perennial Puzzle. *Journal of Social History* 10:284-309.
- Kiple, K.F. and Kiple, V.H. (1981) *Another Dimension to the Black Diaspora. Diet, Disease, and Racism*. Cambridge: Cambridge University Press.
- King, W. (1996). "Suffer them Till Death" Slave Women and Their Children in Nineteenth-Century America In Gaspar, D.B. and Hine, D.C. (eds.) *More than Chattel: Black Women and Slavery in the Americas*. Indiana University Press.
- Klaus, H. (2012). The Bioarchaeology of Structural Violence: A Theoretical Model and a Case Study. In Martin, D.L. and Harrod, R.P. (eds.), *The Bioarchaeology of Violence*, University of Florida Press.
- Lallo, J.W., Armelagos, G.J., and Mensforth, R.P. (1977). The Role of Diet, Disease, and Physiology in the Origins of Porotic Hyperostosis. *Human Biology* 49(3):471-483.

- Larsen, C.S. (1997). *Bioarchaeology: Interpreting behavior from the human skeleton*. Cambridge University Press.
- Martin, D.L., Goodman, A.H., and Armelagos, G.J. (1985). Skeletal Pathologies as Indicators of Quality and Quantity of Diet. In Gilbert Jr., R.L. and Mielke, J.H. (eds.) *The Analysis of Prehistoric Diets*. Academic Press.
- Mathieson, W.L. (1926). *British Slavery and its abolition*. London: Longmans, Green.
- McFadden, C., and Oxenham, M.F. (2020). A paleoepidemiological approach to the osteological paradox: Investigating stress, frailty, and resilience through cribra orbitalia. *American Journal of Physical Anthropology* 173:205-217.
- Mintz, S.W. (1985). *Sweetness and Power: The Place of Sugar in Modern History*. New York: Penguin Books.
- Morgan, J.A. (2004). *Laboring Women: Reproduction and Gender in New World Slavery*. University of Pennsylvania Press.
- Mostafa, W. Z., and Hegazy, R. A. (2015). Vitamin D and the skin: Focus on a complex relationship: A review. *Journal of advanced research*, 6(6), 793–804.
- Novak, S.A. (2017). On the Stories of Men and the Substance of Women: Interrogating Gender through Violence. In Agarwal, S.C. and Wesp, J.K. (eds.) *Exploring Sex and Gender in Bioarchaeology*, The University of New Mexico Press. 129-164.
- Null, C., Blakey, M.L, Shujaa, K.J., Rankin-Hill, L.M. and Carrington, S.H.H. (2004). Osteological indicators of infectious disease and nutritional inadequacy. In Blakey, M.L. and Rankin-Hill, L.M. (eds.) *Skeletal Biology Final Report to GSA*, Vol. 1. Howard University. 351-302.
- Olmstead, F.L. (1856). *A Journey in the Seaboard Slave States: With Remark on their Economy*. New York: Dix and Edwards.
- Ortner, D.J., Putschar, W.G.J. (1981). *Identification of Pathological Conditions in Human Skeletal Remains*. Smithsonian Institution Press.
- Owsley, D.W, Orser Jr, C.E., Mann, R.W., Moore-Jansen, P.H., Montgomery, Rl. (1987). Demography and Pathology of an Urban Slave Population from New Orleans. *American Journal of Physical Anthropology* 74:185-197.
- Paerregaard, A., Hjelt, K. and Krasilnikoff, P.A. (1990). Vitamin B₁₂ and folic acid absorption and hematological status in children with postenteritis enteropathy. *Journal of Pediatric Gastroenterology and Nutrition* 11:351-355.

- Rana, R.S., Wu, J.S. and Eisenberg, R.L. (2009). Periosteal Reaction. *American Journal of Radiology* 193: W259-W272.
- Rathbun, T.A. (1987). Health and Disease at a South Carolina Plantation: 1840-1870. *American Journal of Physical Anthropology* 74:239-253.
- Rathbun, T.A. and Scurry, J.D. (1991). Status and Health in Colonial South Carolina: Belleview Plantation, 1738-1756. In Lucas Powell, M., Smith, B.D. Milner, G.R., Larsen, C.S., Eisenberg, L., and Bridges, P.S. (eds.) *What Mean These Bones?* University of Alabama Press.
- Rathbun, T.A. and Steckel, R.H.. (2002). The Health of Slaves and Free Blacks in the East. In Steckel, R.H. and Rose, J.C.(eds.) *The Backbone of History: Health and Nutrition in the Western Hemisphere*. Cambridge University Press.
- Roberts, C. and Manchester, K. (2005). *The Archaeology of Disease*, Third Edition. Cornell University Press.
- Rose, J.C. (1985). *Gone to a Better Land. A Biohistory of a Rural Black Cemetery in the Post-Reconstruction South*. Research Series No. 25. Fayetteville: Arkansas Archaeological Association.
- Scrimshaw, N.S., Taylor, C.E., and Gordon, J.E.. (1959). Interactions of Nutrition and Infection. *The American journal of the medical sciences*. Vol. 237(3): 367-403.
- Scrimshaw, N.S. (1966). Effects of the Interaction of Nutrition and Infectious Disease. In *Pre-school child malnutrition*. National Research Council-National Science Association. Washington, D.C.
- Shuler, K.A. (2009). Life and Death on a Barbadian Sugar Plantation: Historic and Bioarchaeological Views on Infection and Mortality at Newton Plantation. *International Journal of Osteoarchaeology* 21:66-81.
- Spencer-Wood, S.M. (2010). A Feminist Framework for Analyzing Powered Cultural Landscapes in Historical Archaeology. *International Journal of Historical Archaeology* 14: 498-526.
- Steckel, R.H. (1979). Slave Mortality: Analysis of Evidence from Plantation Records. *Social Science History* 3(3-4):86-114.
- Steckel, R.H. (1986). A Peculiar Population: The Nutrition, Health, and Mortality of American Slaves from Childhood to Maturity. *The Journal of Economic History* 46(3):721-741.
- Steckel, R.H. (1996). Women, Work, and Health Under Plantation Slavery in the United States. In Gaspar, D.B. and Hine, D.C. (eds.) *More than Chattel: Black Women and*

Slavery in the Americas. Indiana University Press. 43-60.

- Steckel, R.H., Sciulli, P.W., Rose, J.G. (2002) A Health Index from Skeletal Remains. In Steckel, R.H. and Rose, J.C.(eds.) *The Backbone of History: Health and Nutrition in the Western Hemisphere*. Cambridge University Press.
- Stone, P.K. (2018). From Womb to Tomb? Disrupting the Narrative of the Reproductive Female Body. In *Biological Analyses and Bodies: New Ways of Knowing Anatomical and Archaeological Skeletal Collections*. Springer International Publishing.
- Stone, P. K. (2020). Bound to Please: The Shaping of Female Beauty, Gender Theory, Structural Violence, and Biological Investigations. In Sheridan, S.G. and Gregoricka, L.A. (eds.) *Purposeful Pain: The Bioarchaeology of Intentional Suffering*, Springer International Publishing.
- Stuart-Macadam, P. (1985). Porotic Hyperostosis: Representative of a Childhood Condition. *American Journal of Physical Anthropology* 66:391-398.
- Sutch, R. (1975). The Treatment Received by American Slaves: A Critical Review of the Evidence Presented in *Time on the Cross*. *Explorations in Economic History* 12:335-438.
- Trinkley, M. and Fick, S. (2003). Rice Cultivation, Processing, and Marketing in the Eighteenth Century. Chicora Foundation, Inc., Columbia, SC.
- Turner, S. (2017). *Contested Bodies: Pregnancy, Childrearing, and Slavery in Jamaica*. University of Pennsylvania Press.
- Vashishth, A., Ram, S., and Beniwal, V. (2017). Cereal phytases and their importance in improvement of micronutrients bioavailability. *3 Biotech* 7(1):42.
- Walker, P.L., Bathurst, R.R., Richman, R., Gjerdrum, T., and Andrushko, V.A. (2009). The Causes of Porotic Hyperostosis and Cribra Orbitalia: A Reappraisal of the Iron-Deficiency-Anemia Hypothesis. *American Journal of Physical Anthropology* 139:109-125.
- Wapler, U., Crubezy, E., and Schultz, M. (2004). Is Cribra Orbitalia Synonymous with Anemia? Analysis and Interpretation of Cranial Pathology in Sudan. *American Journal of Physical Anthropology* 123:333-339.

White, D.G. (1991). Female Slaves in The Plantation South. In Campbell, Jr., E.D.C. and Rice, K.S. (eds.) *Before Freedom Came: African-American Life in the Antebellum South*. The Museum of the Confederacy. 101-121.

White, D.G. (1999). *Ar'n't I a Woman? Female Slaves in the Plantation South* (revised edition). W.W. Norton & Company.

World Health Organization and United Nations Children's Fund (2004). Focusing on Anaemia: Towards an integrated approach for effective anaemia control (joint statement). Geneva: WHO.