PART I

CHAPTER ONE

Introduction

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Human biologists, historians, and other social scientists have expressed enduring interest in the evolution of human health over the past several millennia. The search for knowledge is propelled in part by intellectual curiosity. For the same reasons that explorers of the early twentieth century strove to reach the poles and the highest peaks, and their modern counterparts journey to outer space or deep into the oceans, most humans are inquisitive about their past. They want to understand how they evolved and how they shaped and adapted to their environments. They want to visualize or imagine the contours of the human experience – the peaks of adaptive success that led to human growth, expansion, and flowering of civilization, and the valleys of despair in which human presence ebbed and retreated.

But more practical considerations also lead the quest for knowledge. Not only a basic ingredient in the quality of life, health is intertwined with demographic, social, economic, and political change and with the outcomes of wars and other conflicts. Length of life and other aspects of health affect work capacity and the incentives to invest in skills that contribute to economic growth. Basic indicators of the standard of living, such as the human development index proposed by the United Nations, have a substantial health component (UNDP, 1990). Historians and political scientists have identified inequality, not only in income or wealth, but also in the form of disparities in health and nutrition, as a driving force in social, political, and economic change. Thus, health has played a central role in human history, both as an agent of change and as an outcome measure indicating the quality of life. Skeletal measures of health, which are the central focus of this book, furnish the best and, in many cases, the only picture available of human health over the millennia.

Study of skeletal remains for insights into health in the past creates valuable long-term perspective on several modern social problems. Virtually all researchers are aware, at some level, of the significant processes of evolution that gave rise to modern societies over the past several millennia. They understand that many modern problems have roots reaching very deep into the human past, and that current conditions were often created by complex interdependent processes that unfolded

over very long periods of time. In evaluating the results of their research, most social and medical scientists would like to have access to very long-term historical studies that would, for example, place in perspective the prevalence of trauma and violence, urbanization and health, child health, aging and health, and biological inequality.

Research on prehistoric and historic skeletons will also contribute to understanding the evolution of modern medical problems. Numerous modern diseases evolved with humans adapting to humans living in proximity to one another and to animals in a wide variety of ecological environments. Recent advances in the extraction of DNA from pathogens found on skeletons now make it possible to study the coevolution of humans with many diseases. Important first steps in the research agenda are to describe the evolution of human health and to understand its change in response to varying ecological environments.

Despite widespread interest and the general importance of health to human change over the past several thousand years, relatively little is known about the subject. Raw data on population size by age and on deaths by age are virtually unavailable prior to the nineteenth century, and thus, investigators cannot tabulate traditional measures of health, such as life expectancy at birth. Average height, a measure of health long known to human biologists and now familiar to some social scientists, is available in quantity from military muster rolls and other sources as far back as the eighteenth century, but height data are very sparse for earlier eras (Steckel, 1995). Thus, the story of very long-term trends in health cannot be told with traditional evidence, or even with newly developed sources of information, such as average height.

In the 1980s, the fields of history, economics, and physical anthropology began to develop some common interests and methodologies. Since the mid-1970s, economic historians have been applying average human stature, which measures a population's history of net nutrition, to issues in slavery, mortality, inequality, and health during industrialization (Steckel, 1998). They have used a measure familiar to physical anthropologists, but applied it to a broad range of well-established historical problems.

Similarly, by the early 1980s, physical anthropologists were mounting substantial efforts to study long-term trends (in health), the traditional domain of historians. *Paleopathology at the Origins of Agriculture,* edited by Mark Cohen and George Armelagos, was the first significant publication of this type. Contributors to the book assembled skeletal evidence of disease patterns that compared the health of hunter-gatherer societies with that of settled agriculturalists. This transition has been long celebrated by social scientists as a major advance in civilization, but to the surprise of those outside physical anthropology, the book reported that health deteriorated during the changeover.

This book brings together 18 essays that study long-term trends in health in the Western Hemisphere using evidence of chronic disease or biological stress measurable from skeletal remains. Basic information on the geographic, ethnic, and temporal distribution of the database for the project is listed in Table 1.1. Nearly 80 percent of the 12,520 individuals were Native Americans, with the remainder almost evenly split between Euro-Americans and African-Americans. About two-thirds of the

Table 1.1: Distribution of Skeletons in the Database

Period	Native American			Euro-American	African-American
	North America	Middle America	South America		
1750+	627	0	0	1201	1380
1500–1749	2580	0	39	113	0
1000–1499	888	236	1095	0	0
1 AD–999	1642	594	382	0	0
1000 BC–AD 0	250	0	247	0	0
Before 1000 BC	485	343	418	0	0
TOTAL	6472	1173	2181	1314	1380

Grand total = 12,520.

Native Americans resided in what is now the United States (noted as North America in the table and in parts of the text), as opposed to Middle America (11.9 percent) or South America (22.2 percent). Slightly more than one-half (52.6 percent) lived in the Western Hemisphere prior to the arrival of Columbus, and nearly 14 percent lived prior to the birth of Christ (ages of individual sites are reported in years BP, that is, before present, taken as 1950).

Developed in recent decades by physical anthropologists, these data are unfamiliar to most social scientists, but they are likely to be the best single source available to scholars for measuring and analyzing very long-term trends in health. Therefore, the first section of the book formulates the methodology, and remaining sections examine applications to Native Americans, Euro-Americans, and African-American populations in North America, Mesoamerica, and South America.

The essays are the culmination of over a decade of intense interdisciplinary activity inspired by these two movements – the acceptance and use by economists and historians of measures traditional in human biology and physical anthropology (especially average height), and the study of long-term trends in health by physical anthropologists. Our efforts depart from and contribute to these movements, and draw attention to the advantages of collaboration. Historians, economists, and other social scientists gain by acquiring measures of health available to study long-term trends and differences in health. Similarly, physical anthropologists acquire a fresh reservoir of research questions and methodologies that are found beyond their traditional, localized spheres of interest. It is our hope that all groups go forward in this collaboration with renewed energy and purpose.

The essays take Cohen and Armelagos as their starting point, but go beyond their book in several important respects. First, the data assembled in *Paleopathology at the Origins of Agriculture* were not truly comparable because contributors utilized varying coding schemes for individual records. Researchers included the frequency of common variables, such as degenerative joint disease, skeletal infections, and linear enamel hypoplasias, but the specific measures were not reported using the same scale, which complicated comparisons. The essays herein utilize a common

data-reporting format. Second, the size and diversity in our data resources by region, time period, and ethnic group exceed that studied in Cohen and Armelagos. We assemble over 12,500 observations on individuals who lived in the Western Hemisphere from over 4000 BC to the early 1900s, which is by far the largest comparable data set of this type ever created. Third, this project explicitly and extensively incorporates interdisciplinary perspectives. We do not claim this is necessarily desirable in itself, but the book is innovative in its collaborative strategy of using physical anthropologists, historians, and economists, who jointly headed most research teams producing essays. This approach broadens the range of questions typically asked of skeletal data to include widespread comparative study and brings new methodologies to their analysis. Prominent among the latter are the concept of a health index and measures of assessing inequality in health. Fourth, the range of questions asked of the data exceeds that in Cohen and Armelagos. *Paleopathology at the Origins of Agriculture* focused mainly on health during the transition, whereas this project considers issues over a broader time span, including the dynamics of pre-Columbian health, the consequences of contact, and the fates of Euro-Americans and African-Americans up to the early twentieth century.

The first chapter in the methodology section discusses something fundamental to the remaining chapters – indicators of skeletal disease. Bones are living tissue that respond or adapt to biological stress, which may be caused by numerous persistent conditions, such as a deficient diet, various infections that penetrate soft tissue, and arduous work or physical effort. With the help of a few necessary photographs, Alan Goodman and Debra Martin articulate these indicators of stress and disease and explain what they mean and show how they may be interpreted.

The chapter on the health index by Richard Steckel, Paul Sciulli, and Jerome Rose brings several innovations to the measurement of health using skeletal data. First, attributes of health, such as stature, infections, and degenerative joint disease, are scored by severity on a scale of 0 (lowest) to 100 (highest, indicating no visible impairment). Second, the scores of each attribute are pooled by site, converted to age-specific rates, and adjusted by the distribution of person-years lived by age in a reference population. Third, the resulting indexes for each attribute are averaged to create an overall health index that is comparable across sites. Sites are then ranked, and their placement within the rankings, by the index and its components, become an object of comparative study.

Robert McCaa's chapter tackles the difficult and thorny question of estimating life tables from skeletal data on deaths by age. Demographers learned long ago that the age distribution of deaths is more sensitive to variations in fertility rates than variations in mortality rates. Yet, useful information about life expectancy is recoverable from the age distribution of deaths if proper allowance is made for possible fluctuations or differences in fertility rates and for possible biases caused by selective migration, that is, if the age distribution of deaths is studied in context.

The remaining chapters are organized by sections of ethnic and regional groupings. Each section is introduced by a brief discussion of results on the health index that raise questions for readers to consider in perusing individual essays. The health of Euro-Americans and of African-Americans in North America is considered

first because many readers are familiar with issues in their health and authors can readily attach more familiar measures of health to the discussion, all of which helps newcomers to this work to calibrate the meaning of skeletal data. The groups under study are diverse with respect to socioeconomic conditions, ranging at the top from the middle and upper class in Belleville, Ontario, to southern plantation slaves. In between lie the free blacks in the urban East and in the frontier West, soldiers, and those who died in Rochester's poorhouse. The health rankings that emerge confirm several findings based on other approaches and sources, but they also challenge our methodology and preconceptions of health in relation to social status.

The remaining chapters, which comprise about one-half of this volume, consider the health of Native Americans in Central America, South America, and North America. The chapters on Central America examine the biological stresses endured by the declining Maya and the pre-Hispanic populations of central Mexico. The older prehistoric populations examined in Ecuador and Brazil lived in ecological environments that led to better health. The North American groups under study were extraordinarily diverse, living under hunter-gatherer or agricultural conditions and in the pre- and postcontact periods. Thus, some of both the healthiest and least healthy populations in our database were found among natives in North America.

Considerable scholarly energy has been devoted to formulating models or explanations of long-term changes in health. Although a comprehensive explanation has been beyond anyone's reach, various factors thought to have been important, at least in some contexts, have been identified. Subsistence shifts, climate, population growth, technological change, and political evolution have all been suggested as active ingredients contributing to changes in health. Although it would be interesting to investigate all such hypotheses with the data at our command, our ambitions are more limited. We have acquired evidence and developed new methodologies that help elucidate a series of microstories, which are enhanced by our comparative perspective using comparable data and the health index. Despite our large database, we feel that considerably more diverse evidence would be required for adequate evaluation of broad explanations. Eventually, we hope to acquire considerably more data and a global perspective for this purpose. Nevertheless, the chapter on "Patterns of Health in the Western Hemisphere" and the "Conclusions" appraise some hypotheses and draw attention to various patterns in the skeletal evidence.

In the "Epilogue," prominent physical anthropologists and an historian who are familiar with the project comment on our methods and results from the perspective of their disciplines. Although these short essays might be considered the first reviews of the book, our objective is to initiate a dialogue from which all scholars interested in very long-term health trends may advance this fascinating and important research agenda.

For decades, bioarchaeologists have intensively studied skeletons in their microenvironments as learned from burial artifacts and various features of burial sites. While this type of work is essential for the objectives of this volume, we anticipate this book will also stimulate greater comparative study of skeletal remains in their historical, economic, ecological, and cultural contexts. In short, we hope our collective efforts lead to the flowering of macrobioarchaeology.

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PART II

METHODOLOGY