Contributions of biological anthropology to the study of hormones, health, and behavior

CATHERINE PANTER-BRICK
AND CAROL M. WORTHMAN

1.1 Current issues linking hormones, health, and behavior

This book concerns the relationship of human biology and human society, as viewed by examining the interconnections among behavior, hormones, and health. There is both scientific excitement and practical urgency behind the ideas and findings presented here, as the need for a sociobiological view of function and well-being has become ever more apparent.

During the past two decades, a paradox has emerged in worldwide patterns of health and health risk. On the one hand, international initiatives have succeeded in dramatically increasing life expectancy for many populations by means of interventions that reduce early mortality through technology-based measures such as vaccination, provision of clean water, provision of health care, and improvements in nutrition. On the other hand, a set of health issues has emerged that is less tractable to such measures. These health issues include the emergence of chronic degenerative diseases as major sources of mortality for aging populations, increases in age-specific rates of such diseases concomitant with lifestyle change, and the appearance or resurgence of major infectious diseases with behaviorally-dependent transmission. A common thread running through all these intransient challenges to health is the importance of patterns of everyday behavior and social relationships in their etiology or transmission. Recognition of the importance of socio-behavioral factors in increasingly significant risks to health has stimulated interest in specifying the pathways by which these factors affect health risk, in order to identify novel health-promoting interventions or refine improved implementation of existing health measures. Such an enterprise is predicated on a fine-grained and thorough understanding of the local contexts that influence health outcomes.
The task of unravelling the relationships between social ecology and health has been impeded by the difficulty of monitoring the physiological processes that mediate immediate biological impact or long-term functional consequences of contextual factors which affect health outcomes. Endocrine measures have proven useful for tracking both such short- and long-term pathways, for hormones serve as indices or markers of the processes that mediate relationships between behavior and health. The endocrine-neuroendocrine system is in large part designed to coordinate various biological processes at disparate body sites over time (e.g., metabolic regulation, growth, reproduction), and to orchestrate physiological responses to shifting inputs and demands. In addition to being responsive to physical demands, this system is exquisitely responsive to cognitive-emotional experiences that thereby influence physiology.

Table 1.1 outlines the action and regulation of the principal endocrine axes discussed in the present volume, and its layout reflects the impressive diversity of endocrine impact. Extensive exploration of both the endocrine and neuroendocrine systems has led to a recognition that these constitute a functional continuum and are hence scarcely separable. The distinction was originally based on the blood-borne effects of secretions on remote tissues (classic endocrine activity) versus the cell-mediated and local effects of neuroendocrine activity. The functional spectrum over which endocrine and neurological actions interact is reflected in Table 1.1. It includes (a) central nervous system regulation of peripheral gland activity via a set of humoral messengers with elaborate feedback mechanisms (the hypothalamo-pituitary axes); (b) direct neural regulation of neuropeptide release by a peripheral gland (epinephrine and norepinephrine release by adrenal medulla) (c) gland-based regulation of circulating levels of nutrients, metabolites, or other biochemicals (pancreatic production of insulin stimulated by blood glucose), and (d) a mobile cells-based distal system of endocrine action in immune function, in which local stimuli trigger release of cytokines and other substances with autocrine, paracrine, and endocrine effects.

The well-recognized linkages between external and internal conditions forged by the endocrine–neuroendocrine system make it a prime focus for the investigation of links between behavior and health. Expanding knowledge of endocrine physiology and function has converged with continual improvements in endocrine measurement techniques to provide fertile grounds for such investigation.
### Table 1.1. Regulation of principal hormones discussed in this volume

#### (a) Hypothalamo-pituitary axes

<table>
<thead>
<tr>
<th>Hypothalumus</th>
<th>Anterior pituitary</th>
<th>Target organ</th>
<th>Peripheral hormone</th>
<th>Binding protein</th>
<th>Major function</th>
</tr>
</thead>
<tbody>
<tr>
<td>GnRH</td>
<td>FSH and LH</td>
<td>ovary</td>
<td>estradiol (E2) progesterone (P)</td>
<td>SHBG</td>
<td>reproductive development, regulation, and behavior, sex characters, growth.</td>
</tr>
<tr>
<td>GHRH (+)</td>
<td>GH</td>
<td>liver and many other tissues</td>
<td>IGF-1, IGF-2</td>
<td>IGFBP-3</td>
<td>organic metabolism, metabolic role, alertness, neural development, potentiate GH</td>
</tr>
<tr>
<td>GnRH (-)</td>
<td>TRH</td>
<td>TSH</td>
<td>T3, T4</td>
<td>TBG</td>
<td>energy availability, immune function, vascular reactivity</td>
</tr>
<tr>
<td>CRF</td>
<td>ACTH</td>
<td>adrenal cortex</td>
<td>cortisol</td>
<td>CBG</td>
<td>energy availability, immune function, vascular reactivity</td>
</tr>
<tr>
<td>CRF (+) delays (-)</td>
<td>ACTH (+)</td>
<td>adrenal cortex, intestines, reproductive organs</td>
<td>Δ4, DHEA, DHEAS</td>
<td>poorly understood</td>
<td>breast development, milk production</td>
</tr>
<tr>
<td>CRF (+)</td>
<td>PRL</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

#### (b) Direct neural regulation

<table>
<thead>
<tr>
<th>Neural input</th>
<th>Target organ</th>
<th>Peripheral hormone</th>
<th>Major function</th>
</tr>
</thead>
<tbody>
<tr>
<td>sympathetic nervous system</td>
<td>adrenal medulla</td>
<td>epinephrine, norepinephrine</td>
<td>cardiovascular function, organic metabolism, stress response</td>
</tr>
</tbody>
</table>

#### (c) Semi-distributive regulation and production

<table>
<thead>
<tr>
<th>Provocative agent</th>
<th>Production site</th>
<th>Hormone produced</th>
<th>Major function</th>
</tr>
</thead>
<tbody>
<tr>
<td>glucose</td>
<td>pancreas</td>
<td>insulin</td>
<td>regulate blood sugar levels</td>
</tr>
</tbody>
</table>

#### (d) Distributive regulation and production

<table>
<thead>
<tr>
<th>Provocative agent</th>
<th>Production units</th>
<th>Hormone produced</th>
<th>Major function</th>
</tr>
</thead>
<tbody>
<tr>
<td>foreign antigen</td>
<td>leukocytes, macrophages</td>
<td>cytokines</td>
<td>immune defense, sickness behavior</td>
</tr>
</tbody>
</table>

Note: Abbreviations used:
- ACTH: adrenocorticotropic hormone
- CBG: cortisol binding globulin
- CRF: corticotrope releasing hormone
- Δ4: androstenedione
- DHEA: dehydroepiandrosterone
- DHEAS: dehydroepiandrosterone sulfate
- FSH: follicle stimulating hormone
- GH: growth hormone
- GHRH: growth hormone releasing hormone
- GnRH: gonadotropin releasing hormone
- IGF-1: insulin-like growth factor-1
- IGF-2: insulin-like growth factor-2
- IGFBP-3: insulin-like growth factor binding protein-3
- LH: luteinizing hormone
- SHBG: sex hormone binding globulin
- T3: triiodothyronine
- T4: thyroxine
- TRH: thyrotropin releasing hormone
- TSH: thyroid stimulating hormone

(+) stimulatory, (-) inhibitory, ? factor uncertain.
attention on two levels of variation, that between and within populations. As much of the work reviewed in this volume underscores, the comparative cross-population approach can assist in identifying factors that accompany variability in function or outcomes (in growth, work, health, reproduction). Biological anthropology has repeatedly demonstrated that the ecologies characteristic of a population can shape its biology in a manner distinctive from others. Therefore, only comparison among populations or subgroups within populations can reveal the differential effects of ecological and other, such as genetic, variables that significantly influence human biology and the population specific "normal range". The need for a population comparative view of human biology becomes especially significant when one considers that most of what we know about human physiology, development, reproduction, endocrinology, and aging is based on studies of relatively well-nourished, healthy, well-nourished, post-industrial societies of Europe and North America in the mid-late twentieth century. As such, these societies may represent human biology under rather privileged circumstances, thereby also presenting a very particular and perhaps unusual (in human historical-evolutionary versus) picture of human biology that reflects the particularities of largely favorable and novel ecological circumstances. In this view, gaining insight into health issues that plague the west may depend on a comparative approach that reveals the ways in which patterns of development, function, and aging may be distinctive in these groups and lead to specific health risks. Concurrently, comparative research can expand our view of what constitutes the normal and expected ranges for functional and morphological parameters across the life span. Such ranges may often be condition specific or ecologically contingent.

Improved models of health determinants increasingly rely on probing individual variation within populations. Basic and clinical research have focused on establishing how the body works in health and illness, and identifying ranges of normal function for humans; the prevailing assumption guiding this work is that such norms will be generalizable or universal across populations. Epidemiological analyses reveal the variation in internal health risk structures within populations and provide the statistical basis for comparison between them. Furthermore, not all individuals who fall within "risk categories" manifest the phenomenon for which they are at risk, for risk merely denotes a greater probability of a negative health outcome (i.e., morbidity or mortality). Identification of the determinants of positive outcomes in individuals at risk (sometimes termed "positive deviance") (Ben-Yehuda, 1990; Johns, 1993; but see Sagarin, 1955, Las

Contributions of biological anthropology has increasingly recognized as a means to uncover health-protective factors, not only constitutional or intrinsic (biologically based) but also conditional or extrinsic (social-contextual) variables. Moreover, the complexities of human social ecology (namely, the living conditions created or influenced by social factors such as social behavior, subsistence activity, or social status) mean that individuals do not live in a "society"; rather, they live under specific circumstances determining the microecology that effectively defines the actual experiences, exposures, challenges, inputs, and supports they encounter. Anthropologists therefore concentrate on the socio-cultural factors that generate differential demands, resources, and contexts encountered by members of a society. Individuals within populations encounter specific circumstances that are organized by status (age, gender, social class), specific practices (e.g., reproductive behavior, child care, workload), attitudes (perceived needs, valued goals), and social constructions of the life course. Hence, members of a society may experience quite different lived microecologies that can vary within (synchronously) and across (diachronically) time.

Third, biological anthropology aims not only to identify variability per se, given that people and populations may differ from each other in innumerable ways, but also to ascertain the relative significance of observed variation. Variation is of specific interest when it demonstrably associates with changes in important outcomes, such as differential growth, fertility, activity, and survival. Of course, the determination of what is "important" is also a matter of value and open to socio-political critique and debate. Nevertheless, identification of relative risk and benefit can assist in the process of evaluating outcomes and weighing alternative interventions. Here, integration of multiple levels of analysis must ensure that an evaluation of significant variation will draw on multiple domains. Such an approach, moreover, allows identification of conflicting outcomes, or trade-offs, in which a positive effect on a desired outcome may be offset by a negative effect in another. Instances from chapters in this book include McGarvey's data linking lifestyle change and enhanced influence among Samoans to increased risk for obesity, diabetes, and cardiovascular disease, and Ellison's suggestion that heightened gonadal activity resulting from sustained good nutrition and health contributes to increased risk for reproductive cancers among affluent contemporary populations.

Fourth, anthropology places strong emphasis on people's actual, everyday lives. The centrality of action "on the ground" leads to a keener appreciation of the cultural logics and practical constraints that significantly inform human behavior and thus, human ecology and experience.
As with any empirical endeavor, biological anthropology recognizes the need to operationalize functional concepts or hypotheses in real-world terms that break down phenomena into their testable, measurable components. For instance, in this volume, the important but vague concept of stress is repeatedly explored in both non-human and human primate models to elaborate the nature of stress and its distinguishing pathways linking inputs, biobehavioral characteristics, and consequences. Nevertheless, an insistence on integrating specified and validated models into an overall view of primate social contexts that vary over time supports a drive to integrate what we learn of specific functional relationships into models of increasing complexity, diversity, and thus enhanced general validity. In particular, a concern with lifespan processes, namely, the shifts in functional capacities, risks, and opportunities across the lifespan, lead anthropologists to take a diachronic view of human variation. This view is codified in life history theory, which concerns species-specific patterns of time and resource allocation to the critical tasks of survival, maintenance, growth, and reproduction across the lifespan. Central to anthropological thinking is the recognition of finite resources in finite and energy, and the consequences of limited and time-limited resources to long-lived creatures living in complex social contexts. Juxtaposition of competing demands with limited resources leads to trade-offs among functional biological domains (e.g., growth versus reproduction), between current and future demands (immediate versus long-term), and between present and deferred reproduction), and across adaptive demands (biological versus social). The specific set of trade-offs faced by individuals or populations arise from temporal and socio-ecological parameters that define the distribution of resources and demands. As noted above, the landscape of trade-offs faced by individuals is shaped by sex, age, and status-specific biological and socio-cultural variables that shift the urgency and distribution of demands and access to needed resources. Here, the anthropological view of humans as intelligent and intentional or planful, but also as constrained, biological and social beings, shapes our understanding of differential health outcomes. Not everything can be optimized all of the time, so the prime question becomes what to optimize, and when. Maintenance of a lifespans perspective in anthropology foregrounds the significance of trade-offs across time, and the temporal nature of constraints placed upon individual choices. These issues are discussed in Worthman's chapter, particularly with reference to the role of the endocrine-neuroendocrine system in mediating these trade-offs on the biological level.

Fifth, the anthropological contributions in this volume reflect the stimulating effects of methodological innovations and modifications that have paved the way for new approaches to the study of hormones, behavior, and health in everyday contexts in diverse populations across a wide range of settings. Anthropology has repeatedly self-identified as a parasite (or perhaps symbiont) on the technological advances in other research disciplines that borrows those methods and adapts them to anthropological purposes. A new generation of anthropologists has also begun to develop novel methods that substantially add to the existing battery of research methodologies. Underlying this trend has been recognition that methods are and should be driven by the research questions they serve, rather than the other way around. This is especially true in biological anthropology, for methods designed to work in clinical or laboratory settings (with good infrastructure and high participant compliance may not be suitable for remote settings, or non-clinical populations to customize to elaborate biomedical protocols. The techniques for measuring hormones and other biomolecules in saliva (Ellison, 1968; Ellison et al., 1993; blood spots (Worthman & Stallings, 1994, 1997) and urine (Campbell, 1994) have greatly expanded the scope of research involving endocrine measures. These laboratory advances underlie much of the work reviewed in this volume.

Another methodological advantage which anthropology brings to the study of dynamics among hormones, health, and behavior, is its strong tradition in behavioral research. This tradition involves fieldwork along with diverse techniques for studying behavior and its cultural, cognitive, and performance measures. Fieldwork with close observation in the study community provides a basis for fine-grained characterization of behavior, while attention to why people do what they do, and react the way they do, permits understanding of the motivational structures underlying behavior. Behavioral research and field research are labor intensive, and therefore, the number of people and geographical spread that can be covered (per investigation) is limited; such research is costly in time and effort as well as money. In large-scale studies of hormone-related issues, the cost factor has led us to a marked preference for less observational and fine-grained approaches and reliance instead on interview or survey techniques. Such an approach may work well when good models are available to suggest which variables will be important, but may be less productive where operationalized conceptual schemes are limited or absent, or their relevance to a specific situation is questionable. As our empirical models of how things work have become more and more elaborate, the business of...
operationalizing them for field research has become increasingly challenging. Contributions in this volume (Sapolsky, Flinn, Pantel-Brick and Pollard) explicitly illustrate the process of translating a research problem concerning linkages among hormones, behavior, and health, into a workable field project.

Finally and fortunately, advances in biostatistics over the past 20 years have tremendously strengthened anthropological research by providing powerful techniques for dealing with repeated measures (of individuals over time), truncated series (individual follow-up where target period is not completely observed), categorical variables, multivariate problems, and small sample sizes (e.g., Breen, 1996; Long, 1997; Mayer & Tuma, 1990). Availability of these techniques on the large statistical packages makes them accessible to many researchers.

1.3 Relevance to health

This volume reflects and extends ongoing investigation of the relationship of biological and social factors in differential health and stress. More than 30 years ago Rene Dubos noted that: "Any medical problem presents itself under two aspects which are sharply different, but complementary. On the one hand, all phenomena of health and disease reflect the biological unity of mankind; on the other hand, all are conditioned by the diversity of the social institutions and ways of life" (Dubos, 1966, p. 367). A perpetual challenge to identification of linkages between factors exogenous to the body and biological health outcomes has been the spatial and temporal remoteness of cause and effect. Risk factors, or conditions that influence the probability that some variable will be associated with individual health consequences, can be especially difficult to detect because the association may be quite remote or complex. An intriguing instance of this is the recent work by Barker and colleagues concerning relationships of gestational factors, reflected in birth and placental weights, to long-term risk for diabetes or cardiovascular disease in British cohorts (Hales et al., 1991; Barker et al., 1993; Law et al., 1995). Although they have established statistical linkages on the population level, the mediating mechanisms remain a matter of speculation (Barker, 1997; Dennison et al., 1997) and the possible confounding variables that may covary with birth weight but act as the actual causal factors (e.g., family environment or dysfunction) remain to be empirically determined. In the case of diabetes, endocrine and metabolic measures can be used to ascertain whether there is an association, if at near birth, between birth or placental weight and these markers
C. Panten-Brick and C. M. Warrenman versus shop floor in Western post-industrial societies, by entailing different consequences in terms of efficacy and social appropriateness of given behaviors. Implications of behavior variation, such as in style or degree of assertiveness, can be strongly gender- or age-differentiated within cultures as well as diversely organized between cultures.

Well-being or frank ill-health is therefore socially situated, in both its individual and trans-individual aspects, and must be investigated as such. This is the perspective that informs the concepts and research presented in this volume. Furthermore, health status does not simply arise naturally or inevitably from the constitution of the individual (e.g., genes) or from the action of external forces (e.g., pathogens, or stressful circumstances). Rather, it is produced as an outcome of the interaction of constitutional with external domains via complex pathways that operate over time, in quite long periods of time. Structures of health risk can vary with age or through secular trends: factors that are health-promoting or neutral at one point may be deleterious at another. This developmental and temporal perspective is also integral to the contributions in the present volume. The socially situated and temporal character of health and health determinants leads to an important conclusion, namely, that global prescriptions for health interventions are not feasible or desirable. Nevertheless, we can identify the critical variables that are likely to be operative, and ascertain the conditions under which they become important. For instance, Boyce and colleagues (1995) have observed that cardiovascular reactivity (heart rate response to challenging tasks) in 3 to 5-year-old American children is associated with high incidence of respiratory illness when such children experience high-stress childcare environments, but high reactivity children show lower rates of illness than low reactivity children under low stress childcare settings. Another example emerges from the enormous literature on infant feeding, infant survival, birth spacing, and maternal reproductive health. Although breastfeeding has been repeatedly demonstrated to have significant effects on health, via the impact on maternal reproductive function, the importance of specific dimensions of breastfeeding behavior varies across populations, and the impact also depends on other environmental variables (see discussion by Panten-Brick and Pollard). Likewise, the impact of supplementary feeding practices on infant health and survival depends on pathogen load, and short versus long-term trade-offs between growth and survival. Thus, despite an intensive search for an ideal schedule for breastfeeding and supplementation, the main conclusion appears to be that appropriate behavioral strategies vary between, and even within, populations.

Contributions of biological anthropology

Finally, we note the escalating need for attention to issues of mental, not just physical, health (Demjén et al., 1995). Although these two dimensions of health are well understood as interrelated, the high priority given to physical health interventions has led to rapid strides in life expectancy concurrent with massive worldwide social transformations, and increasing dislocations have raised substantial challenges for psychosocial adjustment and health. Dynamics among hormones, behavior, and health often intimately involve emotional-cognitive processes and make this an especially appropriate arena for investigating determinants of mental health as well.

1.4. Goals and overall organization

This volume aims, then, to draw together the existing conceptual and empirical threads linking hormones, behavior, and health with specific anthropological contributions that examine the sources of human variation and its consequences across social contexts and through time. We use this lens to focus on endocrine mediators and moderators of interactions between behavior and health, and deploy a socio-ecological and lifespan framework that views behavior as both a determinant and a consequence of the specific ecologies individuals inhabit. The practical goals are to: (1) provide an articulated set of overviews of current knowledge to act as a resource to readers interested in this area, and (2) point to a set of ideas, analytical frameworks, methodologies, and empirical findings that can ultimately assist in guiding choices in resource allocation for preventive medicine and health intervention. Our goal as scientists is ultimately to improve the quality, not just quantity, of life for people at all ages and in diverse contexts.

The organization of this book reflects this set of goals. Each chapter provides details on relevant molecular function, on its associations with behavior and social ecology, and on connections to health consequences over the life course. The long-term, lifespan developmental character of interactions among behavior, hormones, and health figure as a major theme throughout the volume. Most contributions include in-depth case studies of the authors' research on the problem in a specific setting or as extensive comparative data from a range of populations. By working through a specific hormone-health-behavior nexus in terms of the relevant physiological, developmental, epidemiological, methodological, and analytical parameters in association with examples from current studies, the authors also illustrate how research in this area is conceived and imple-
Chapter 2 offers a comparative perspective on social relations and life history. Robert Sapolsky discusses the biobehavioral bases of individual differences in social relations, in response to resource and social instability among non-human primates across the life course. He surveys models, methods, and findings concerning stress as investigated in a number of species, and uses his extensive fieldwork with baboons in Masai Mara, Kenya, as a case study to work through the emerging, much more nuanced, views of stress, social dominance, and the vicissitudes of life. He also presents intriguing data concerning effects of temperamental differences in social relations and stress across the life course.

In Chapter 3, Carol Worthman evaluates life history theory and the endocrine organization of human development, and then considers the implications for variation in that architecture suggested by pronounced contemporary worldwide and historical secular trends in accelerated growth and maturation. She summarizes her comprehensive work on endocrine trajectories in later versus earlier-maturing populations, and considers the causes and consequence of variation in maturation timing. In addition, she reviews the hormonally mediated and developmentally organized variation in physical and mental health outcomes over the short and long term. Relationships among childhood stress, family environment and health represent the complex set of issues addressed by Mark Fulk in Chapter 4. He considers particular challenges for the study of such relationships, and goes on to provide a detailed case study that exemplifies the kind of research, design, methodology, and analysis required. His extensive data from a village in Dominican enable him to reflect on the temperamental, family compositional, and physiological pathways by which children's daily life experiences are connected to their affective and physical well-being. This work represents the most sustained, intensive anthropological effort to date to provide fine-grained psychobehavioral research in the context of close ethnographic observation.

Chapter 5, by Catherine Pantzer-Brick and Tessa Pollard, tackles perhaps the most closely studied nexus of hormone-behavior-health, namely work. The topic has been a focus of attention in Western populations, principally with regard to psychosocial work stress and cardiovascular disease. Its coverage is here considerably expanded to include: (a) research in Western (modern industrial) and non-Western populations, (b) wage/office work versus subsistence labor, (c) unemployment, (d) workload stresses on women's reproductive health, and (e) children's psycho-social stress in school and street work environments. Their review is illustrated with salient examples from the literature.

The burgeoning field of reproductive ecology is surveyed in Chapters by one of its principal architects, Peter Elison, and related to risks for reproductive cancers in contemporary populations. The etiology of cancer is characterized and the relationship of gonadal steroids to carcinogenesis in target tissues reviewed, with particular reference to breast cancer. In the light of this relationship, he presents his collaborative work documenting wide population variation in patterns of gonadal steroid output and thus lifetime exposure to these carcinogenic agents. Behavioral and sociological sources of this variation are outlined and illustrated with extensive fieldwork with a variety of populations.

Chapter 7 examines reported links between cancer and diet from an evolutionary perspective. Pat Whitten describes the effects of nutrients and other chemical components of plants like phytoestrogens on the reproductive system. She considers the physiological mechanisms predisposing modern populations toward adoption of diets that increase cancer risk and illustrates parallels to the mechanisms that organize foraging behavior and reproductive timing in the great apes. She argues that evolutionary adaptations to frugivorous diets predispose humans to select and construct lifestyles that become "unhealthy" when developed to their logical extreme.

In Chapter 8, Steve McCormick pursues health implications of worldwide social change, often termed "modernization," that entail changing work and dietary patterns, altered everyday human relationships and carbohydrates of consumption, as well as modified expectations and values. He outlines methodological approaches to tracing these changes in detail and provides detailed information on how such changes are associated with endocrine-mediated metabolic shifts that enhance risk for adiposity and cardiovascular disease. His extensive work on these issues in Western and American Samoa provide the basis for a closely considered analysis of how social transformations translate into new patterns of health risk that emerge over the life course.

1.5 Audience

The book is directed to scholars from a range of academic disciplines, including human sciences, human biology and ecology, biological anthropology, endocrinology, developmental behavioral pediatrics, developmental psychology, public health and epidemiology. We hope these will include
readers from around the globe who are engaged by scientific and practical concerns over how transforming conditions of life may influence health and well-being. The work presented herein should demonstrate how a human biology approach that deeply observes people in their everyday settings, attends to affective and social dynamics, employs a lifespan developmental perspective, compares patterns of variation within and between populations, and integrates these with a sense of trade-offs across competing demands and practical constraints, will singularly advance understanding of the determinants of health. Although these determinants are complex and variable within and between populations, the empirical advances presented in this volume indicate how biological anthropology provides means to unpack these complexities in a way that contributes substantially to scientific and practical policy concerns.

1.6 References

Contributions of biological anthropology