

Warming Up the Past

The Hot-Blooded Dinosaurs: A Revolution in Paleontology

by Adrian J. Desmond
Dial Press, 238 pp., \$12.95

Reviewed by Archie Carr

It is in the air to think of dinosaurs with greater respect. A new generation of paleontologists is looking at them unorthodoxly, and publishing strange views about them in prestigious journals. The popular idea that dinosaurs were cumbersome, dull-witted creatures, tolerated by nature for only the time it took the sly, shrewd mammals to evolve, may have to be modified. I take it as a straw in the wind that even a recent novel speaks of dinosaurs with warmth. In his book *Centennial*, James Michener traces the history of a little Western town clear back to the origin of the earth and, along the way, recounts happenings in the life of a 30-ton *Diplodocus* that used to live in the area.

Adrian Desmond's book explains how the resurgence of interest in dinosaurs and their kin has come about. A science historian whose special interest is the impact of paleontology on evolutionary theory in 19th-century Europe, Desmond is also a biologist with the background to explain complicated paleophysiologic events. As the title of his book suggests, his main aim is to present the evidence for, and explore the implications of, endothermy (warm-bloodedness) in dinosaurs, which most people have considered to be reptiles and thus inescapably dependent on outside warmth.

Nothing that has come out of the rocks has equaled the effect of dinosaurs

Archie Carr is graduate research professor of zoology at the University of Florida. His most recent book is *So Excellent a Fish: A Natural History of Sea Turtles*.

and their relatives on human thinking. The first Mesozoic leviathan to be unearthed was not a dinosaur but a mosasaur, a huge aquatic relative of the lizard. The specimen was a pair of four-foot jaws, hewn out of the chalk under St. Peter's mountain near Maastricht, Holland, in 1770. The jaws made their way into the hands of the famous French anatomist Baron Cuvier, who correctly identified them as belonging to a gigantic marine lizard. The Maastricht skull went back in time much farther than mammoths did, and it prompted Cuvier to

has occurred through extinction. Today, extinction seems an inevitable outcome of natural selection, but in the 18th century it seemed an adverse reflection on the omnipotence of God. Other disturbing fossils soon emerged, and the controversy that these discoveries generated among scholars and clergymen continued right up to the time of Darwin, and merged with the debates over natural selection.

Mr. Desmond follows these happenings with drive and relish, but his book finds its real pace when he begins to follow out the ramifications of warm-bloodedness in dinosaurs and their kin. There is evidence that endothermy came early into the dinosaur line, perhaps before the dinosaurs themselves had evolved. About 210 million years ago, in the early Triassic, a group of reptiles called thecodonts began moving their hind-leg bones into the vertical plane beneath the body. This was the beginning of a momentous advance—bipedal locomotion; and by mid-Triassic, 200 million years ago, the bipedal carriage was well developed in the thecodonts. To many



The pterodactyl, or "phantom from hell"—"Gentle, intelligent, slow-soaring."

E. Newman, 1843. *The Zoologist*

make a startling generalization that today goes without saying: that the farther back into past times you look, the more different the fauna appears.

So all at once thoughtful people found themselves confronted by two disturbing ideas: that giant creatures, unknown today, once roamed the earth; and that obliteration of the Creator's handiwork

biologists it goes practically without saying that this stance and locomotion required an improved circulatory system, increased energy output, and endothermy. From those warm-blooded thecodonts the dinosaurs emerged.

Another venture into endothermy was made independently in the Triassic by the mammals, or even by their

Permian ancestors, the therapsids, or mammal-like reptiles. The hallmarks of mammals are milk production and hair, and neither of these is recorded in the fossil record. But fossils show that the therapsids had a secondary palate. The effect of this was to allow the animals to continue breathing while they chewed their food. At the same time their cheek teeth acquired additional cusps. These changes indicate increased feeding and oxygen consumption, and this in turn suggests that they had become warm-blooded. Recently found fossil impressions suggest that they may even have had hair.

THE MOST SENSATIONAL fossil ever discovered was *Archeopteryx*, the reptile bird. It had teeth in its jaws, it had feathers, and some of its bony structure was similar to that of the dinosaurs. After the first specimen was found, in 1861, arguments over the meaning of *Archeopteryx* were noisy and protracted. Even some paleontologists, though convinced of the reptilian origin of birds, have remained loath to accept their dinosaurian ancestry. Only recently, however, endo-

thermy has been adduced as evidence in the case for regarding birds as pretty much just feathered dinosaurs. Birds, it is now suggested, appear to be the result of the dinosaur's evolutionary effort to get small. Feathers were not at first for flight; they evolved before flight, as a device for retaining metabolic heat. This means that the dinosaur forebears of *Archeopteryx* were warm-blooded, and that their heat source was not sunshine absorbed by basking, as it is in lizards, but a by-product of high metabolic activity. So, seek not to know where the dinosaurs have gone. They are hiding under the feathers of birds. In a manner of speaking.

The bird ancestors were probably diminutive bipedal dinosaurs, with hopping hind legs and small front legs. Before the end of the Cretaceous this two-legged pattern had produced *Tyrannosaurus*, a hopping carnivore 40 feet long, and a host of small, light-bodied creatures whose attributes led Desmond to describe them as "ultra-intelligent," "graceful," "sophisticated," and "beautiful and alert."

Another set of descendants of the old

warm-blooded thecodonts show strong circumstantial evidence of high energy use, but until recently there has been no indication as to how the necessary temperatures were maintained. These are the pterosaurs. If *Archeopteryx* was the most intellectually disruptive idea ever dug up, the pterodactyl was the most emotionally unsettling, the farthest removed from animal norms and the nearest to nightmares. The title of Desmond's chapter on pterosaurs is "Phantoms From Hell"; before the chapter is finished, however, he has built a case for the phantoms' being "gentle, intelligent, slow-soaring, . . . probably coated in white fur."

Pterosaurs ranged in size from that of a sparrow to giants with a 50-foot wingspread. The little ones probably flapped their wings; the big ones were almost surely soarers or gliders. The main support for the wing was the greatly elongated fourth finger. The whole skeleton was beautifully engineered to combine lightness and strength, and some pterosaurs are thought to have been able to rise gently from the ground on a 15-knot breeze. But as light and scraggly as they

LEO ROSTEN'S new book is "a complete delight..."

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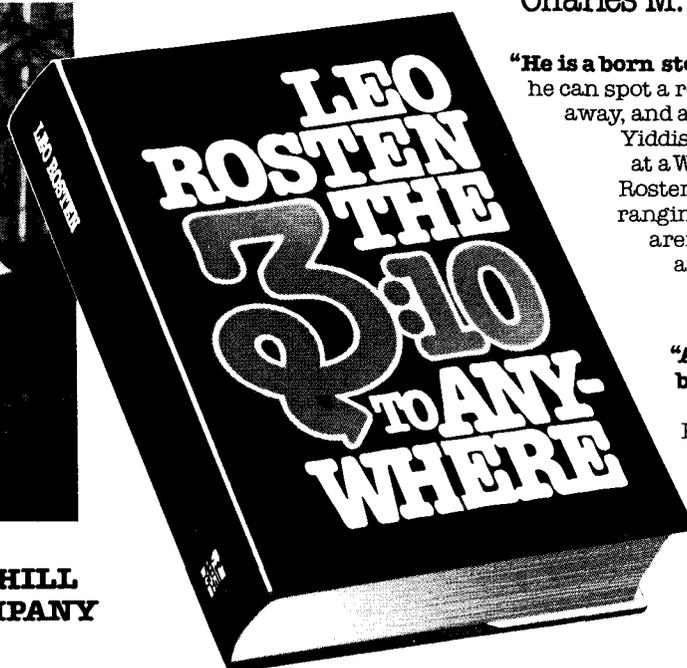
—Charles M. Schulz, creator of Peanuts



Photo by Alice B. Acheson



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"A book to set the travel-weary back on their travels. Chicago, Moscow, Tel Aviv, London, Kyoto, Zurich, Vienna, Istanbul, Beverly Hills, Agamemnon's Palace — Rosten bounces around the world as though it is his private trampoline . . . there's magic to it!" — *Publishers Weekly*
\$8.95

were, how did they regulate heat loss? The answer to that may have come from recent finds in the Soviet Union, where fossils of pterosaurs with fur have been discovered.

THE LAST CHAPTER of the book is called "The Coming of Armageddon." The disaster referred to is the sudden, total disappearance of the dinosaurs 70 million years ago, at the end of the Cretaceous. The appearance of the dinosaurs was the most dramatic paleontologic event of all earth history. They exploded into the mid-Triassic world, completely replacing the mammal ancestors in nearly every ecologic niche. The suddenness and completeness of dinosaur extinction is an even more dramatic occurrence, and its cause is a complete mystery.

The unprecedented spread of dinosaurs can be at least partly explained by their combining warm blood with large size; but their going makes no sense at all. It is one of the towering mysteries of earth history, and Mr. Desmond's review of the possible causes makes a suitable climax for his book. It was not just dinosaurs that disappeared. The end of the Cretaceous also saw the last of the marine plesiosaurs, mosasaurs, and ammonites (shelled, tentacled mollusks which themselves had staged an evolutionary explosion in the Mesozoic), the pterosaurs, much of the woody terrestrial vegetation of the earth, and many groups of plankton, including the foraminifera that formed the Cretaceous chalk. When you think through the implications of that diverse list, that some horrid cataclysm occurred seems the inescapable conclusion. But it would have to be a peculiar kind of cataclysm, because not *all* life was wiped out—birds, mammals, cockroaches, and a lot of other creatures lived on. The author chooses as the most likely disaster the explosion of a star near enough to the earth to produce both killing radiation effects and less rapid, but just as lethal, changes in the climate of the planet.

Some paleontologists and physiological ecologists may take exception here and there to this fast-moving treatment of the momentous interplay among body size, brain size, athleticism, and body temperature in the dinosaurs and their relatives. But for anybody to come up with a better synthesis of the facts and logic involved will require more work, talent, verve, and erudition than Desmond has shown—and those will not be easy to bring together. □

Feminism Without Cant

Literary Women

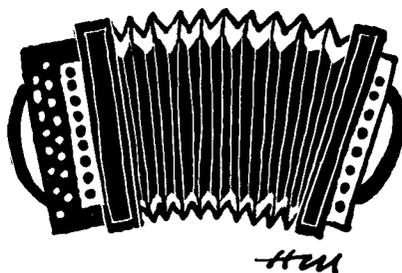
by Ellen Moers

Doubleday, 360 pp., \$10

Reviewed by

Pamela Hansford Johnson

If I had not read her excellent *The Two Dreisers*, I might have fallen into the impertinence of hailing Ellen Moers as a discovery. Like the other book, *Literary Women* is beautifully written and scholarly, exhibiting a wide frame of reference. In fact, so thorough are her discussions that when you think she might have overlooked an author in making a point, you need only turn a page or two to discover that she has not been overlooked at all. What I had not realized before, and certainly do now, is that Ms. Moers has a splendid sense of fun: not acrid fun, or harsh fun, but fun



pure and simple, acute and high-spirited.

Beginning in the last decades of the 18th century, women in England, in America, and on the Continent have contributed significantly to the development of the novel, and it is in this genre, for the most part, that Ms. Moers finds her subjects. She has chosen to produce neither history nor theory but, in her own words, "a celebration of the great women who have spoken for us all." Her work is a vast, admirably researched panorama. She does not suffer from exaggerated feminism, but, on the other hand, gives weight where it is due, and finds her way accurately upon the vast map of her subject. She never deals with tosh, but often with the forgotten women writers who deserved no such fate.

It is Ellen Moers's contagious fascination not just with the fact of her literary women's sex, but with their accomplishments regardless of that sex, that shines most brightly throughout her study—

British novelist Pamela Hansford Johnson is the author of *Important to Me and A Summer to Decide*.

from Mrs. Tonna (Charlotte Elizabeth, 1790–1846) to Madame de Staël, Harriet Beecher Stowe, Mary Shelley, Jane Austen, the Brontës, Elizabeth Barrett Browning, all the way through to Sylvia Plath. She offers new ideas—allowing us to consider, for instance, that Mary Shelley's *Frankenstein* was a birth myth—and notes the political significance of many a printed page (the writing of several Victorian women on the subject of work was a radical action in itself).

She observes that many women novelists gave their heroines mature and tutorial lovers—Knightly to Emma, Paul Emmanuel to Lucy Snowe, Professor Bhaer to Jo March—adding: "Perhaps only coeducational schooling ended this long tradition of teacher-lovers, when women found, given half a chance at schooling, they were better learners than men; George Eliot, early on, gave it the kick of derision with Casaubon." I had never really seen Casaubon in that light before, but now I shall never see him any other way.

One of the author's most delightful tricks is to state things baldly, making one gasp, stretch one's eyes, and say, "But of course!" For example, Ms. Moers states that women confined to the home during the 1790s, without the freedom men had in the university and coffeehouses, tended to read one another's work closely and with fertilizing effect. Now that this has been said, it sounds obvious. Of course, a lot of rubbish was published during this period, and it is a joy to hear of Mary Wollstonecraft countering a piece of it with a simple "Pray, Miss, write no more!" Nevertheless, many women sent their influence ranging beyond their homes (and not only to other homes) by good, serious, and committed writing. Jane Austen, George Eliot, and Elizabeth Barrett Browning were the most influential of all. It is much to women's credit that, cribbed, cabined, and confined, they opened the door to freedom by their literary works, and made their powerful voices heard.

THE SECTION on Madame de Staël gives a most interesting and thorough breakdown of *Corinne*, which might at first seem rather a silly book, but which actually had a wide influence on European literature:

George Eliot in her scrupulous attention