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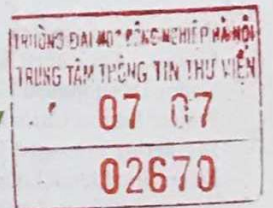
ESSENTIALS OF  
PHYSICAL ANTHROPOLOGY

CLARK SPENCER LARSEN

# Essentials of Physical Anthropology

DISCOVERING OUR ORIGINS

Second Edition



**CLARK SPENCER LARSEN**

The Ohio State University



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# To the Instructor

## HOW THIS BOOK CAN HELP YOUR STUDENTS DISCOVER PHYSICAL ANTHROPOLOGY

### It Is about Engagement

Teaching is about engagement—connecting the student with knowledge, making it real to the student, and having the student come away from the course with an understanding of core concepts. *Essentials of Physical Anthropology: Discovering Our Origins* seeks to engage the student in the learning process. Engaging the student is perhaps more of a challenge in the study of physical anthropology than in the study of other sciences, mainly because the student has likely never heard of the subject. The average student has probably taken a precollege course in chemistry, physics, or biology. Physical anthropology, though, is rarely mentioned or taught in precollege settings. Commonly, the student first finds out about the subject when an academic advisor explains that physical anthropology is a popular course that fulfills the college's natural science requirement.

Once taking the course, however, that same student usually connects quickly with the subject, because so many of the topics are familiar—fossils, evolution, race, genetics, DNA, monkeys, forensic investigations, and origins of speech, to name a few. The student simply had not realized that these separately engaging topics come under the umbrella of one discipline, the subject of which is the study of human evolution and human variability.

Perhaps drawn to physical anthropology because it focuses on our past and our present as a species, the student quickly sees the fundamental importance of the discipline. In *Discover* magazine's 100 top stories of 2009, 18 were from physical anthropology. Three topics from the field were in the top 10, including the remarkable new discovery of our earliest human ancestor, *Ardipithecus*. So important was this discovery that *Science*, the leading international professional science journal, called it the “Breakthrough of the Year” for 2009. The discussions in this textbook of topics familiar and unfamiliar give the student stepping stones to science and to the centrality of physical anthropology as a window into understanding our world.

Whether the student finds the material familiar or unfamiliar, he or she will see that the book relates the discipline to human life: real concerns about human bodies and human identity.

In writing this book, I made no assumptions about what the reader knows, except to assume that the reader—the student attending your physical anthropology class—has very little or no background in physical anthropology. As I wrote the book, I constantly reflected on the core concepts of physical anthropology and how to make them understandable. I combined this quest for both accuracy and clarity with my philosophy of teaching—namely, engage the student to help the student learn. Simply, teaching is about engagement. While most students in an introductory physical anthropology class do not intend to become professional physical anthropologists, some of these students become interested enough to take more courses. So this book is written for students who will not continue their study of physical anthropology, those who get “hooked” by this fascinating subject (a common occurrence!), and those who now or eventually decide to become professionals in the field.

The book is unified by the subject of physical anthropology. But equally important is the central theme of science—what it is, how it is done, and how scientists (in our case, anthropologists) learn about the natural world. I wrote the book so as to create a picture of who humans are as organisms, how we got to where we are over the last millions of years of evolution, and where we are going in the future in light of current conditions. In regard to physical anthropology, the student should finish the book understanding human evolution and how it is studied, how the present helps us understand the past, the diversity of organisms living and past, and the nature of biological change over time and across geography. Such knowledge should help the student answer questions about the world. For example: How did primates emerge as a unique group of mammals? Why do people look different from place to place around the world? Why is it important to gain exposure to sunlight yet unsafe to prolong that exposure? Why is it unhealthy to be excessively overweight? Throughout their history, what have humans eaten, and why is it important to know?

I have presented such topics so that the student can come to understand the central concepts and build from them a fuller understanding of physical anthropology. Throughout the book, I emphasize hypothesis testing, the core of the scientific method, and I focus on that process and the excitement of discovery. The narrative style is personalized. Often I draw on my own experiences and those of scientists I know or am familiar with through their teaching and writing, to show the student how problems are addressed through fieldwork or through laboratory investigations.

Scientists do not just collect facts. Rather, they collect data and make observations that help them answer questions about the complex natural world we all inhabit. Reflecting this practice, *Essentials of Physical Anthropology: Discovering Our Origins* is a collection not of facts for the student to learn but of answers to questions that help all of us understand who we are as living organisms and our place in the world. Science is a way of knowing, it is a learning process, and it connects our lives with our world. In these ways, it is liberating.

## HOW THE BOOK IS ORGANIZED

The book is divided into two parts. Following an introductory overview of anthropology and physical anthropology, Part I presents the key principles and concepts in biology, especially from an evolutionary perspective. This material draws largely on the study of living organisms, including humans and nonhuman primates. Because much of our understanding of the past is drawn from what we have learned from the present, this part lays the foundation for the presentation in Part II—the past record of primate and human evolution. In putting the record of the living up front, this book departs from the style of most other introductory physical anthropology textbooks, which start out with the earliest record and end with the living. This book takes the position that most of what we learn about the past is based on theory and principles learned from the living record. Just as all of Charles Darwin’s ideas were first derived from seeing living plants and animals, much of our understanding of function and adaptation comes from living organisms as models. Therefore, this book views the living as the window onto what came before—the present contextualizes and informs our understanding of the past. It is no mistake, then, that *Discovering Our Origins* is the subtitle of the book. The origins of who we are today do not just lie in the record of the past, but are very much embodied in the living. Our origins are expressed in our physical makeup (bones, teeth, muscles), in our behavior, and in so many other ways that the student taking this course will learn about from this book and from you. You can teach individual chapters in any order, and that is partly because each chapter reinforces the central point: We understand our past via what we see in the living.

Part II presents evidence of the past, covering more than 50 million years of evolution. Most textbooks of this kind end the record of human evolution at about 25,000 years

ago, when modern *Homo sapiens* evolved worldwide. This textbook also provides the record since the appearance of modern humans, showing that important biological changes occurred in just the last 10,000 years, largely relating to the shift from hunting and gathering to the domestication of plants and animals. Food production was a revolutionary development in the human story, and Part II presents this remarkable record, including changes in health and well-being that continue today. A new subdiscipline of physical anthropology, bioarchaeology, is contributing new and profound insights into the last 10,000 years, one of the most dynamic periods of human evolution.

During this period, a fundamental change occurred in how humans obtained food. This change set the stage for our current environmental disruptions, including global warming; the alarming global increase in obesity; and the rise of health threats such as newly emerging infectious diseases, of which there is little understanding and for which scientists are far from finding cures.

## CHANGES IN THE SECOND EDITION

For this second edition, *Essentials of Physical Anthropology* has been significantly updated, both to keep the content fresh and to keep the book engaging for instructors and students. While the basic tenets of physical anthropology—especially the focus on evolution—are unchanged, revisions throughout the book reflect new discoveries and new insights in this rapidly changing field. Others are intended to sharpen the book's focus and increase its visual appeal:

- *Revision of content to enhance clarity.* To ensure that readers come away from the book with sound understandings of physical anthropology's core concepts, topics such as cells, genes, DNA, race, primate taxonomy, locomotion, the fossil record, and dating methods have been especially scrutinized for clarity. As in the first edition, figure captions reinforce important points while adding information to the discussions in the main text.
- *Inclusion of new discoveries.* An important emphasis in the first edition, carried through to the second edition, is the importance of scientific discovery. How are hypotheses generated, and how do new findings address hypotheses and lead to theories? While the first edition discussed the discovery of the hominid *Ardipithecus* (aka "Ardi"), the second edition includes expanded coverage of the

remarkable *Ardipithecus* fossils and how they have affected scientists' interpretations of hominid origins and early human evolution. The second edition includes both updated text and a brand-new double-page spread devoted to "Ardi," perhaps the most important scientific discovery of the last century. Contrary to some authorities' long-held notions, the earliest hominid did not look or walk like a chimpanzee!

- *New examples that illustrate key points about evolution.* Students always ask for clear examples of evolutionary forces, especially natural selection. One of the most eye-catching new examples in the second edition is the leafy dragon seahorse, which has a selective advantage of looking like a plant.
- *New content on biocultural adaptation.* Anthropologists provide important insights into how humans' remarkable intelligence is related to their evolutionary success. This second edition presents new research on the role of *social learning* and the retention of knowledge—the accumulation of information—over many generations.
- *New content on life history.* The second edition pays special attention to the years of growth and development, which are especially critical for understanding the uniqueness of humans and their development. Anthropologists and others are learning that a poor maternal environment for a human fetus predisposes the individual in later life to coronary heart disease, type 2 diabetes, and other debilitating chronic conditions.
- *New content on classic variation and new insights into adaptation and evolution.* The second edition provides a discussion of sociobiology and its role in understanding behavior and evolution. This edition also includes a new discussion of melanin and the importance of the protection of folate for normal growth and development. The skin, our largest organ, is central to the body's well-being. The protection of folate, a vitamin essential to many bodily functions, is tied to the body's amount of melanin and skin pigmentation.
- *New content on alternative explanations of primate taxonomy and evolution.* The second edition includes a new discussion of primate and human taxonomy, especially explaining the fundamentals of cladistic and traditional approaches. Taxonomy is important because it guides the interpretation of primate and human evolution.
- *New content on fossil primate and hominid discoveries.* The book is fully up-to-date in covering

new fossils and their importance in understanding primate and human evolution. In addition to its expanded coverage of "Ardi," the second edition includes new information on sites and fossils that are changing our understanding of the origins and evolution of the human lineage. For example, newly discovered remains from the Malapa cave site, in South Africa, revealed a new species of later australopithecines. Called *Australopithecus sediba*, this new fossil provides a potential ancestor for the genus *Homo* dating to around 2 mya. At Sima del Elefante, in northern Spain, remains that are probably over a million years old represent some of the earliest humans in Europe. This finding is a major expansion of the frontiers of knowledge about the earliest people and the rise of modern humans. Meanwhile, the restudy of fossils provides new insights about human behavior, such as the earliest speech. For example, contrary to old models, Neandertals talked.

The record of past human evolution does not stop with the appearance of the first modern humans. This new edition provides a glimpse at the evolution of humans who occupied the once-lush Sahara Desert. In a relatively short period, these people underwent a change in morphology and physical appearance. An increasingly dry climate forced them to leave. The lessons learned from this setting give us insights into the environmental changes we face now and those we will face in the future. Such environmental challenges are covered extensively in chapter 13.

- *New content on the appearance and evolution of behaviors that make us uniquely human.* Discussion and debate about the origins of our species focus on events in Europe from about 100,000 years ago to about 20,000 years ago. By the later date, all humans around the globe were modern *Homo sapiens*. Some 20,000 years before, at least two kinds of hominids lived in the region: Neandertals, who were a premodern *Homo sapiens*, and fully modern (or nearly so) *Homo sapiens*. Some argue that Neandertals were not part of human evolution in Europe. However, new findings on hunting, on cognition, and on symbolic behavior argue that Neandertals were fully capable in these aspects of modern human behavior. The second edition discusses these new interpretations. As the Neandertal skeletal remains and material (cultural) record show, Neandertals were fundamentally like modern humans! For the first time, the genome of Neandertals has been revealed through amazing new

technology. This exciting discovery shows that there is a small but significant presence of Neandertal genes in modern *Homo sapiens*.

- *New content on evolution in modern humans.* The second edition extensively discusses the domestication of plants and animals, or what is sometimes called the Neolithic Revolution, which played a considerable role in recent human evolution. The roots of many health and lifestyle issues confronting the world today—obesity, infectious diseases, and chronic conditions generally—extend to developments occurring in the last 10,000 years, especially the shift from foraging to farming and dramatic population increase. Increased food security and predictability resulted in a mutualistic relationship between the domesticated plants and animals and their human caretakers.

The second edition also discusses the strong likelihood that the pace of evolution has picked up owing to vastly increased population. Simply, more people means more genetic mutations and increased gene flow. At the same time, increased cleanliness in many parts of the world may explain the alarming increases in infections, allergies, and some illnesses. The developing body's failure to engage its immune system leaves the adult body more vulnerable to microbes, allergens, and pathogens.
- *Enhancement of the art program.* The first edition focused on the visual nature of physical anthropology. Building on this approach, the second edition includes new figures and newly revised figures. Anywhere an image would help the student more clearly understand a concept, an image is included. In chapter 10, a new double-page spread looks at *Ardipithecus* from recovery in the desert of Ethiopia to lab work, reconstruction, interpretation, and publication. A new figure showing key anatomical features of bipedalism versus quadrupedalism helps the student visualize central concepts about major differences in living and fossil hominoids as these differences relate to locomotor patterns.
- *New teaching and learning tools.* The content of physical anthropology is so visual that a DVD is a natural teaching tool. The second edition of *Essentials of Physical Anthropology* comes with a DVD for instructors that presents footage of field sites and interviews with scientists on the forefront of new discoveries.
- *New chapter on primate behavior.* The second edition provides a new chapter devoted to primate social behavior. Emphasizing the important role of