THE Complete DINOSAUR

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The Study of Dinosaurs

Any one of the larger carnivorous dinosaurs would meet the case. Among them are to be found all the most terrible types of animal life that have ever cursed the earth or blessed a museum.

—Sir Arthur Conan Doyle, The Lost World

As summarized in the first part of this book, our knowledge of dinosaurs has accumulated through the combined efforts of many people, professionals and amateurs alike, over the last century and a half. We now know a great deal about these "fearfully great" reptiles, and we are learning more all the time.

So how do we know what we know? What are the bases for the statements about dinosaur biology and evolution that will be made by one contributor after another in the remaining sections of this book? Those questions are the subject of Part Two, which describes how paleontologists, and the other professionals who assist them, find, study, and interpret dinosaur fossils.

This section begins by explaining how a paleontologist decides where to look for dinosaur bones, and what is done with them once they are found; both traditional and state-of-the-art methods of collecting and preparing dinosaur fossils are summarized.

It would be very nice to have a living Anatotitan or Triceratops to study in the field or laboratory, but nature hasn’t been that kind to us. Most of our information about dinosaurian evolutionary relationships, or about
how the great reptiles functioned as living animals, comes from study of
their skeletons. This means that in order to understand how paleontolo-
gists interpret dinosaurs, one must have a basic knowledge of the bones of
the dinosaur skeleton, and so we devote chapter 7 to a tour of the different
bones of a dinosaur’s body.

One of the major goals of paleontology is to reconstruct, to the extent
that this is possible, the course of evolution. In dinosaur paleontology this
involves determining the phylogenetic relationships of the various dino-
saur groups to each other, and also to other kinds of animals. How is this
done? Chapter 8 explores different approaches to the naming and classify-
ing of organisms, including dinosaurs.

One of the key developments in evolutionary biology over the last
generation has been the general acceptance of the principles of phyloge-
netic systematics (cladistics) in interpreting the evolutionary relationships
among different groups of organisms, including dinosaurs. Although a
cladistic approach to organizing information about evolutionary patterns
is an eminently logical way of doing things, it comes as a shock the first time
one encounters it. (Birds are dinosaurs? Get out of here....) So our chapter
on classification explains how phylogenetic systematics works, and com-
pares its approach to dinosaur classification with a more traditional
approach.

To say that dinosaur classification is contentious is like saying that the
Atlantic Ocean is a bit damp. The number of different dinosaur classifica-
tions operational at any one time can be described by the formula

\[ C = (N + A) - 1 \]

where \( C \) is the number of classifications, \( A \) is the number of amateur
paleontologists, and \( N \) is the number of dinosaur paleontologists. The
“\(-1\)” represents the true classification, which we shall never know (part of
Durham’s Law). The stability of any classification can be a double-edged
sword. A classification can be stable because we have obtained a close
approximation to the actual relationships of the organisms under study.
Unfortunately, stability can also reflect consensus due to the lack of an
adequate fossil record—or a stagnation of research.

Geologists have constructed a formidable set of terms to describe the
intervals of earth history during which dinosaurs and other ancient organ-
isms lived. Readers will not be able to understand how dinosaurs evolved
unless they understand the names applied to the various intervals of
Mesozoic time. Consequently we include a short chapter to orient the
novice in a timely manner.

Although some field and laboratory methods in paleontology have not
changed in the last century, new technologies have revolutionized much of
the way in which dinosaurs are studied. Chapter 10 describes these new
technologies, and the way they are affecting the research methods of
paleontologists.

*Jurassic Park* gripped the imagination of the moviegoing public with the
possibility that dinosaurs might be re-created from genetic material in
dinosaur blood once imbibed by Mesozoic mosquitoes. Paleontologists are
indeed interested in the possibility of recovering dinosaur biomolecules,
but there is very little chance that these can be used to populate our zoos
with living examples of the fearfully great reptiles. On the other hand,
dinosaur biomolecules may well provide us with valuable insights into the
relationships of dinosaurs to other animals. It is, in consequence, necessary
to include a chapter about the problems and potential of finding and
studying such biochemical traces of dinosaurs.

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The results of scientific research on dinosaurs are generally published in learned technical journals written by and for scientists. However, the general public has an insatiable interest in dinosaurs, and part of the mission of major natural history museums is to satisfy that curiosity by putting dinosaur fossils, and explanatory material about them, on display. This is not an easy task. Chapter 12 describes all the planning and labor that goes into putting together a successful dinosaur exhibit.

Our most vivid impressions of dinosaurs as living creatures are based on the work of scientific artists. The final chapter of Part Two outlines the thinking and the steps that a paleontological artist goes through in preparing a scientifically accurate drawing or painting of a dinosaur as a living animal.
Understand how the study of dinosaurs informs scientific knowledge. Use technology as a mode of inquiry to access information from experts. Describe through writing accumulated knowledge of dinosaurs. Improve content-area reading skills, such as reading for detail.

Materials. Before beginning the activity with your class, review each section of the online activity. Although this project is appropriate for grades K–8, certain activities are geared toward more specific grade ranges. Dinosaur Times (Grades 3–8) In this interactive timeline, students unearth the time of the dinosaurs. “Click and drag” technology allows students to organize dinosaurs into appropriate time periods. Information about each dinosaur will pop up and aid as a clue for appropriate placement. The new stage of the study of the dinosaur faunas and other Mesozoic vertebrates of Kyrgyzstan begins now. Determining features of this stage are the wide international cooperation including both joint field works in Kyrgyzstan, joint data processing, publication of the results, and formation of a national staff of vertebrate paleontologists in Kyrgyzstan (Averianov and Bakirov, 2000; Bakirov, 2009, Bakirov, 2013. ... A large accumulation of dinosaur bones, including presumable sauropods, was discovered by G.G. Martinson in 1962 in the middle layers of thick strata (more than 100 m thick) of red sandstones and clays assigned to the lower part of the Sharikhan Formation.