

Skeleton Keys: An Introduction to Human Skeletal Morphology, Development and Analysis, 2nd Edition

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In this second edition, the author has retained the appealing title, *Skeleton Keys*, as well as the subtitle—*An Introduction to Human Skeletal Morphology, Development and Analysis*—from the first edition (Schwartz, 1995). It is somewhat revised and updated from the first edition but most of the figures, content, and style have not been significantly modified. Much of the data in the appendices in the first edition now has been integrated within the chapters in the new edition. This textbook, an important source of reference for osteological research, comprises ten chapters, two appendices, a glossary, a reference list, and an index. Most of the tables are restricted to glossaries, tips to siding certain bones, and formulae for estimating stature in specific ethnic groups. The author makes it clear in the preface that “This is not your usual textbook on how to analyze the human skeleton.” and “sees this book as a primer for individuals to develop their own idea as much as a textbook whose content is perceived as the last word” (p. xiii). Also in the preface, Schwartz highlights the contents of the CD, which contains hundreds of black-and-white and color images of photographs used in the book as well as additional ones including those of: 1) individuals that range in age from fetus to adult; 2) females and males; 3) degrees of individual variation; 4) different diseases; and, 5) the effects of ante- versus post-mortem insults to bone. The CD operates on an html format and uses Internet Explorer for systematically browsing through the figures. These are conveniently organized in an outline that corresponds with the topics in the book.

The first chapter (*An Introduction to Skeletal Anatomy and the Development, Physiology, and Biochemistry of Bone*) introduces the volume and the human skeleton from a general perspective. It begins with line drawings of the human skeleton with that of a canine or quadruped for comparative and aspect purposes. In addition to providing basic illustrations of general anatomical positions, terms of direction and position, major planes, and degrees of movements of various synovial joints, it also goes into detail about the physical properties of bone in general. For example, this chapter includes key information on such topics as gross anatomy, osteogenesis, pathological aspects, biochemistry, and diet. Several useful illustrations are provided to accompany the descriptions in the text as visual aids for readers.

As expected, the second chapter (*The Skull*) is about the human skull, with discussions of the internal and external morphology. The format is consistent in that a table of important terms is provided in the beginning instead of all

terms being exclusively in the glossary at the end of the volume. This allows readers to refer to the tables/terms quickly instead of tediously searching for terminology within the extensive text. In this chapter however, the posterior view of the cranium is not provided and some of the photographs could have been of higher quality. For example, Figure 2-7 does not clearly illustrate key details inside the skull such as the Pacchionian depressions or specific grooves for the middle meningeal vessels as clearly seen in the line drawing on the opposite page.

Chapter Three (*Individual Bones of the Skull*) further expands on the anatomical details of the skull. Here, Schwartz begins with a small introduction explaining the importance of describing the development of each bone in relation to the similarities and differences between juveniles and adults and associated age-related attributes. Curiously, such introductions are missing in the following chapters. Chapter Three begins with illustrations of human fetal skulls and concludes with discussions on the hyoid and inner ear bones. Although Schwartz does not show occlusal views, specifically photos, of the maxilla and associated morphological features, he does include such aspects for the mandible (although additional data on the maxilla and mandible are provided in Chapter Seven).

The *Postcranial Axial Skeleton* is represented by Chapter Four and includes information on the vertebral column, sacrum, sternum, and the ribs. A reasonable amount of the chapter is dedicated to the morphology of vertebrae, their development, and ossification. This pattern of description (morphology, development, and ossification) is consistent throughout most chapters and for almost all skeletal elements.

Chapters Five and Six are dedicated to *The Upper Limb* and *The Lower Limb*, respectively, and include numerous illustrations to accompany the text. For instance, the line-drawing on page 134 usefully illustrates a semi-articulated right carpus where key bones are individually numbered for identification and visualization of the articulation. Chapter Seven (*Teeth*) represents the last chapter describing bones and dental specimens and, perhaps, it would have been better situated as Chapter Four, thus anatomically following the skull. In the beginning of this chapter (Seven), it is unclear why the author included a photomicrograph of a fruit bat molar, rather than a human specimen.

The remainder of the book focuses on such topics as *Aging* (Chapter Eight), *Differentially Expressed Morphological Character States* (Chapter Nine), and *Pathology* (Chapter Ten). A large portion of Chapter Eight discusses tooth for-

mation and eruption sequences during various stages in a person's life. This is followed by similar information for cranial and postcranial bone formation and growth. In that regard, the extensive table on pages 231-233 provides associated details for virtually all skeletal elements in the human body and their respective developmental stages (i.e., ossification and fusion) from childhood to adulthood. The figures on pages 234 and 235, respectively showing age-related change in pubic symphyses, complement each other as they include both line drawings and photographs. Chapter Nine contains extensive photographs and tables in relation to non-metric attributes in bones and teeth as well as sex determination from specific skeletal elements. It concludes with a short section on metric approaches to biodistance analysis. The final chapter (Ten) pertains to the effects of disease, trauma, and stress on human bones. Again, it contains numerous images of variable quality. The compilation of the table on pp. 316-317 (summary of major diseases that impact the skeleton) is highly informative and original and an excellent guide for the textual data. Appendix A and Appendix B respectively address the topics of *Osteometry* and *Comparative Osteology* (human, deer, bear, and pig).

There are both positive and negative comments that can be made regarding certain aspects of the volume. The glossaries (in table form) provided in the beginning of Chapters One and Two were not a continuing feature in the remaining chapters, although new vocabulary is defined and described throughout the text. A final statement in the form of an overview or concluding remarks is not provided and the book appears to end abruptly with a section on infectious and degenerative diseases of the jaws and teeth. Not that it directly affects the overall substance of the volume or its academic value, but many examples of specimens used in the figures are from collections of prehistoric population samples, mostly from parts of South America and North America (i.e., geographically biased). Rather than providing original figures or updated data, many of the line-drawings and information in numerous tables also come from older published sources (see Suchey 1997); less than 35 references cited in the text postdate the year 2000 and the majority are much older. There is no doubt that some of the older references can be easily updated with the incorporation of new data from more recent publications and through the author's other possible resources. In the table on page 146, for example, the information is primarily restricted to white, African-American, Asian, and Mexican males and females. Comparable information (if available) on other ethnic groups would have been much more informative and comprehensive.

A major drawback in this volume is that the photographic quality is not consistent throughout the volume; some are of higher caliber than others (in terms of resolution, focus, lighting, and so forth). The lighting or preparation of many of the specimens prior to their photography is not adequate and can be improved immensely. Examples of ideal photographic quality for skeletal elements can be found in other volumes (e.g., White and Folkens 2005) including the author's own work (e.g., Schwartz and Tatter-

sall 2002). At times, high-quality photographs would have been more beneficial than select oversimplified or low-resolution line-drawings that do not show adequate detail for comparative studies (e.g., p. 246). Likewise, the figures in Appendix B are too small and proper morphological detail is difficult to gauge as guides in the lab or field. Chapters Four through Six do not offer any photographs but only line drawings. Also, it may have been more helpful if some of the bones, especially on the CD, were labeled directly in the photographs (e.g., p. 243), as is done with most of the line drawings. A photographic scale, often useful when illustrating specific skeletal elements like long-bones, is missing in some figures—an important criticism also voiced by a reviewer of the first edition (Suchey 1997).

The book is primarily aimed at a general readership and a wide variety of specialists including biological anthropologists and medical students. The best and most useful feature of Schwartz's volume is the CD of images, which gives it a competitive edge over competing titles. These images can be used for reference, comparative studies, and even as informative visual slides during lectures. The CD also wonderfully balances the lack of high-resolution photographs in the volume, which are not always possible to include in print. Another useful feature of the book is that key words or vocabulary are either in bold or italicized format, including numerous words that are not formally a part of the glossary. This makes it more convenient for readers to recognize and re-locate key words and concepts in the text. The tables in many of the sections list methods to distinguish between bones of the left and right sides of the body. These are extremely useful, easy to understand, and easy to apply based on accompanying illustrations. This 'quick-guide' information in the tables supplements the more detailed siding instructions embedded in the text. The informal reader-friendly format and style of the book is clearly its best attribute next to its content of classic concepts, combined with coverage of modern techniques, in human osteology. It does not go into excruciating or unnecessary detail in human osteology but approaches the subject with a general descriptive and stimulating approach. The language is very clear and concise, thus making this volume easily accessible to undergraduate and graduate students, instructors and professionals in human osteology, biological and forensic anthropology, and paleoanthropology, as well as non-specialists such as archaeologists and bio-archaeologists.

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