

Dinosaurs Were Real!

Pictured here, covered with kids, is "Uncle Beasley" (figure 1), a life-sized model of the dinosaur, Triceratops, located on the Smithsonian Mall. Every year, thousands of children visit the Smithsonian to climb on Uncle Beasley and to see dinosaur exhibits in the National Museum of Natural History—giving just some indication of the fascination that dinosaurs hold for children of all ages.

This article, written in collaboration with JEAN LAFAYE SIEGEL of the Office of Education in the National Museum of Natural History, suggests ways in which you can capitalize on your students' natural interest in dinosaurs. By presenting dinosaurs as real animals, subject to the same laws of nature as other animals, you can introduce basic concepts that will help students to understand the history of all life.

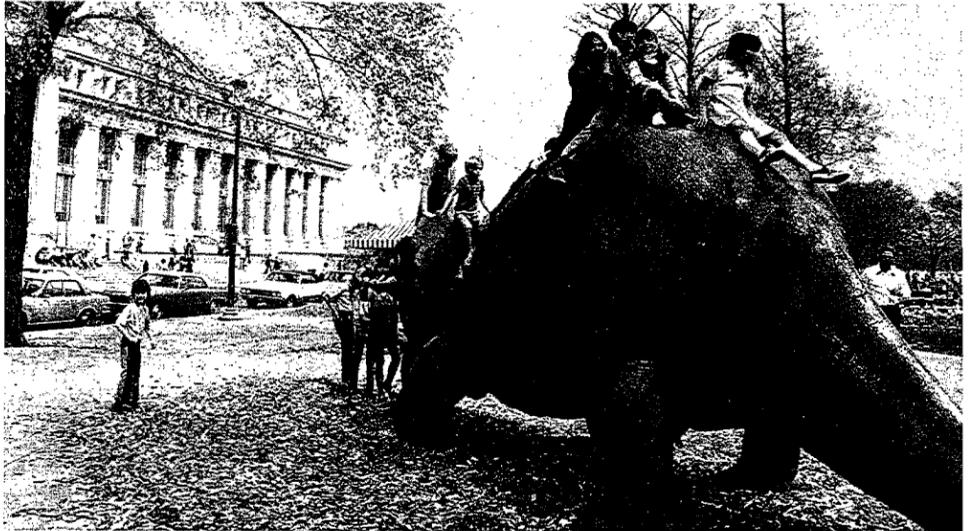


Figure 1.
Children climb on
"Uncle Beasley."

What to Look For

In looking at a dinosaur—or at any other animal for that matter—students have primarily two questions to consider: (1) What and how did the animal eat? (2) How did the animal defend itself? The specialized, weak, or ground-down teeth of the plant eater and the long, sharp teeth and grasping claws of the meat eater provide revealing clues to the answers to these questions. The presence of armor, of bulky configurations, of swimming adaptations such as webbed feet, and of horns, as well as the over-all body build of the animal, offer additional clues.

The drawing shown here in figure 2 is of the skeleton of the dinosaur, Stegosaurus. If you have an

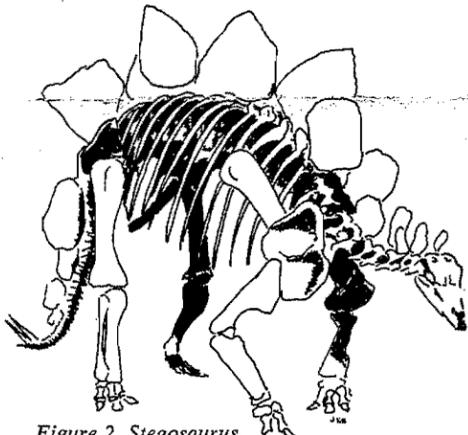


Figure 2. Stegosaurus.

opaque projector, show the drawing to your students. Have them pretend to be paleontologists trying to reach conclusions, from just this visible evidence, about an unidentified "mystery find." What did the creature eat, and how did it obtain its food? How did it defend itself against other animals that might have tried to eat it? Was it fast on its feet . . . or quick with its claws . . . or endowed with some other means of defense? Students may guess correctly that Stegosaurus's small jaw (with small teeth) and low head position indicate a diet of soft, low-growing plants. Since the creature lacked claws, as well as the agility to escape from its predators by running, as is clearly apparent, Stegosaurus must have relied primarily on its armored plates and horned tail for defense.

After students have thoroughly examined Stegosaurus, they may want to ask similar questions of our second "mystery find"—Carnotaurus, shown in figure 3. This carnivorous animal, with its long, sharp teeth and claws, and strong jaws for seizing and eating prey, probably depended on superior strength and speed for defense. The function of the small horn above its nose is unknown.

For a follow-up exercise to this inquiry, the children may enjoy making colored drawings of Carnotaurus and Stegosaurus in the flesh, in a Mesozoic setting. Then they may want to use some of the materials suggested at the end of this article to check their hypotheses about these two very different kinds of dinosaurs.

Of course, other types of dinosaurs make equally good "mystery finds"—and much better than a picture of a dinosaur is the real thing, seen in a museum. This article ends with a list of museums whose exhibitions of dinosaur skeletons you and your students might visit.

The World of Dinosaurs

Dinosaurs emerged early in the Mesozoic Era, in a world very different from that of today. The land was lower in relation to the oceans than it is now, with shallow seas flooding wide areas. Temperatures were even and mild, and the presence of wide bodies of water helped to prevent fluctuations in climate such as we have today. Ferns, tree ferns, cycads, and other primitive plants were dominant; flowering plants had yet to appear.

Before the dinosaurs, a variety of reptiles roamed the land, including a group known today as the archosaurs, which eventually gave rise to crocodiles, flying reptiles, birds, and also to dinosaurs. Two clues to this line of descent from the archosaurs can easily be observed today in fossil dinosaurs. The first clue is a pattern of short forelegs, inherited from the archosaurs, which may be seen in the drawings on this page of Stegosaurus and Carnotaurus (figures 1 and 2), as well as in a marked similarity—which students may see in Carnotaurus and in other, smaller dinosaurs—between dinosaur feet and the feet of birds.

The dinosaurs were enormously successful over a very long stretch of time and developed a variety of specialized features that helped them to deal effectively with their environment. Mostly they were plant eaters as opposed to meat eaters, a fact reflected both at the Smithsonian and at other museums, where few carnivorous dinosaurs are exhibited because relatively few have been found. The dominance of the dinosaurs over other land animals, including mammals, lasted nearly 130 million years, until the dinosaurs' disappearance 65 million years ago.

Reconstructing the Era

Paleontologists have reconstructed a picture of the world of dinosaurs, from fossil remains laid down in sediments during the Mesozoic. An interesting problem these scientists faced has been the fragmentary nature of the fossil evidence. Few animals are ever preserved as fossils, and since those that are preserved usually live in or near the water, scientists cannot be certain that what they have found is representative of an animal population as a whole. Imagine the odds against a giant dinosaur's being washed into a stream, lodging on a sand bar, and being covered over with silt—which is the very sort of thing that would have had to occur in order for a dinosaur to be preserved! Nonetheless, a sufficient number of prehistoric animals have been unearthed to enable us to build a logical picture of the succession of life. Indeed, fossils (and even pictures of fossils, as we have just demonstrated) have a great deal to tell us about the lives and times of dinosaurs.

In rare instances, a dinosaur's habits are illuminated by a find of preserved soft tissues. For ex-

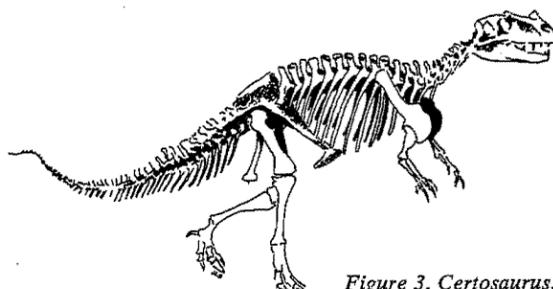


Figure 3. Carnotaurus.

ample, several mummified specimens of duck-billed dinosaurs have been found. From these we know that the skin of the duck-bill was scaly like that of modern reptiles. The presence of webbed feet indicate time spent in the water, while a meal of pine needles found in one specimen's stomach shows that the duck-bill must have done at least some feeding on shore. (We do not know for certain the function of the crests on some of the duck-bills' heads.)

In considering all the evidence available to them about dinosaurs, paleontologists have drawn on a reservoir of background information, a familiarity with specialized features, and a knowledge of animal interrelationships. Students should be aware, however, that children's books sometimes ignore the scientific evidence and on pure speculation alone ascribe habits to dinosaurs. It is important for students to learn the difference between such speculation and fact.

Were Dinosaurs Warm-Blooded?

This brings us to a subject of current hot speculation: *were dinosaurs warm-blooded?* A number of recent articles and books have claimed that they were. The truth is, however, that we simply do not know for sure. With the smaller, more active dinosaurs and with flying reptiles, some sort of internal temperature control would have been useful, maybe necessary. But with the larger animals, temperature fluctuations would have been slow anyway, owing to the fact that the larger an animal, the smaller its relative surface for heat loss. Considered along with the mild climatic conditions of the Mesozoic, the fact of naturally slow temperature fluctuations in large mammals seems to indicate that the development of internal control may not have been too urgent in giant dinosaurs. Indeed, the dinosaur's increase in size may in itself have been a solution to the problem of maintaining a narrow temperature range. A recent article in *Science* magazine claims Stegosaurus's plates constitute an excellent heat exchange system. This, if true, would argue against warm-bloodedness, at least in Stegosaurus.

We bring this subject up, not because it is central to studying dinosaurs but because it is likely that someone in your class may have read or heard about the theories on warm-blooded dinosaurs, and you may want some background information with which to respond. We think the point to be made with students here is that this is just one of many questions about dinosaurs that remain to be answered by scientists in the future.

Change Is Constant

The one constant throughout the history of the earth is change. The land lifts, erodes, and folds; animals and plants adapt, give rise to new species, become extinct. Shifts in climatic patterns, invasions of an area by new predators, creation of a new habitat or food supply, competition for food and shelter—all these promote changes in life forms.

Although change is constant, the *rate* of change is not. At those times when conditions are the most stressful, adaptation is accelerated. During the Mesozoic, conditions remained fairly stable, favoring the continuing rule by reptiles. For 130 million years, there were few major events to alter the environment. In response to the slow evolution of bigger,

A Matter of Looking

BY BONNIE BASKIN

EDITOR'S NOTE: This article by BONNIE BASKIN—Curator of Education at the University Art Museum, University of California at Berkeley—is the first in a series of articles from museums other than the Smithsonian to be printed in **ART ZOO** this school year. The purpose of these articles will be to share with you news of museum education programs, from across the country, whose concepts and methods may be applied to your curriculum in fresh and imaginative ways. Meanwhile, as the year progresses we hope you'll share with us news of museum programs in your community that you feel might interest other teachers. Your letters will provide the basis for **ART ZOO** articles in the future.



Is there an abstract image that shifts, or deepens, or dazzles the eye the more that it is viewed?

"I didn't know the world was cracked up like that."

This line concludes a letter from a fifth-grader named Gary and refers to Gary's tour, with his class, of the University Art Museum, where we have been trying to crack up the world a little differently for the past five years.

What we do in our tours is to pair three or four children with an adult guide who loves art, wants to share his or her enthusiasm, and has a fascination for learning what other people think about art works. The children in this equation are mainly elementary-school students, although groups range from preschoolers to adults. The guides are all college students—usually art or art history majors, and mostly from the University of California/Berkeley—who receive academic credit for their museum work.

The guides present games, looking activities, and Socratic discussion questions—both time-tested and *pontaneously invented*—that seem appropriate to the tour group, the art work, and the moment. Frequently there are sensory activities, like intuiting the smells, tastes, sounds, and feel of art works just by looking. There is also considerable movement as groups "become" portraits, "walk" in landscapes, "dance" a painting, "phone up" an art work and ask it how it is, "eat" paintings color by color, and examine and compare works from many different angles and distances. The discussion often deals with how art works were made, what they express, and how—and how well—they achieve expression.

Over the years we have come up with three rules for ourselves in this endeavor: (1) We listen and respond to children and build the tours on their ideas. (2) We keep the focus on the art (being sure, for example, that children re-creating a painting with whsses, blubs, whabbles, and similar sounds are looking at the painting while they work, not just making sounds). And (3) we avoid yes-no questions, such as "Do you think it's hot and windy in this painting?"

The guides build their tours around feedback from the children, using teaching approaches to diagnose interests and spark ideas. They do not, therefore, feel responsible for providing brilliant art entertainment. Rather they operate as catalysts, working to attain a level of participation that will "launch" a tour and make it a group effort. When launching occurs, conversation develops naturally; the children initiate both discussion and activities, with the guide moderating the group process and providing focus, continuity, and occasional changes of pace. Nor do the guides

feel they must be oracles. They are, in a sense, "experts"—because they love art and know the museum well. Since they are in the museum, however, to facilitate the experiences of others and to learn for themselves through exchanges with visitors, they have an experimental attitude towards their tour approaches. It is perfectly fine with them if the kids hate the idea of inhaling colors, down to their toes. These same children would probably hate *tasting* colors even more, but they might enjoy taking precise, faithful mental photographs of art works, or just looking wordlessly at some paintings.

What the flexibility of this approach to museum teaching means to you is that even with little or no training in art—but with an enthusiasm for art and the abilities to listen sensitively and to ask good questions—you can successfully lead gallery tours for your students or offer slide presentations in the classroom, in absence of a nearby gallery or museum.

The first step in leading a successful gallery tour is to become *visually familiar with the art works the class will see and to note what strikes the children personally about the works*. Is there a particularly expressive face? An abstract image that shifts, or deepens, or dazzles the eye the more that it is viewed? A scene with an odd or mysterious object that you might not notice at first? Such are the germs of lead-off questions and activities.

There are also some basic, standard approaches for getting *inside* art works. • *Portraits*: What are portrait subjects thinking about? What would they be like as people? (And how can you tell all this?) • *Landscapes*: What time of day and what season is it? Where would you wander in this scene, and what would you find there? What could you smell, hear, and feel in the air? What would the ground be like under your feet? (Listen, breathe.) • *Abstract Paintings*: Which lines are fast and which are slow? Where are the centers of energy, and how do they move? Where would you fly in the painting, and what would you find there? How do specific colors affect each other? Which colors come forward at you and which recede? • *All-Purpose*: What do you notice—and what else do you notice? What's happening in this painting or sculpture—and what else? Students also find it interesting to compare and contrast similar art works, such as two or more portraits, works by the same artist, or pieces done in the same period.

The second step in leading a tour is to *look at art works from many different vantage points and to direct students to do the same*. It is vitally important to walk close up and back and from side to side in front of paintings, in order to gain a sense of their complexity and meaning. From a certain viewing spot, different for each person, landscapes come into focus and the viewer feels himself inside the scene. Similarly, you need to walk *around* sculptures, viewing them from different heights, distances, and angles, in order to see them properly.

In all, perhaps the most important element in tours is your *feeling for the art*. Love communicates, and the tour guide who loves art becomes the living proof that art can be worth loving. With this enthusiasm, plus some simple methods for looking carefully and exhaustively at art and sharing visual discoveries, you can help your students to understand art—to be open to experiencing it with all their senses, in visual, emotional, aesthetic, technical, and intellectual ways. For art is a matter of looking, of looking deeply and letting art works talk to you, and of developing a creative and perceptive eye.



At the University Art Museum, University of California/Berkeley: Students find that art is a way of looking.

ART ZOO

ART ZOO is a new publication bringing news from the Smithsonian Institution to teachers of grades three through six. The purpose is to help you use museums, parks, libraries, zoos, and many other resources within your community to open up learning opportunities for your students.

Our reason for launching a publication dedicated to *promoting the use of community resources among students and teachers nationally* stems from a fundamental belief shared by all of us here at the Smithsonian: in the power of objects. Working as we do with a vast collection of national treasures that literally contains the spectrum from art to zoo, we believe that objects (be they works of art, natural history specimens, historical artifacts, or live animals) have a tremendous power to educate. We maintain that it is equally important for students to learn to use objects as research tools as it is for them to learn to use words and numbers—and you can find these objects close at hand, by drawing on the resources of your own community.

Our idea, then, in producing **ART ZOO** is to share with you—and you with us—methods of working with students and objects that Smithsonian education staff members have found successful. This is the first of four pilot issues to be published in October, December, February, and April of this school year. Beginning in the fall of 1977, **ART ZOO** will be made available on a wider basis to teachers nationally.

You are one of approximately seven hundred teachers across the United States who have agreed to respond critically to the four pilot issues. In December, and then again in April, evaluation questionnaires will be sent to you. To make it easier for you to know who we are, we have listed—in the masthead below—the Smithsonian museums and divisions whose education staff members will be contributing regularly. Please read the articles carefully and be absolutely frank in stating your opinions. We're counting on your help.

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THE NATIONAL PORTRAIT GALLERY
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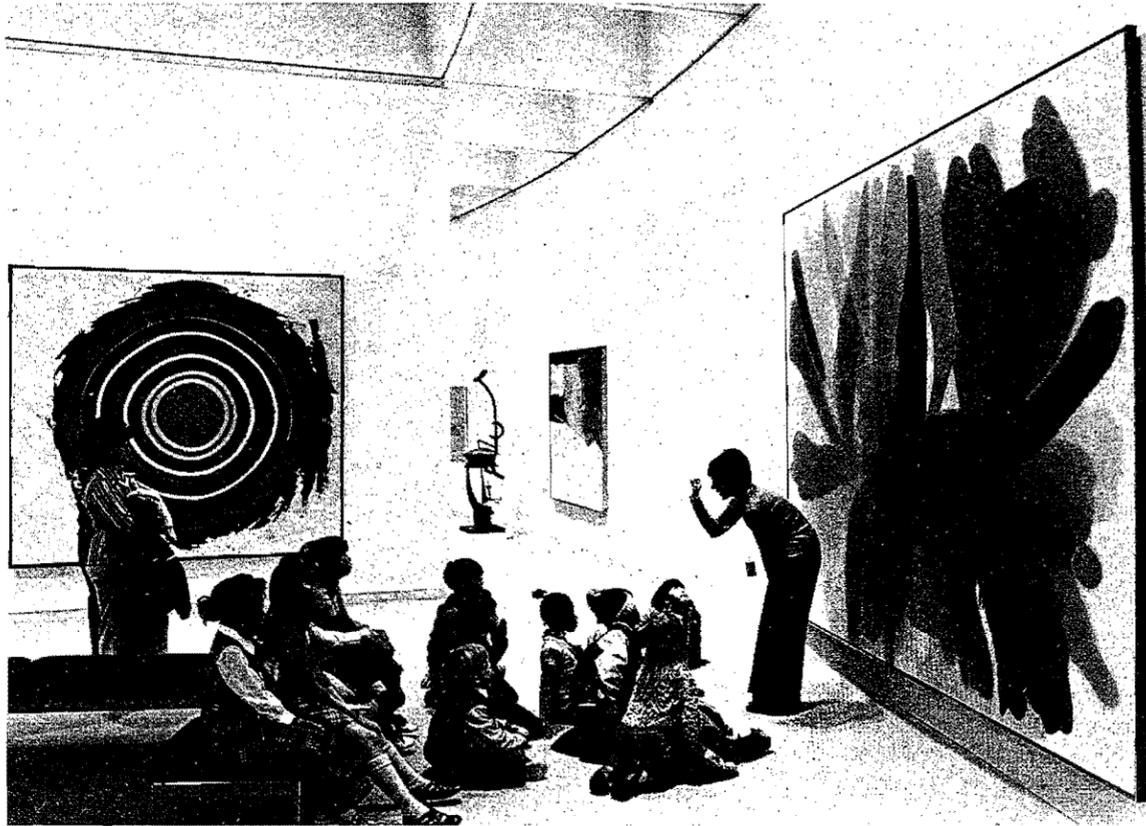
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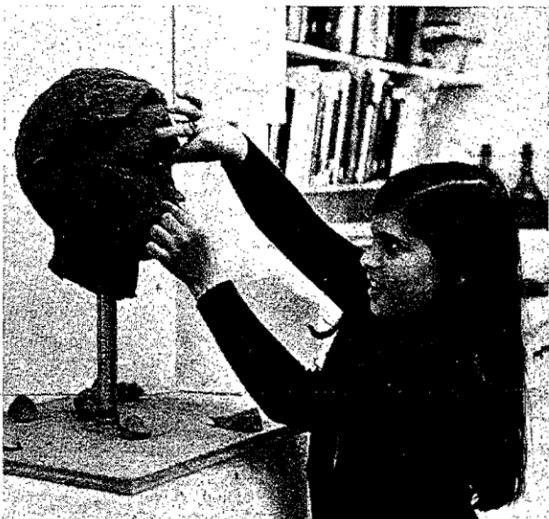


The Smithsonian Institution: Who We Are



At the Hirshhorn Museum and Sculpture Garden: Fourth-graders are introduced to the pleasures of a richly varied collection of 19th and 20th century painting and sculpture.

The Smithsonian Institution, founded in 1846, is a vast complex of museums and art galleries, scholars and experts, with facilities here in Washington, D.C., around the country, and overseas. It owes its beginning to James Smithson, a wealthy English scientist, who willed his fortune to the United States "to found at Washington, under the name of the Smithsonian Institution, an establishment for the increase and diffusion of knowledge among men." Over succeeding generations, the Smithsonian has carried out the terms of this bequest through scholarly activity in the fields of history, science, and art; through museum and library operation; and through the dissemination of information. In recent years, increasing emphasis has been placed on public education, with classes, films, lectures, musical events, guided tours, and other activities offered to growing numbers of children and adults. These photographs show schoolchildren from the Washington metropolitan area engaged in activities created especially for them by the various education departments of the Smithsonian. Look to future issues of *Art to Zoo* for articles based on these activities.



At the National Portrait Gallery: A fifth-grader helps to complete a sculpture, during a Discover Portraits tour.



At the Chesapeake Bay Center for Environmental Studies: Fifth-graders investigate the physical and biological characteristics of an estuary.



At the National Museum of History and Technology: Students examine Revolutionary War artifacts.



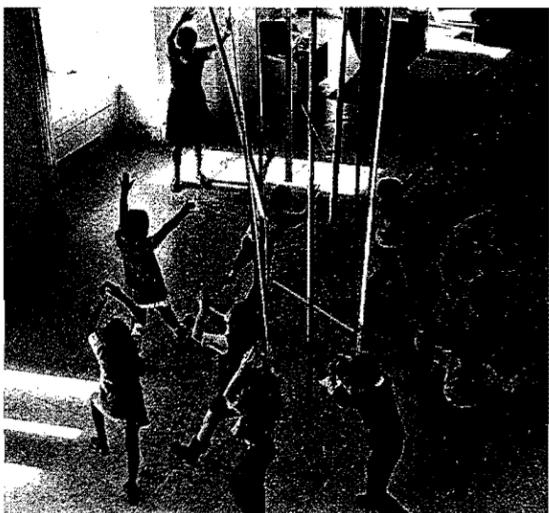
At the National Air and Space Museum: Young visitors study the spacecraft exhibition featuring the Apollo command module, "Columbia."



At the National Museum of Natural History: An Early Man tour.



At the Anacostia Neighborhood Museum: A lesson on black history.



At the National Collection of Fine Arts: An improvisational tour.



At the National Zoological Park: Giraffes really are tall, aren't they?

DINOSAURS WERE REAL! *Continued*

more ferocious predators and changes in plant life, dinosaurs adapted and remained dominant.

The Curtain Falls

What happened to alter this picture? Suddenly, maybe over a 5-million-year timespan, the dinosaurs disappeared, along with the large sea reptiles and the flying reptiles. The only animals left that were closely related to the dinosaurs were the crocodiles and the birds. It was as if a curtain had come down on the scene, and when it rose again, the leading parts had been assumed by the mammals.

Many children's books offer simplistic explanations for this phenomenon. They say that dinosaurs became extinct because the mammals ate their eggs (*but mammals have always eaten reptile eggs, and still do*) . . . because the plants changed (*but dinosaurs had adapted successfully to plant changes previously, during the Mesozoic*) . . . because the mammals overcame the reptiles (*but there is overwhelming scientific evidence to the contrary*) . . . or because of the start of the Ice Age (*which was, in truth, 64 million years into the future*).

The fact is, we do not know what caused the dinosaurs to disappear. We do know, however, that the end of the Mesozoic brought a gradual cooling of the environment, with a general uplift of the continental mass and a slow loss of watery habitats. The disappearance of the dinosaurs could have been due to a single one of these factors, or to a combination of many factors.

Dinosaur Activities

Along with class discussion of the above and other facts, clues, theories, and questions about dinosaurs,

there are many activities that students enjoy. A number of these activities are presented in a teaching kit (*see under "Dinosaur Materials" at the end of this article*), which you may borrow free of charge from the Smithsonian's National Museum of Natural History. In addition, PATTY PORTER FIRESTONE, who recently taught a course on dinosaurs for the Smithsonian Resident Young Associates program, suggests that students *create mobiles and improvisational dances* to illustrate the place of dinosaurs in the evolution of life. She also recommends having students *draw dinosaurs from museum exhibits*, as a way of sharpening observation skills and acquiring a sense "of the importance of inner structure to all things." Or, you might *devise variations on the "mystery find" theme*, outlined earlier in this article.

Whatever the activity, the object is to encourage the discovery that dinosaurs once ate, and breathed, and fought for survival just like other animals. Quite unlike the mythical, otherworldly creatures students might imagine, dinosaurs were, indeed, astonishingly real.

Dinosaur Exhibits

Dinosaur skeletons or other materials may be seen in the following museums: **Alabama.** *Tuscaloosa:* University of Alabama Museum of Natural History. **Arizona.** *Flagstaff:* Museum of Northern Arizona. **California.** *Los Angeles:* Los Angeles County Museum of Natural History. **Colorado.** *Denver:* Museum of Natural History. *Boulder:* University of Colorado Museum. *Dinosaur:* Dinosaur National Monument. *Golden:* Colorado School of Mines Geology Museum. **Connecticut.** *New Haven:* Peabody Museum of Natural History, Yale University. **District of Columbia:** National Museum of Natural History, Smithsonian Institution. **Florida.** *Jacksonville:* Jacksonville Children's Museum. **Illinois.** *Chicago:* Field Museum of

Comparative Zoology; Harvard University. **Nebraska.** *Lincoln:* University of Nebraska State Museum. **New York.** *Buffalo:* Buffalo Museum of Science. *New York City:* American Museum of Natural History. **Ohio.** *Cleveland:* Cleveland Museum of Natural History. **Pennsylvania.** *Philadelphia:* Academy of Natural Sciences. *Pittsburgh:* Carnegie Institute Museum. **South Dakota.** *Rapid City:* Museum of South Dakota School of Mines and Technology. **Texas.** *Austin:* Texas Memorial Museum. **Utah.** *Jensen:* Dinosaur National Museum. *Vernal:* Natural History State Museum.

Dinosaur Materials

• *Teacher's Kit on Dinosaurs and Other Giants.* Includes 25 slides, with script, of dinosaurs and prehistoric mammals exhibited in the National Museum of Natural History. Available on a *free loan basis* from the Office of Education, Room 212, National Museum of Natural History, Washington, D.C. 20560. A teacher's guide, containing activity suggestions, and a "dinosaur hunt" will be sent with the slides if requested.

• *Dinosaur Information Packet.* Includes an 8-page leaflet, "Dinosaurs and Other Reptiles," as well as a bibliography and 7 pictures of museum dinosaurs suitable for bulletin board display. Available free from the Department of Paleobiology, National Museum of Natural History, Washington, D.C. 20560.

• *Prehistoric Life.* A folio containing pictures, with explanatory text, of fossil specimens on exhibition in the National Museum of Natural History. Shows the place of dinosaurs in the history of life. Time line included. Cost: \$1.25. Send check (made payable to the Smithsonian Institution) to the Office of Education, Room 212, National Museum of Natural History, Washington, D.C. 20560.

Historian on the Campaign Trail

TEACHERS' NOTE: This interview with HERBERT COLLINS, Associate Curator of Political History in the National Museum of History and Technology, has been written to be read by your students. It is the first in a series of interviews with Smithsonian staff members to be printed in *Art to Zoo* this school year. We hope it will give students some insight into what we do here at the Smithsonian—and why—in a format that can be worked into your curriculum in a variety of ways.

While Gerald Ford and Jimmy Carter are out collecting votes, Herbert Collins has been following the campaign trail in search of items of a different sort. Mr. Collins works at the Smithsonian Institution in Washington, D.C. An important part of his job is to collect objects—such as campaign buttons, posters, and signs—that will give people living a hundred years from now a feeling for the important events of our time. Mr. Collins is a political historian in the Smithsonian's National Museum of History and Technology.

His job is not always easy. "I spent a lot of time trying to convince people at the Republican and Democratic conventions to give their campaign hats and buttons to the Smithsonian, where they will be displayed and cared for, not stashed away and forgotten," he says. "But many people wanted to keep the objects for themselves."

So Mr. Collins had to plead and trade and even search the floors of the convention halls to get what he wanted. It took some doing to get a police department sign from the Democratic convention. The sign says, "No Standing—Democratic National Convention." It had been posted outside the hall in New York City where the convention was held. Finally, Mr. Collins found a sympathetic policeman who checked with headquarters for permission to give the sign to the Smithsonian.

Mr. Collins collects objects for the Smithsonian just as you might collect football cards or seashells or stamps for your own enjoyment. He says that in deciding what to add to the collections, he tries to think 100 years into the future, imagining what our great great grandchildren will want to know about the events of today. The things he collects are not always worth a lot of money right now, but he feels that someday they will be priceless.

"Future generations will learn about our times from photographs and paintings, from printed material, such as magazines and newspapers, and from objects," he explains. "Objects are important because they help to make history come alive. My job is to find and care for those objects that will mean the most in the future."

Often the things he collects are put on exhibit in the museum for everyone to see. The photograph here shows Mr. Collins standing in front of an exhibit containing campaign buttons.

Many of the objects are stored carefully away in a special area of the Smithsonian. Before they are stored they are labeled. Each label



Mr. Herbert Collins with political history exhibition.

tells where the object came from, who made it, and how it was used. This is for the information of the many scholars and students who come to the Smithsonian to study the collections. Recently Mr. Collins took us through the storage area of the National Museum of History and Technology. In addition to modern objects, the area contains many things from the past. Among other treasures, we saw china used by President John Adams, a dress worn by First Lady Bess Truman, and a chair used by Abraham Lincoln.

Mr. Collins has worked at the Smithsonian for sixteen years. Besides collecting and caring for objects, he prepares exhibitions, writes books and articles, and answers a lot of mail. He likes his work. And one part of his job that he especially enjoys is getting letters from schoolchildren.

This is partly because he remembers his *own* childhood interest in history. While growing up in a small Virginia town, he loved to hear his grandparents tell stories of the Civil War as *their* parents remembered it. His first historical collection—began when he was eight years old—was of portraits of the U.S. presidents, cut from the backs of cereal boxes.

Do you have a historical collection? If so, we would like to hear about it. Please send your letters and drawings to *Art to Zoo*, OESE, Smithsonian Institution, Washington, D.C. 20560.

Vocabulary

EXHIBITION. A display, for the public, of paintings or objects.

POLITICAL HISTORIAN. An expert in the history of government.

SCHOLAR. A person who knows a great deal about a particular subject, such as history, and is studying to find out more.