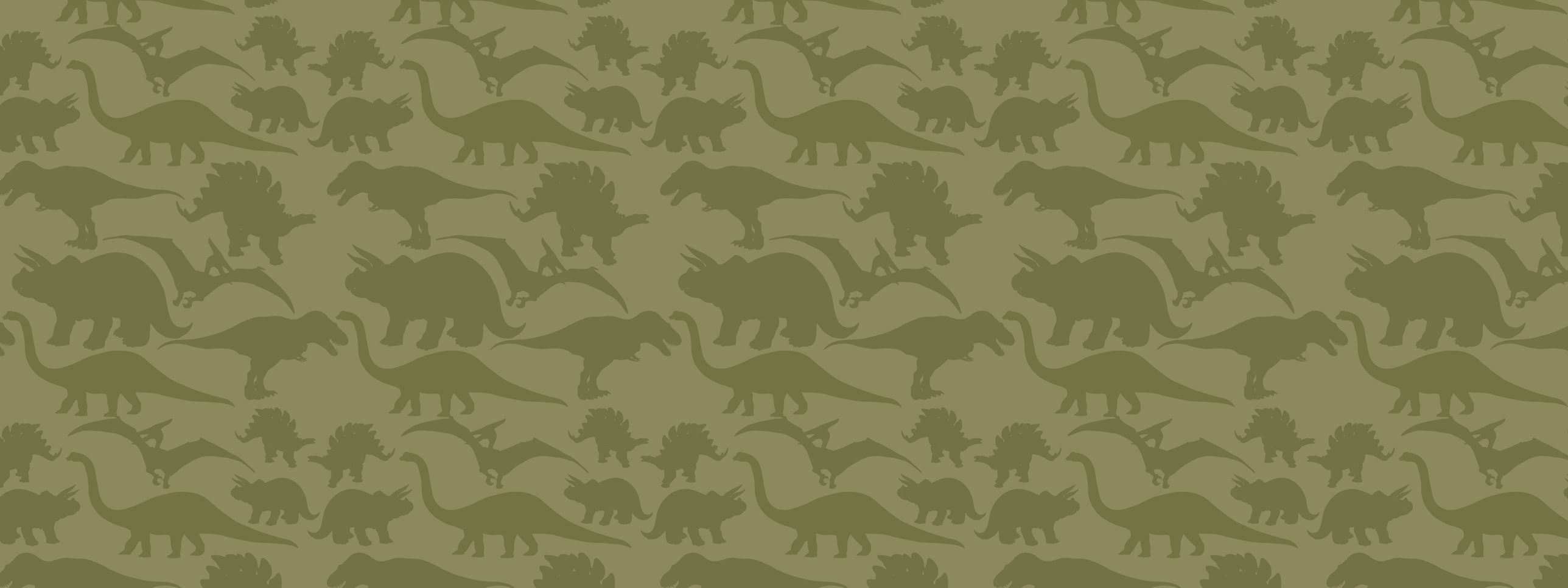
land of the DINOSAURS

Cheryl Sampson



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NATIONAL GEOGRAPHIC

National Geographic Society
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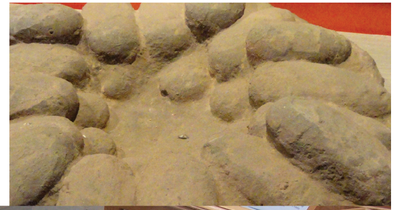
HOW THEY lived

Left: This Ampelosaurus dinosaur is portrayed laying eggs in it's nest.

Eggs & Nests

Dinosaur eggs and nests were first recognized from discoveries by the American Museum of Natural History in Mongolia's desert, the Gobi, led by Roy Chapman Andrews in the 1920s. They provided scientists with their first ideas about how dinosaurs might have raised and cared for their young. A number of recent discoveries in the western United States and in Mongolia, including embryos and baby dinosaurs, have greatly improved our knowledge of dinosaur birth. Careful study of these precious fossils has shown that dinosaur-nesting behavior was very similar to that of living birds.

Dinosaur eggs come in a wide variety of shapes and sizes. Some eggs are circular and about the size of a tennis ball, whereas others are up to 21 inches (53 cm) in length and have an elliptical shape. This might seem very big, but even these eggs are not as large as those laid by the biggest birds, such as the extinct elephant birds of Madagascar. Dinosaurs generally laid many more eggs in their nests than living birds do, even though the eggs were larger.



Below: These dinosaur eggs are from Henan Province, China. They are more than 65 million years old.

Right: Fossil exhibit in the Kunming Natural History Museum of Zoology in Kunming, Yunnan, China.

In addition, there are limits to egg size. The eggshells of dinosaurs, birds and reptiles are perforated with many tiny holes, called pores, which allow the life-giving gas oxygen to enter the egg. The maximum size of all eggs is controlled by the rate at which oxygen can pass through the egg. If the egg becomes too large, oxygen cannot enter the egg fast enough to supply the growing embryo.

LAYING EGGS

Current evidence suggests that all dinosaurs laid eggs and that the eggs were laid in nests. The total number of eggs laid in a single nest was about 22 for the small theropods Oviraptor and Troodon, and up to the 25 for the duck–billed Maiasaura. Troodon appears to have laid its eggs in pairs, probably over a period of several hours, until the complete clutch had been deposited in the nest. In contrast, Maiasaura seems to have laid its eggs in a spiral pattern, starting at one side of the nest working around it until all of the eggs were in place.

NESTS AND NEST SITES

The nests of Troodon and Maiasaura were quite different. Those belonging to the Troodon were simple bowel-like structures formed by digging a shallow hollow in the soil. A Maiasaura nest was much more impressive. It consisted of a tall mound of earth up to 6 feet (2 m) across. The eggs were laid in a shallow hallow on top of the mound. Which might have been lined with plant material that helped to cushion he eggs and keep them warm — Maiasaura was much to large to sit on its eggs! Some living birds, such as the scrub-fowl, as well as crocodiles still make similar nests today. Detailed study of Maiasaura nests shows that they are made up of several layers of mud and other material piled on top of each other. This suggests that they were reused year after year.

EGG MOUNTAIN

Most of our information on Maiasaura nests comes from a specular locality in Montana called Egg Mountain. This area contains evidence of many dozens of nests. Analysis of the rock types on Egg Mountain shows that this area was an island in a shallow lake during the late Cretaceous period. It appears that herds of Maiasaura used this island as a communal nest site. The nests are situated very close to each other, but are separated by just enough space for an adult Maiasaura to move around in without trampling on its eggs. These nesting colonies must have been very noisy, smelly and crowded places, much like penguin colonies of modern times. However, by living together so closely, the Maiasaura herd were able to protect their young much more easily. The shallow waters that surrounded the island might also have offered some protection from predators.

Biology & Behavior

Left: These are the bone remains of a Velociraptor dinosaur.

Below: Depicted is a vicious Tyrannosaurus Rex.

Far Right: Skin impressions are seen fossilized in a rock.

Like detectives attempting to solve a crime, paleontologists try to reconstruct the appearance and behaviors of dinosaurs by using all of the available evidence. Most of the time, all that remains of a dinosaur are bones and teeth. But consideration of other fossils, such as footprints and skin impressions, provides a valuable source of additional information. However, there are many aspects of dinosaur biology that will always be a mystery, as so many different parts of these animals, and many of their behaviors, are never preserved as fossils.

Paleontologists working on dinosaurs and other extinct creatures need to have a thorough knowledge of the biology and natural history of living animals. By seeing how the muscles, organs and bones of living animals are put together, scientists can attempt to reconstruct the skeleton and soft parts of a dinosaur from their fossilized remains. Birds, crocodiles and lizards, the closet living relatives of dinosaurs, provide important clues to dinosaur biology.

WARM OR COLD-BLOODED?

Today's warm-blooded animals — birds and mammals — have a higher metabolic rate than living cold-blooded animals such as fishes, amphibians, and reptiles. This means that their body's chemical processes occur at faster rates and higher temperatures, so that they yield more sustained energy for the animal. However this higher energy level requires a much greater intake of food.

But that is not the only difference. Warm–blooded animals get only part of their energy this way. They use heat from the environment, such as sunlight, to warm up enough to be more active, so they depend on the climate much more than warm–blooded animals do. As a result, their body temperatures tend to go up and down with the climate, whereas warm–blooded reptiles such as lizards and snakes can move very quickly — but only for a short time, after which they seem to run out of gas. Their lifestyles — and metabolisms — are based more on short, rapid bursts than on sustained periods of activity, such as we see in birds and mammals.

Were dinosaurs more like today's reptiles or like birds and mammals? The question is not easy. Some scientists think they were more reptilian because, after all, dinosaurs were reptiles. But birds, which are warm-blooded, are descended from dinosaurs, so somewhere along the line warm–bloodedness evolved, as it did when mammals evolved from their cold–blooded ancestors.

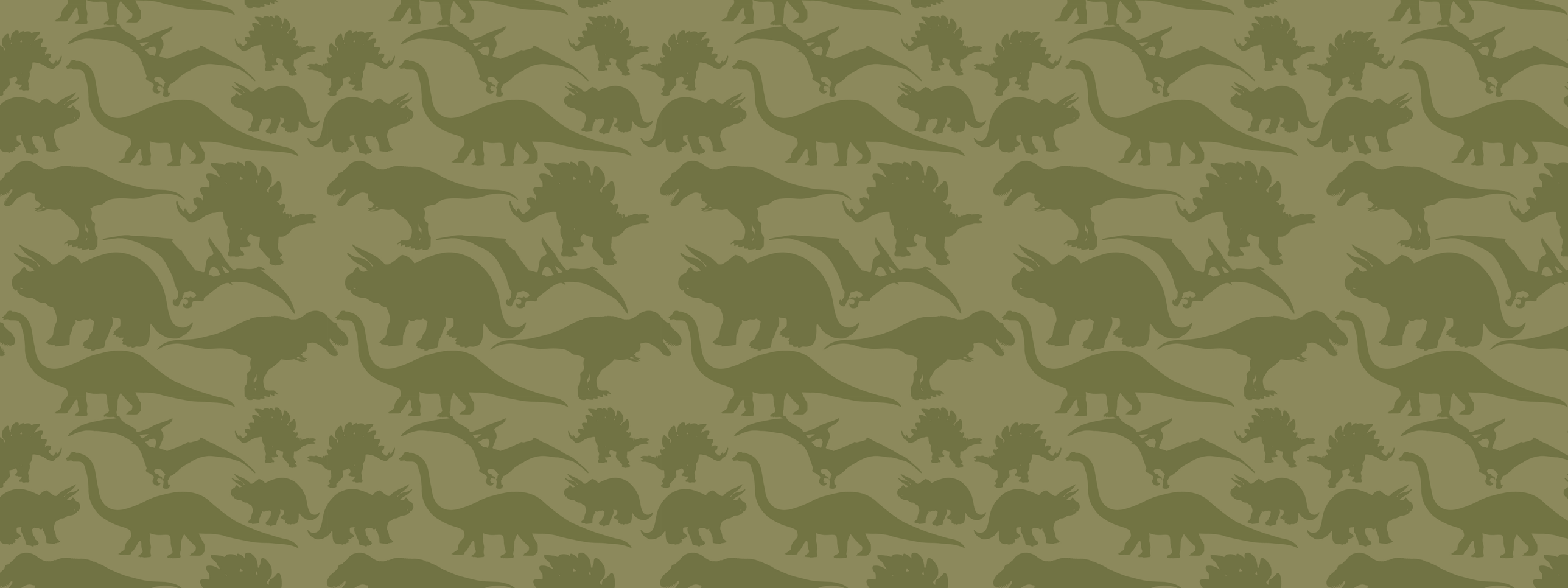
How can we tell if dinosaurs were warm or cold–blooded? Large dinosaurs almost certainly kept fairly constant body temperatures, if only because it would take so long to warm or cool such large body masses. What about smaller dinosaurs — and babies? Studies show that dinosaurs grew very quickly — much as large birds and mammals grow today. A typical duck-billed dinosaur may have become 23 feet (7 m) long in just seven years! To grow so fast for such a long time would seem to require a sustained high metabolic rate, because we know no animals today that can grow so fast and yet are cold–blooded. Mesozoic dinosaurs may not have been exactly like large birds and mammals of today, but they were apparently more like them than like crocodiles and lizards in these respects.

FEATHERS, SKIN, AND COLORS

Fossilized skin impressions show that many dinosaurs had scaly skin, similar to that of living reptiles. But a few exceptionally well—preserved fossils show that some dinosaurs had coatings of fluffy down, or even of features.

The most spectacular of these fossils are those of small theropod dinosaurs from the early Cretaceous period of China. Sinosauropteryx has the remains of small down-like structures running along the length of the back, whereas Protarchaeopteryx (before the ancient wing) has a small fan of feathers attached to the end of the tail. The presence of feathers in these dinosaurs is not too surprising, however, as other features of their skeletons show that they were closely related to birds.

But although feathers and skin impressions are sometimes preserved as fossils, the original color of the skin never survives the fossilization process. In their reconstructions of dinosaurs, scientists use the colors of living lizards, crocodiles, birds and large mammals.



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Here is everything readers want to know about dinosaurs and their world — in one magnificently illustrated, up–to–date reference. Through dramatic graphics and descriptive text, this authoritative volume charts the discovery of all the main types of dinosaurs and reveals the latest details on how these creatures most likely looked, behaved, defended themselves, found food, cared for their young, and interacted.

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