

CHAPTER 1

Introduction: the development of biocultural perspectives in anthropology

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Introduction

Since the mid-twentieth century, the biocultural approach has acted as a cohering and integrative intellectual approach within anthropology, particularly within the subdisciplines of biological, medical, and sociocultural anthropology (Goodman and Leatherman 1998; Goodman *et al.* 1988). It has provided an avenue for synthetic research that unites and crosscuts these diverse arenas, helping to prevent fragmentation and schisms in the face of increasing specialization. Further, it enables anthropologists to achieve the core anthropological objectives of explaining human behavior across time and space, comprehending cultural similarity, difference, and complexity across space and time, and applying this knowledge to the solution of human problems (AAA 2012). These objectives are obtained by addressing and answering complex research questions through an array of methods, theory, and data from across anthropology and related disciplines, such as demography, public health, medicine, biology, ecology, and geological sciences, with the biocultural approach providing coherence.

Definitions of the biocultural¹ approach have varied over the past several decades and, to a certain extent, based on the intellectual enterprise to which it is being applied, but it is characterized by several core themes. Overall, the biocultural approach attends to both the intertwined biological and cultural aspects of any given human phenomena (Levins and Lewontin 1985), explicitly emphasizing the dynamic, dialectical interactions between humans and their larger physical, social, and cultural environments. In this approach, human variation is conceptualized as a function of phenotypic plasticity and responsiveness to factors within these larger environments that both mediate and produce each other (Blakely 1977; Dufour 2006; Van Gerven *et al.* 1974).

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We introduce readers to the development, utility, and applications of the biocultural approach. We provide a short history of its origins and development, and unpack the approach and demonstrate how it translates into a model that can be operated to guide research. Further, we demonstrate the diverse theories and explanatory approaches, methods, and data sets that have been incorporated into the biocultural approach, through the course of its development into its contemporary usage, through a short review of the chapters included in this volume, highlighting the unique applications of the biocultural approach found in each. Importantly, each of the chapters contained within this edited volume has a consistent format. Each is centered around a key concept within the biocultural approach, from the causes and meaning of violence to the effects of colonialism on indigenous communities. Each chapter provides a review of relevant theory, methods, and data, and then delves into a case study, grounded in a real-world human problem that demonstrates the applicability of the biocultural approach to each particular concept and the utility of the approach for generating resolutions and solutions to the problem. We highlight each chapter and case study, emphasizing for readers how the biocultural approach can be used to elucidate, think through, and in some cases productively resolve real-world human problems. While some of these are ostensibly far removed from the lives of modern-day students, such as the effects of agricultural intensification during the Neolithic (c. 10 kya) on human health, readers will see many of their own tribulations and trials reflected in these case studies, from an exploration of what cultural factors motivate violence (see Chapters 22 and 23), to the role that the ‘cleanliness’ of modern environments may play in producing high rates of allergies and asthma (see Chapter 18), to the continuing effects of agricultural diets and sedentary lifestyles on modern-day human health and well-being (see Chapters 3 and 14). While the biocultural approach is a deeply useful analytical tool for exploring the diversity of problems that human societies have faced throughout time, it is also very useful for laying bare just how many of these challenges are shared across societies, time, and space.

The origins and development of the biocultural approach

The biocultural approach has a rich and varied history in anthropology, which is discussed in greater detail in Zuckerman and Armelagos (2011). Here, we provide a short survey of its origins and development.

The biocultural approach has its origins within biological anthropology, though for much of its history biological anthropology was deeply uninterested in the humanistic, cultural, and historical inquiries that have characterized the other anthropological subdisciplines since their nineteenth-century emergence

(Armélagos and Goodman 1998). Instead, throughout the nineteenth to mid-twentieth centuries, biological anthropologists were devoted to descriptive attempts to establish racial typologies for various regions and cultural contexts, largely through cranial morphology and other phenotypic traits. This focus did not shift until the 1950s, with the Holocaust, eugenic science, and the fall of colonialism, all of which demonstrated to physical anthropologists the disastrous, real-world applications of racial classification and typological thinking (Armélagos and Goodman 1998; Blakey 1987). This paradigmatic shift coincided with the development of the population approach in the biological sciences, which emphasized population-level rather than individual-level analyses and investigation of characteristics in breeding populations. This perspective provided an avenue for biological anthropologists to investigate the mechanics and effects of evolutionary processes in human populations for the first time. This development was augmented by the introduction of Washburn's (1951, 1953) "new physical anthropology" to the field, which proposed a strategic redirection from typological thinking towards synthetic, theory-driven research, and hypothesis testing based on models of evolution and adaptation.

At the end of the 1950s, Livingstone (1958), in what is widely regarded as one of the first truly biocultural works in anthropology, cohered these trends into an investigation of the complex relationships between the adoption of agriculture in West Africa, the protective effect of sickle cell anemia on malaria, and the ecology of the *Anopheles* mosquito that carries the plasmodium parasite that causes malaria. This study not only was one of the first to conceptualize the "environment" as more than just external physical conditions, it also struck a wedge into typological thinking about phenotypic and genetic traits as static "racial markers" (Dufour 2006). Livingstone's use of deep time to unravel the complexities of contemporary health problems is one of the foundational components of the biocultural approach, as is his entanglement of humans with many aspects of their environments, including insect vectors and changing ecologies. Together, these advances mark the beginnings of the development of the biocultural approach (Armélagos 2008).

Between the 1960s and the 1980s, the biocultural approach matured under the influences of ecological anthropology and political economy. Livingstone's work launched research within biological anthropology exploring human adaptability, which includes genetic adaptation, and non-genetic acclimatization and phenotypic plasticity in response to a wide range of environmental and social stressors (see Chapter 2). This coincided with increasing popular concern in the United States and around the world about environmental issues and ecology; these issues became popular within anthropology and the larger social and natural sciences as well (Goodman and Martin 2002). As part of these studies, anthropologists developed an ecological approach that conceptualized all of the social, cultural, biological, and physical aspects of human environments as an integrated whole that could influence human behavior and biology

(see Chapter 3). This integrative, ecological approach became fundamental to biocultural studies (Goodman and Leatherman 1998), as is evident in many of the case studies in this volume, from Thomas's attention to how political conflict can shape the biology of affected communities in Peru to Smith-Guzmán *et al.*'s holistic, ecologically informed approach to identifying the disease responsible for causing an ancient epidemic, the Hittite plague.

Political economy, and with it, processual ecology, both developed in the 1980s, became critical for developing political economic perspectives within biocultural anthropology. Processual ecology places greater emphasis on mechanisms of change, actor-based models, and on conceptualizing adaptive strategies as being constrained by scarce resources and social and economic hierarchies. A processual approach is one that focuses on methodological study of culture change and variability. Overall, political economy paradigms in anthropology focus on the history of intersections between local and global systems, how these intersections shape social relations and institutions that control access to fundamental resources such as housing, food, and medical care (Goodman and Leatherman 1998). In this way, power – and who has it and who does not – as well as related issues of sex, sexuality, gender, class, race, and ethnicity, are central foci (Roseberry 1988; see Chapters 2 and 3).

In the 1980s and 1990s, these approaches and paradigms – human adaptability, processual ecology, and political economy – became firmly embedded within biocultural anthropology, permanently shaping the approach (Zuckerman and Armelagos 2011). These have made the biocultural approach and its practitioners more socially engaged, action oriented, and activist than previous generations of anthropologists, particularly during the earlier adaptationist paradigm (Buikstra 2006). In particular, it has produced the biocultural approach's focus on the impacts of power relations and social inequality, such as processes affecting the control, production, and distribution of material resources on human biology in cultural systems throughout history, as well as the reciprocal influence of compromised biologies on these cultural systems (Blakey 2001; Goodman and Leatherman 1998; Leatherman and Goodman 1997). In this way, the biocultural approach is deeply dynamic and diachronic, attending to the dialectical (the interaction of opposition forces) relationships between biology and culture, power and well-being across time and space.

In these first few decades of the twenty-first century, the biocultural approach has forcefully maintained its political economic, ecological, and processual ecological components (Stinson *et al.* 2012). Foci are diverse and proliferating, but some are highlighted here (see also Chapter 2). Practitioners have intensified their focus on the key variable of poverty and determining the best ways to unpack and operationalize this complex, multifaceted, and culturally and historically contingent or context-dependent concept (Dufour 2006). Political economic perspectives have been applied to better understand how adaptive responses to environmental stress will vary depending on an individual and their community's relative social and economic status, with attention to the fact

that some overly stressed and extremely poor individuals may find themselves beyond their ability to adapt, making short-term adjustments with long-term detrimental consequences; this reminds scholars, as Thomas and Leatherman *et al.* discuss (see Chapters 2 and 3), that not all biological responses are adaptive (Bailey and Schell 2007).

Biocultural anthropologists increasingly attend to how components of modern cultural and economic systems, such as environmental degradation and the “Americanization” of the world, in particular through the spread of high-calorie, nutrient-poor “Western diets,” have altered the disease risks for certain communities as well as the overall global system, as a product of our contemporary interconnectedness (see Chapters 3 and 14). Many biocultural anthropologists employ the concept of embodiment, drawn from social epidemiology, which contends that humans biologically incorporate their social, physical, and biological conditions, and that bodies therefore can tell “stories” about the conditions of their lives that otherwise might go unrecognized and untold (Krieger 2005). Bioarcheologists and paleopathologists, studying ancient bones to reconstruct past lives and diseases, employ this concept, whether explicitly or implicitly, to reconstruct how humans have adapted, or failed to adapt, to various types of conditions in the past (see Chapters 6–11 and 21). Medical anthropologists use this concept to unpack how different patterns of health, disease, and well-being are found in different communities as populations are largely a product of differential circumstances, such as wealth versus poverty, but more insidiously, life-long levels of exposure to prejudice, social inequality, and stress (see Chapters 3–5).

Overall, practitioners of the biocultural approach seek integrative and engaged methods for broadening the ways in which questions are framed. Researchers consider multiple levels of causality for various conditions, processes, and outcomes, attending to both microenvironmental, proximate or closest causes and the often more complex, ultimate or fundamental causes, which are often political, economic, and social (Goodman and Leatherman 1998). These causes, conditions, processes, and outcomes are addressed and investigated by framing robust hypotheses within political, social, and economic contexts, with attention to such variables as violence, gender, and sexuality and testing them with empirical data (Armelagos 2003). This engagement, producing a broad, cross-cultural, historically situated study of human behavior, is an important scholarly activity because it contributes to explaining the complex human behaviors that underlie the pressing and persistent problems of today.

Locating the history or origins of contemporary problems is productive because it isolates the very specific, historically contingent factors that help to situate and explain human behavior. Often, in order to understand a complex behavior in its specific manifestation, for example, culturally determined age at weaning or the age at which males go off to war, it is useful to look deep into the past to see when those behaviors first appear and what the circumstances were that favored them. Anthropological studies have the potential to situate modern-day problems within a larger temporal and spatial framework. Using

these cross-cultural and deeply temporal analyses, the biocultural approach contributes to understanding human variation within and across different cultures as well as non-Western ways of dealing with and adapting to challenges.

Using a biocultural model

The linking of demographic, biological, and cultural processes within an ecological framework that is found in the biocultural approach is essential for dealing with the kinds of questions that interest anthropologists across the discipline. These include, for example, understanding the diverse purposes for which violence is committed, the relationship between subsistence and economic change and disease, and the relationship between social stratification, differential access to resources, and health. These kinds of problems demand a multidimensional approach because they cross over numerous disciplinary boundaries.

A deceptively simple model (Figure 1.1) provides a very useful framework for integrating information regarding human adaptability and health with larger biocultural and ecological contexts. In this model, the physical environment is viewed as the source of resources essential for survival. If there are constraints on the resources (Figure 1.1, box 1), then the ability of the population to survive may be limited accordingly. Humans' ability to adapt to these conditions can be enhanced by their cultural system which can buffer the population from environmental stressors (Figure 1.1, box 2) or, when this fails, exacerbate the stressful effects. The technology, social organization, and even the ideology of a group provide a filter through which environmental stressors pass. However, cultural practices can also be the source of stress as well (Figure 1.1, box 3). For example, epidemiological data strongly suggest that the high incidence of chronic

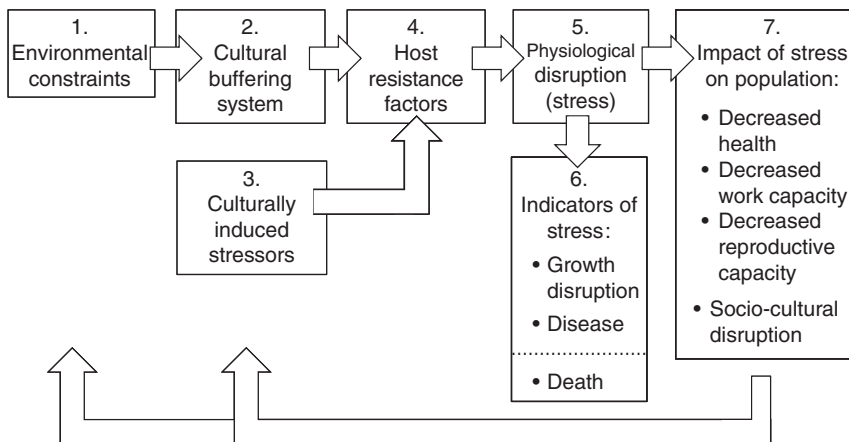


Figure 1.1 Biocultural model highlighting the common and important aspects of integration across domains.

inflammatory conditions, such as asthma and allergies, currently afflicting high-income developed nations may be a byproduct of public health interventions, like water sanitation and food pasteurization, that reduced mortality from epidemic infectious disease in the nineteenth century (see Chapter 18).

When thinking about all of the possible ways in which individuals can be physiologically stressed, it is important to acknowledge that the impact of stress will be different depending on the individual's host resistance factors: their age, sex, and overall health and immunological status (Figure 1.1, box 4). For example, infants and the elderly may be harder hit by a seasonal drought that decreases food supplies than a healthy adult. A female who has lost a lot of blood during a difficult childbirth experience will be hit harder by food shortage or cold stress than a female who has not just given birth. Someone suffering from dysentery will have a lower resistance to contagious infections than someone who is healthy. Thus, host resistance is both biological but also cultural in nature because such things as wealth can buffer some people from dying of disease, while poverty can predispose communities to greater morbidity and mortality.

One excellent example of this is articulated by Kuzawa and Gravlee (see Chapter 5), in which they demonstrate how host resistance is always part of a larger political economy in which some bodies/hosts are of higher value than others, thereby receiving greater access to food, medical care, and other resources. As they discuss, racial inequality and prejudice become literally embodied in the biological well-being of racialized groups and individuals. This kind of reasoning can be extended to other biologically based phenomena such as age and sex across the life history of individuals who also are affected by inequality and differential access to resources (see Chapters 4, 6, and 7).

Human bodies and phenotypes are highly plastic and can physiologically respond to a diverse range of stressors in a variety of ways. Positively, in ways that are neutral to positive for survival and reproduction, the stress response can lead to habituation, acclimation, and adaptation over the course of hours to years. But humans can also physiologically respond in ways that are disruptive and maladaptive, and detrimental to survival and reproduction (Figure 1.1, box 5). Maladaptive responses to stress, particularly chronic stress, can manifest on the phenotype in a variety of ways (Figure 1.1, box 6), with particularly marked effects on young, developing individuals (Shonkoff *et al.* 2012), older individuals, and those already in a poor state of health (Schneiderman *et al.* 2005). A robust, burgeoning body of evidence demonstrates that stress experienced by parents, particularly while the mother is pregnant, can influence the health of offspring (e.g., Barker 1997; see Chapter 4), and that these effects can even extend back to the stresses experienced by previous generations (multigenerational effects) (Aiken and Ozanne 2013; see Chapter 5). These negative effects include an impaired immune response, which can lead to greater susceptibility to disease (Khansari *et al.* 1990) as well as reduced rates of wound healing and tissue repair (Graham *et al.* 2006), impaired developmental growth (Shonkoff *et al.* 2012), and predisposition to chronic and degenerative

disease, such as cardiovascular disease and stroke (e.g., Barker 1997). Ultimately, extreme acute stress and prolonged chronic stress and its negative impacts can also cause death. Growth disruption can manifest in a variety of ways, such as through reduced stature, evident both in height of living individuals and stature reconstructed from skeletal metrics, as well as reduced deposition of enamel on teeth, known as enamel hypoplastic defects (see Chapters 6–11 and 21). Human tissue often responds in a generalized and non-specific way to stress, but what often has the greatest explanatory power for understanding human experiences of stress is not the specific disease agent involved, but rather the severity, duration, and temporal course of physiological disturbances (Figure 1.1, box 5). Information from a variety of phenotypic indicators, from birth weight to enamel hypoplastic defects to stature, provides a large body of data to interpret the well-being of individuals during life, from modern to ancient populations.

Although it is crucial to document these physiological changes at the individual level, from an anthropological perspective it is even more important to realize that health and adaptation fit into a larger network of relations that extends beyond the individual to the population and community (Figure 1.1, box 7). For example, undernutrition of individuals can be established by examining their phenotype. This can be extrapolated to community effects; severe or prolonged undernutrition in large numbers of people within a group has the potential to negatively impact work capacity, fertility, and mortality. It is also associated with disruptions to the social, political, and economic structure of single communities and has the potential to destabilize whole regions as well.

Although ecological stress can be sometimes causally related to biological stress, ecological factors are not the only source of stress. For instance, warfare can become pervasive due to shifts in ideology and power and this can be a source of biological stress and mortality as well. The model in its most simplistic form may seem to be largely processual, in suggesting unicausal variables and a simple feedback loop. However, the model can easily accommodate much more complex, and postprocessual, cultural factors as causal mechanisms creating biological stress. The feedback from box 7 back into boxes 1, 2, and 3 represents the ways that cultural and population-level changes can further cause changes in the environmental – both the physical as well as the culturally constructed – systems. During these times, the subcomponents of cultures, including the economic, political, and social systems that are inextricably linked with the ability to respond to stressors, could be further impacted as well.

Although this generalized model may strike some as being static and containing simple factors within boxes, as a heuristic device, it and other similar models are invaluable to biocultural anthropologists. And, with the recognition that conditions are historically contingent, relational, and highly dynamic, the model can be adapted to particular moments in time and space. The biocultural model is only as dynamic and complex as the researcher using it makes it. For instance, when there is a great deal of available evidence on environmental,

social, cultural, and other contexts, the model can be added to in order to integrate and operationalize all of the forces and processes at work.

Difficulties in using the biocultural approach

As many scholars have noted, the biocultural approach can be too complicated to apply to anthropological research (Dressler 1995; Dufour 2006; McElroy 1990). For instance, researchers using the biocultural approach typically seek to assess the effects of a culturally defined variable – an independent variable – on some aspect of human biology. These variables can be difficult to operationalize (Dufour 2006), especially when they are composed of multiple, intersecting social, ecological, and economic components. Successfully operationalizing them in ways that are ethnographically or historically accurate and valid and scientifically replicable requires having location- and condition-specific ethnographic, archeological, and/or historical knowledge (Dressler 1995). Sometimes, particularly for the ancient past, this information is no longer available. Researchers must also wrestle with understanding the complex mechanics and effects of concepts and processes such as inequality, poverty, health, and well-being (Dufour 2006). Poverty, as noted earlier, is especially difficult to conceptualize, as it is multidimensional, as well as being a social, economic, material, and even psychological phenomenon. Different aspects of the particular conditions under study, such as nutrition or the dynamics of a given infectious disease, as well as characteristics of the human-built and physical environments, can lead to a great number of research questions and possible approaches (see Narayan 2000).

Lastly, understanding the complex interactions that can occur between various aspects of biology and culture requires researchers to identify, define, and measure – in a scientifically replicable way – many different causal pathways, which can be very challenging in practice (Dufour 2006). However, as this volume demonstrates, these complications, with the assistance of biocultural models such as the one discussed earlier, can be overcome. The authors of all the chapters in this volume and the case studies contained therein make sure to fully explain the theoretical approaches that they employ, be transparent about the methods that they use, and clearly explain how they interpret their results. This shows not only how these challenges can be surmounted, but also the tremendous intellectual rewards and insights that can be gained when they are.

The case studies in this volume

The volume is divided into six sections, each addressing a critical topic that is under investigation using the biocultural approach. In the following, we discuss these topics and the chapters addressing them, highlighting the unique insights of each and how they fit into the volume's synthetic framework.

Part I: Critical and synthetic approaches to biocultural anthropology

Contributions in this section demonstrate how the biocultural approach can be used to synergize and integrate diverse variables, processes, outcomes, and mechanisms dealing with the intersection between biological and cultural factors. Thomas (Chapter 2) provides an overview of the development of the biocultural approach during the twentieth and twenty-first centuries, but without the biases that can come from describing a process in the past while knowing the outcome in the present – “hindsight is 20/20.” Instead, with humility and honesty, Thomas describes how changes in his approach to his long-term (more than 20 years and counting) collaborative research project on human adaptability and plasticity in the highland community of Nuñoa, Peru, mirror changes in the overall biocultural approach. More specifically, he shows how misunderstanding, trial and error, and analytically running in place to keep up with a constantly changing political and cultural landscape drove changes in his thinking, and how these mirror the same processes in the overall discipline of anthropology as it progressively produced the biocultural approach. This transparency should be highly appealing to students, as it reveals the “human side” of research as well as the dynamic nature of research design, all the while explicitly demonstrating how anthropology and the biocultural approach in particular are exceptionally well suited to prepare students to understand, unpack, and address change and flux in their own communities, nations, and world system.

Leatherman and colleagues (Chapter 3) highlight the dynamic and fundamentally intertwined intersection of local and global systems, ecological, economic, and epidemiological, in their analysis of diet, health, and nutrition in Mayan communities in the Yucatán Peninsula, Southern Mexico. They employ a critical biocultural approach, which is centered on critique and reflexivity; great attention is paid to understanding both how historical and political economic forces shape biological variation as well as how the social context in which the research is carried out shapes the research process itself. As applied here, this approach allows Leatherman and colleagues to identify the nuanced processes through which local diets are shaped by global political forces, specifically the replacement of a local, healthful, indigenous cuisine with the high-calorie, low macro-, and micronutrient “Western diet” that so many readers will be familiar with (for many of you, this is *your* diet as well), and how these processes are a reflection of more global nutritional, economic, and epidemiological trends.

Part II: Biocultural approaches to identity

In this section, contributors tackle issues of identity in a variety of different forms. Goodman (Chapter 4) explores relationships between race and health, grounded in the anthropological understanding that race is not biologically “real” or valid, but that social race has dramatic effects on many aspects of quality of life, especially health. Throughout this fascinating chapter, Goodman identifies, unpacks,

and examines evidence for two primary hypotheses or causal pathways posited as to why race – being “black” or “white” – is associated with a great range of differential health outcomes, from cardiovascular disease to death by homicide. These causal pathways are the “racigenetics” hypothesis, which posits that racial health differentials are the product of genetic differences between the races, and the “lived experience” hypothesis, which posits that chronic, life-long experiences of racism, prejudice, and reduced access to opportunities and resources cumulatively produce poor health. With a variety of lines of evidence firmly supporting the lived experience pathway, Goodman explores how insidious and hidden the destructive effects of race-based social inequality can be.

Kuzawa and Gravlee (Chapter 5) tackle questions of disparities in health across racialized identities within contemporary populations. Drawing on many biocultural factors that determine access to resources and good health in the United States, they demonstrate how little genetics have to do with illness and death. Taking the longer arc of time as their reference point, they ably demonstrate that political, economic, and historical factors have led African Americans to not have the opportunities for good health and the social context for a stress-free life. Their case study illustrates the pathways by which these differences in lived experience lead to biological differences that operate through wear and tear on the body’s defensive systems or by modifying early growth and development in children.

Continuing in this vein of exploring the ways in which racism gets under the skin and affects health and patterns of death, Blakey and Rankin-Hill (Chapter 6) present an overview of their long-term study which focused on the now famous African Burial Ground in New York City. Using a wealth of biocultural data collected from the skeletal remains of enslaved individuals, they show the innumerable ways in which they were physiologically and biologically beaten down by oppressive treatment, poor nutrition, and being literally worked to the bone, in a larger political and economic context of the commodification of African bodies. What is most unique about the approach taken here is their engagement with the opinions and desires of the descendant community of African Americans. This case study, perhaps more than all others, emphatically demonstrates that biological indicators of disease or early death only tell part of the story. The rest of the story lies in ethnohistoric documents, slave owners’ wills and diaries, demographic records, and medical accounts.

Rankin-Hill (Chapter 7) follows with a vivid biocultural study of burials from the First African Baptist Church that provides another angle to the story about the welfare and health of Africans forcibly brought to the New World. In this nuanced and richly detailed study focusing on diasporic patterns, she demonstrates how historical skeletal samples can yield not only information about health and disease, but that the burials also offer glimpses into the lived experiences and reality of specific locations at specific times in history. Her study also emphasizes that Africans who ended up in the New World represent wildly heterogeneous populations, which is crucial for deconstructing the myth of the homogeneity of African American identities.

Part III: Biocultural approaches to health and diet

In this section, a number of authors tackle the common yet deadly ways in which diet and disease interact to create human suffering in the form of illness, nutritional diseases, stunted growth, and early death. All of these chapters fall under the rubric of “lessons learned from the past” – admittedly an old trope but one that is employed in novel and inventive ways by these works.

Sandberg and Van Gerven (Chapter 8) present the culmination of decades of research on the medieval indigenous communities that thrived along the Nile River in present-day Sudan. Groups from archeologically contemporaneous sites at Nubia, on an island, and Kulubnarti, on the mainland, are compared to assess the differential biological effects, specifically illness and mortality in infants and children, as well as religious, political, and economic social forces, all of which operated differently between the two communities. They argue, as is reflected in their title – “Canaries in the mineshaft” – that when vulnerable infants and children suffer, it is a signal, like the death of a canary in a contaminated mineshaft, that as go the children so too the adults. The authors use a wide variety of biocultural indicators of health to show why and how the groups on the mainland did so much better, health-wise, than those on the island.

The next chapter, by Baker (Chapter 9), maintains this focus on medieval Nubia, here examining how archeological excavations and skeletal samples from the region have been instrumental in development of the biocultural approach, particularly within bioarcheology. Throughout this discussion, Baker emphasizes the unique insights into ancient lifeways, identity, society, and adaptations in Nubia, that the biocultural approach has been used to generate. These include nuanced interpretations of the biological costs of sociopolitical, economic, and environmental change, including state collapse, as well as social changes wrought by immigration and processes of assimilation, putting into practice Thomas’s assertion that the biocultural approach is uniquely well suited to comprehending the effects of large- to small-scale social change, in the past and the present.

Grauer and colleagues (Chapter 10) employ multiple lines of evidence and methods, including historical demography and paleopathology, to produce a holistic, nuanced, and carefully considered reconstruction of life in nineteenth-century Peoria, IL, a bustling riverside industrial community. Importantly, they emphasize the need for a thoughtful approach to the methods and data employed for reconstructions of lifeways in the past, but one that is just as relevant to multifactorial, holistic reconstructions for present-day communities: what can we learn about their lives from these methods and data sets and what can we not? What can we learn from comprehensively studying one individual in a community versus all available members of the community? In particular, they apply this cautious, considered approach to gain profound insights into the effects of urban living and industrialization on Peoria’s most biologically and economically vulnerable residents: children.

Magennis and Clementz (Chapter 11) use the biocultural framework to interrogate the effects of industrialization on one indicator of adequate nutrition and overall health, specifically skeletal robusticity, which is a measure of bone strength relative to body size. Traditionally, studies investigating skeletal robusticity over the long arc of time have suggested that as humans became less mobile and more committed to sedentism and agriculture, their bone robusticity declined. The authors extend this idea by asking if the shift from an agricultural lifestyle to an industrialized one of mechanization and urbanization also affects robusticity. Their findings, only interpretable within a biocultural context, reveal a stunning rebuttal to traditional interpretations, namely that robusticity increased in urbanites, when compared to their agricultural ancestors. Importantly, Magennis and Clementz caution that skeletal responses to lifestyle, nutrition, and social environments are both variable and contingent, making it crucial to utilize a multifactorial approach.

White and Longstaffe's chapter (Chapter 12) continues to demonstrate the unparalleled intellectual insights that can be gained from in-depth, long-term, holistic, biocultural research in single regions and cultural periods: ancient Nubia and Egypt. Far from exhausting the topic, White and Longstaffe use the region and its people to demonstrate the value of bioculturally oriented anthropological isotopic studies. They intensively discuss the insights into adaptive domains, and population-level patterns of health and disease, that can be gained from isotopic reconstructions of diet and residential mobility. Importantly for students, they also identify key areas for *future* research, highlighting what anthropological isotopic studies may yield in the future on human–pathogen interactions, environmental change, and human–environment interactions, with the understanding that lessons from the past have great implications for current and future human communities.

The case study presented by Widmer and Storey (Chapter 13) deals less with health directly. Instead, it is an in-depth interrogation of what we know about ancient Mexican, or Prehispanic, cuisine as reconstructed through diverse data sets. Their analysis of floral and faunal remains found at archeological sites, combined with ethnohistoric and contemporary accounts of food use, provides a riveting and irresistible listing of what ancient people utilized for food. From insects and eggs from dozens of bird species, to algae and every imaginable reptile and mammal on land and in the waters, Prehispanic cuisine was anything but tortillas and beans. While those foods were foundational, literally dozens of other plants and animals were used to flavor and enhance what people ate. The take-home message in a broader context is that while humans did settle on monocrops, such as corn, in many parts of the world, they supplemented that part of the diet with a long list of nutritious indigenous and common plants and animals that provided texture, flavor, palatability, and spice to these cultigens. Modern agricultural societies could take a hint from these practices.

Part IV: Biocultural approaches to infectious disease

This section focuses on biocultural approaches to infectious disease, a major force in shaping human health and variation since our earliest evolution. In clear and engaging prose, Barrett (Chapter 15) takes on many of the misunderstandings and stereotypes surrounding recent (2014) events involving the Ebola virus and various epidemics of the disease from the 1970s to the present. Barrett draws on his long-time collaborative work with Armelagos, in which they traced the ways that culture affects human behavior and how these shape both the physical and social environments in which humans live. Understanding of these inherently biocultural contexts is the key to explaining the “why,” both proximate and ultimate, and the “how” of epidemics in the past as well as the present. Without this “deep time perspective” on diseases in general, we are doomed to interpret epidemics without understanding the long-term mutually interactive relationship that exists between humans and their pathogens. This contribution powerfully demonstrates our absolute need – in anthropology and related disciplines, namely public health and clinical medicine – to take a broadly biocultural approach to epidemic infectious disease.

In their contribution (Chapter 15), Smith-Guzmán and colleagues present an inherently biocultural model for differentially diagnosing the diseases responsible for ancient epidemics, with a case study focused on the infamous late fourteenth-century BC Hittite plague. Their model, demonstrated in the case study, seamlessly considers and integrates multiple epidemiological, ecological, social, political, economic, and even entomological variables that influenced and produced the “plague” in order to identify what disease may have caused it. Importantly, despite all of this complexity, the model is designed to be generalizable, therefore providing a framework for other researchers who need to empirically divine the causes of past epidemics, from the Plague of Athens to the Black Death. While one of the challenges to implementing the biocultural approach, as noted earlier, is operationalizing all of the highly contingent variables involved in biocultural interactions, Smith-Guzmán and colleagues masterfully demonstrate exactly how this can be performed.

Lastly, following a similar trend, Zuckerman and Harper (Chapter 16) demonstrate how paleoepidemiology and the biocultural approach can be combined to gain empirical insights into the origin, evolution, and distribution of diseases in the past, specifically the origin and antiquity of syphilis. Scholars have debated the origin of syphilis for upwards of 500 years, polarized between whether it originated in the New World and was brought to the Old by Columbus, or whether it was “always present” in the Old World. The authors employ rigorous epidemiologically informed criteria to evaluate the certainty of the diagnosis and date of putative cases of syphilis, and related treponemal variants, reported from the pre-Columbian Old World. Further, they use the biocultural approach to explain how and why syphilis has evolved over time in response to various sexual and environmental pressures, and evaluate arguments as to why pre-Columbian evidence for the disease is so scarce in the Old World.

Together, paleoepidemiology and the biocultural approach are moving scholars progressively closer to understanding whether, when “Columbus sailed the ocean blue,” he did more than “discover” the Americas, instead unleashing a terrifying disease upon the world.

Part V: Biocultural approaches to understanding population dynamics

Contributors to this section apply biocultural approaches to epidemiology, paleoepidemiology, demography, and paleodemography to gain a better understanding of disease patterns and the drivers of population dynamics. Mielke (Chapter 17) integrates the biocultural approach into epidemiologic transition theory (which models relationships between economic growth, population growth, mortality, and fertility) with the emphasis on demonstrating how understanding long-term patterns of disease mortality and their connections to demographic, environmental, and cultural factors is significant for comprehending modern epidemiological landscapes. Documenting, understanding, and modeling the dynamics of past epidemics also enables preparedness for future epidemics. As is particularly demonstrated by Mielke’s sophisticated dissection of epidemiologic transitions in the Åland Islands of Finland, these diverse factors, both biological and cultural, must be conceptualized holistically and integratively in order to effectively understand what drove morbidity (sickness) and mortality in the past and what may produce it in the future.

Zuckerman and colleagues (Chapter 18) also grapple with epidemiologic transition theory, here with the explicit aim of demonstrating how human host–pathogen interactions can be *directly* applied to improve human health in the present, through clinical treatments and public health interventions. The chapter pivots around the question: why are chronic inflammatory diseases (CID), like asthma, allergy, and autoimmune diseases, at high and increasing incidence in high-income, developed nations? This may strike home with many students, themselves increasingly afflicted with conditions like eczema, hay fever, and asthma. The hygiene hypothesis, which implicates contact with environmental microorganisms, parasites, and our gut flora in healthy immune function, is evoked to explain why CID incidence is high and increasing. Embedded in this framework of epidemiologic transition theory and the hygiene hypothesis, Zuckerman *et al.* provide a case study explaining why intestinal parasites, such as the pig whip worm, may soon be available from your local pharmacy to treat one particular CID, inflammatory bowel disease.

In their contribution, Schurr and colleagues (Chapter 19) synthesize archaeological, ethnographic, genetic, and historical evidence for several modern indigenous Caribbean populations to reconstruct the original peopling of the region, and address the complex biological and cultural impacts of assimilation, disease, and genocide brought about by European colonization and the trans-Atlantic slave trade on indigenous Caribbean communities. Historical discourses about

the Caribbean and circum-Caribbean have typically emphasized West African and European influence, generally neglecting indigenous people's contributions to the biology and culture of the contemporary region. But Schurr and colleagues counter this with direct evidence that the islands were inhabited by a complex cultural *mélange* of people prior to European contact, with these conventional labels primarily a product of socioeconomic differences among indigenous populations, hegemonic colonial policies, and misinterpretations of ethnohistorical records. Importantly, this work also has direct, applied implications: indigenous groups, working directly with Schurr and colleagues, are using the synthesized evidence to reconstruct their lost heritage, empower their communities, argue for legal recognition as sovereign tribes, and exert more control over their cultural patrimony.

Swedlund and colleagues (Chapter 20) take a highly novel and interdisciplinary approach to thinking about the important factors that shape human health and population vitality. They work with demographic information, environmental constraints, and sophisticated models to project how well communities of humans living in the sparse and barren portions of the American Southwest could have survived during times of drought and other ecological impositions over the course of hundreds of years of occupation. The biocultural approach lies at the heart of this work, because it offers a way to systematically model biological features which make groups vulnerable—infants dying, frail elderly, males lost to war—and cultural factors that buffer groups or produce and exacerbate poor health—degrading the landscape with intensive farming, decisions to migrate or stay, and establishment and maintenance of trade networks. While these data help us to understand past populations and their responses to climate change and other factors, they can be extended to better prepare for future events as well.

Part VI: Biocultural approaches to inequality and violence

The final section of this volume includes three chapters that focus on the longer history and trajectory of inequality and violence in human groups. The biocultural approach is useful when trying to decipher particular kinds of suffering from the archeological record and from human skeletal remains. The biological data (derived from skeletal remains), the cultural context (reconstructed from artifacts and settlement data), and the environment (pieced together from ethnobotanical remains and ecological signals in the soils and trees) are combined in these analyses to paint a picture of what life was like in the past. Turner and Klaus (Chapter 21) heed the advice of Armelagos, who emphasized that the only way to make sense of the pathologies seen on ancient skeletons is to dig deeply into the cultural context. This can reveal the structures that may have been in place that caused some individuals to be linked to disease and trauma while others

were buffered or protected. This chapter provides a broad overview of all of the major areas wherein bioarcheology, the study of human remains in their cultural context, has made inroads into understanding the human experience in cultures that are only known now by what has been preserved archeologically. Anchoring their discussion in state-of-the-art methods with applications to several regions of the world where they have worked, the authors highlight how the study of ancient burials and human skeletal remains has been enriched and enhanced through the biocultural approach.

Following this are two chapters that specifically highlight how human skeletal remains afford a glimpse into violence, pain, and suffering. Both of these case studies emphasize the biocultural approach, locating the origin and causes of violence that are embedded in political economic structures within the respective cultural systems. Pérez (Chapter 22) draws on the same theoretical approach to direct and structural violence as discussed in Turner and Klaus. He expands their discussion to provide a detailed overview of how deeply embedded violence is within societies. Violence that is patterned and directed at certain groups of people is often used to keep those groups subordinated and in a lower rank within the society. Violence keeps inequality in place by giving some – elites, those in power – access to things such as food and wealth, while limiting access for others. In a stunning example from the early twentieth century, Pérez highlights a massacre of over 100 men, women, and children in Sonora, Mexico, who were brutally attacked by the Mexican army for supposedly carrying out an uprising against the current governmental regime. Pérez's multifaceted analysis incorporates data from the remains of the victims along with historic documents, permitting a detailed reconstruction of this massacre and its reverberating effects.

Martin and Osterholtz (Chapter 23) continue to look at forms of violence through a biocultural lens by investigating two contexts wherein trauma was identified on the remains of ancient indigenous communities from the American Southwest. In one context, a subgroup of adult females had been thrown into and buried in abandoned structures; their bones revealed a life of beatings and hard work. Applying the biocultural approach to investigate why these women had been so abused yielded an interpretation of structural violence whereby some groups practiced raiding for women. These captives were beaten into submission and then forced to do agricultural labor, ultimately dying with a long list of pathologies and trauma. A second case study focuses on the remains of 33 individuals – men, women, and children – who were not only massacred but also tortured; perimortem pathologies on bones of the feet revealed that they had had their feet cut and beaten in such a way that they were hobbled and could not run away. Without utilizing the biocultural approach, it would have been difficult to fathom the cause and purpose of these distinct pathologies, and reconstruct the psychosocial impacts that these traumatic experiences may have had upon the victims, the perpetrators, and the witnesses.

Conclusion

This volume, inspired by a great teacher and researcher within the biocultural approach, is designed to give students of anthropology a sense of the diverse pathways that research and careers in anthropology can take. The future for biocultural anthropology is exciting because there has been a rapid development of new frameworks for understanding and interpreting a wide range of problems that can be seen today at both the local and global levels. Food shortages, nutritional problems, disease and epidemics, increasing violence, and climate change are all in the daily headlines, and all of these topics are covered in the case studies in this volume. But the biocultural approach affords something that few other studies approaching these problems do: the case studies are broad, interdisciplinary, and holistic and they access information that comes from understanding the interplay of environment, biology, and culture.

Beyond the empirical data that anthropologists draw upon, biocultural approaches also use the rich and nuanced information that results from tracing the longer evolutionary arc – the “deep time” perspective – of where the behaviors that lead to these problems originated in the first place. The biocultural model, in its simplicity and elegance, provides a way to integrate these diverse sources of data and to make sense of them in an empirical and replicable manner. In almost every case study, data were obtained that provided information on the forces within cultures that systematically affect individuals, families, communities, and regional populations.

Yet challenges and new frontiers remain for the next generation of biocultural anthropologists to tackle, and we hope that this volume inspires students to do so. May a new generation of biocultural anthropologists interested in bettering the human condition take up the challenges posed by the research in this volume and continue to move it into new areas. Instead of inscribing and staying within intellectual borders, biocultural studies necessarily go beyond traditional lines into new terrain and this is where solutions to complex human problems lie.

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Notes

1 Also known as the “biosocial” approach or perspective in some works.