SELF-DEFENSE EQUIPMENT OF THE TORTOISE-ARMADILLOS

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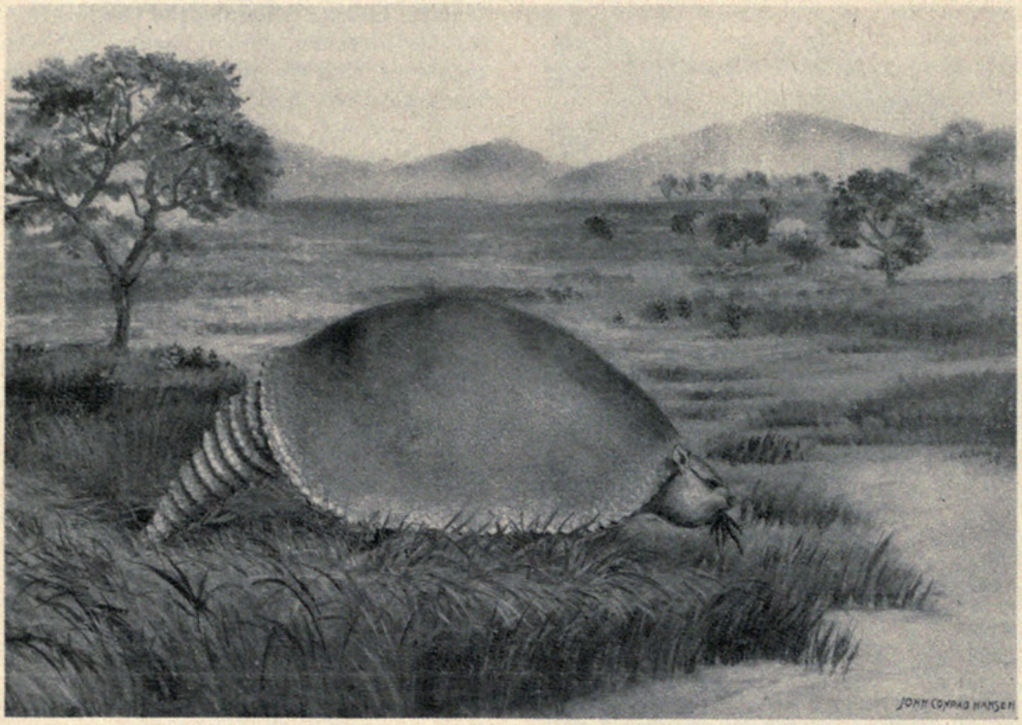
The study of life, both existing and extinct, has revealed a number of fundamental principles that operate in nature. Among the most interesting of these is one known by the formidable name of adaptive radiation. Simply, and perhaps a little loosely put, this means that all groups of living things tend to become adapted to as great a variety of habitats as circumstances and their structure will permit. This principle operates on both the grand and the small scale. The mammals, with their infinite variety of forms adapted to different ways of life, are an obvious example of the grand scale, while the different climatic, altitudinal or soil preferences exhibited by the species of a genus of plants illustrate a smaller radius.



RESTORATION OF GLYPTODON

Artist John Conrad Hansen's conception, based on scientific data, of a typical representative of the later members of the group. The scene depicted is in the Tarija Valley of Bolivia; the time—mid-Pleistocene, about 500,000 years ago.

It follows, as a natural corollary of the principle of adaptive radiation, that there can be no patents in nature. The characters evolved by members of one group may be independently evolved by members of another. This has been particularly true of the ultimate in passive defense—the development of a bony shell to protect the body. The most familiar examples of this effective adaptation are the turtles. Similar protective structures, however, have been evolved in other reptilian groups, notably in a family of herbivorous dinosaurs, among mammals, and even in the fishes.

The only living mammals thus armored are the familiar armadillos that range from Patagonia to Texas. These small to medium-sized omnivorous animals possess shells composed of a large number of united bony plates, each of which is covered by a horny one. A variable number of movable bands of plates across the middle of the body permits a measure of flexibility, which is sufficiently great in one form (*Tolypeutes*) to enable the animal to roll itself up into a ball. The top of the head is covered by a casque, and the tail, except in one form, by a sheath, both composed of bony plates. The whole is an effective device, but it is not absolutely protective—the plates are too thin for that. A small dog that attached itself to the recent Paleontological Expedition to Honduras was able, in the twinkling of an eye, to tear half the shell from the back of an armadillo so unwary as to be caught by it. It would seem that the armadillos owe their survival mostly to their ability to dig themselves out of sight in an astonishingly short space of time.

For the last word in mammalian self-defense we must turn to the giant extinct relatives of the armadillos, the glyptodonts or tortoise-armadillos, the latest and largest of which attained over-all lengths of more than ten feet. Like the armadillos, from early fossil members of which they descended, they were of South American origin. In the course of the evolution of these animals the various characteristics just enumerated were carried to an extreme. The bony plates increased in thickness, and the movable bands in the shell were eliminated. The end result was a solid shield of armor, more than an inch thick in places, protecting the body. The tail was encased in over-lapping bony rings, composed of bony plates, which in many of the later forms terminated in a club-like tube. In some this club was studded with blunt spikes. As in armadillos, the bony plates were covered by horny ones. These, of course, are not preserved in the fossils, but their imprint on the bony plates may be seen in the patterns, often intricate and mosaic-like, which the latter display.

The glyptodonts were strictly vegetarian in diet. As a result, the skull and teeth were very different from those of the omnivorous armadillos. In the latter the teeth are, for the most part, simple and peg-like, and the skull rather long. Glyptodont teeth were exceedingly long-crowned complicated grinders suited for chewing harsh plant food, and the skull became progressively shorter and deeper to accommodate them.

The acquisition of great size and weight and of a solid shell led to interesting modifications of the internal skeleton. The leg bones were massively built. In correlation with the high arch of the shell and the low level at which the head was carried, the hind legs were much longer than the fore. Flexibility of the backbone was no longer valuable, and the trunk vertebrae united to form tubes. This brought a resemblance to conditions in turtles, but it is accompanied by a profound difference related to basic distinctions between the shells of the two groups. The shell in glyptodonts and armadillos developed entirely from small bones formed within the skin, whereas in turtles it arose from a combination of skin bones and elements of the internal skeleton. Consequently, in the latter the trunk vertebrae and ribs are incorporated into the shell, while in the glyptodonts they were free from it, the shell merely resting upon the posterior trunk vertebrae and the hips behind and upon muscles in front. The neck vertebrae were so constructed as to permit the head to be drawn down and back, thus closing the anterior opening of the shell with the casque.

A further contrast to turtles lies in the lack of an under shell. The soft under-belly of the glyptodonts was amply protected, however, at least in the later and larger forms, by the great weight of the animals, which must have made it almost impossible for their enemies to overturn them.

These animals were in effect walking citadels practically invulnerable to attack. At the approach of an enemy all they had to do was squat—bringing the edges of the shell to the ground—draw in their heads, so as to present only the casque to the front, and wait. The tail served as an effective defensive weapon. Swung from side to side, this formidable giant's club was capable of dealing a crushing blow to any attacker incautious enough to venture within reach of it. The glyptodont exhibits in Ernest R. Graham Hall (Hall 38) have recently been overhauled, and restoration paintings and

diagrams have been added to the cases. A series of these shows a Pliocene glyptodont, *Eleutherocercus*, disposing of the saber-tooth marsupial *Thylacosmilus*. The attacker seems in this instance to have been killed by a blow from the glyptodont's tail received full in the face. Any carnivore that survived so unpleasant an experience would be likely to give glyptodonts a wide berth in future.

It has been emphasized in several previous articles that South America was isolated from the rest of the world throughout the greater part of the Age of Mammals, a stretch of time lasting almost 60 million years. The mammals of that continent underwent an adaptive radiation that was uninfluenced by immigration; the result was a fauna totally unlike any that came into existence elsewhere. Many of these mammals evolved along lines that were broadly similar to those followed by unrelated groups in North America and the Old World—the natural corollary of adaptive radiation stressed at the beginning of this article. There were, for example, South American pseudo-horses, pseudo-camels, pseudo-dogs, and pseudo-sabertooth cats. Together with these "ersatz" forms were others that had evolved along lines distinctively their own. The glyptodonts and armadillos were in this category. Nothing like them existed in North America, and in consequence, when the two continents were again united by the elevation of the Isthmus of Panama, they encountered no competitors among the northern mammals. Their ersatz compatriots were unable to compete, even on their home grounds, with the more perfectly adapted invaders, but the glyptodonts and armadillos were able to spread northward and to extend their range as far as the southern parts of the United States.

RAYMOND FOUNDATION OFFERS FREE MOVIES FOR CHILDREN

The James Nelson and Anna Louise Raymond Foundation for Public School and Children's Lectures, which began its annual autumn series of free motion pictures for children in October, will continue to present programs on Saturday mornings throughout November. Each program is given twice, at 10 A.M., and again at 11, in the James Simpson Theatre of the Museum. Children from all parts of Chicago and suburbs are invited and no tickets are needed. They may come alone, accompanied by adults, or in groups from schools and other centers. Many of the films to be shown are in colors, and all have sound tracks. Following is the schedule for November:

November 6—ISLES OF THE SOUTHERN SEAS (*New Guinea, Samoa, Fijis, New Zealand, and other Pacific islands.*

November 13—NORTH OF THE BORDER—CANADA (*Color and black and white pictures of the country to our north*).

November 20—PHILIPPINES—GARDEN ISLANDS OF THE CHINA SEA. (*The Philippines before the war*).
Also a cartoon.

November 27—ALL-CARTOON PROGRAM.

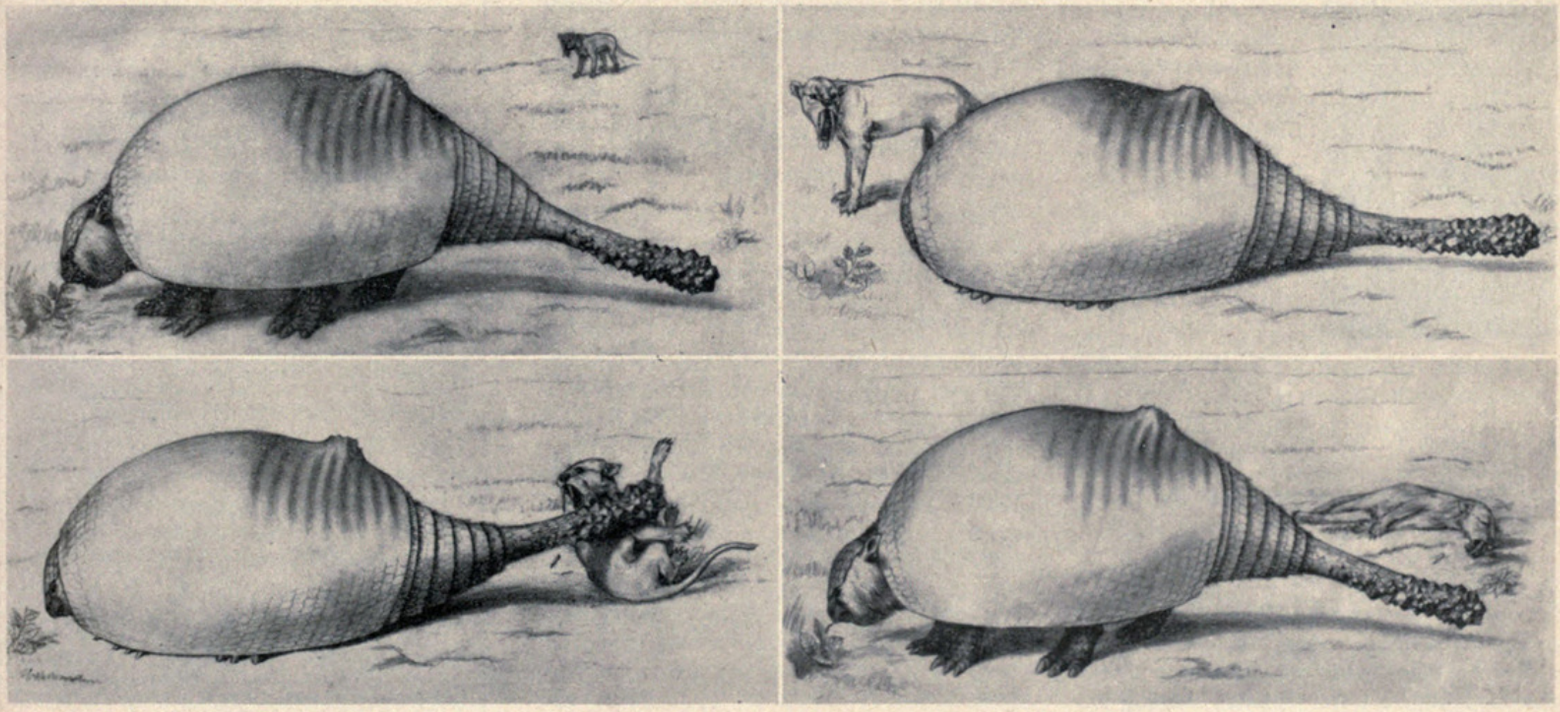
PHOTO EXHIBIT CONTINUES; 14 WIN RIBBONS

Blue ribbons for pictures of special merit were awarded to 14 entrants in the Museum's First International Photographic Exhibit, which opened September 15 *and will continue on display until November 15*, under the title "Lenses on Nature." Altogether, 152 photographs, out of nearly 400 submitted, all bearing on various phases of nature, are shown.

The blue ribbon winners are: Betty Henderson, F. L. Purrington, Chester W. Olson, Dr. Howard K. Gloyd, and Dr. Max Thorek, all of Chicago; and Dr. B. J. Ochsner, Durango, Colorado; William C. Horen, Winnetka, Illinois; Floyd B. Evans, Pasadena, California; Caryl R. Firth, Trappe, Maryland; John J. Harrack, Detroit; Dr. T. W. Kilmer, Hempstead, New York; Charles E. Mohr, Philadelphia; Henry D. Scott, Wheeling, West Virginia, and H. H. Sheldon, Boulder, Colorado.

All photographs, to be eligible, were restricted to subjects falling within the broad subject of nature, and include anthropological portraits, and photographs of plants, forests, birds, animals, geological formations, etc. The Museum has published an illustrated catalog giving the names of all photographers whose work is exhibited, and the titles of their entries (available at The Museum Book Shop, 10 cents). The exhibit was considered a notable success, and it is planned to continue this activity as an annual event at the Museum in the future.

PALEONTOLOGICAL "COMIC STRIP" . . . Sabertooth Meets Old Spiketail . . . by HANSEN



Capable of active as well as passive defense, glyptodonts were animals to be left strictly alone by other creatures desiring to live in health and happiness. Those that failed to realize this often came to grief, and probably death, as depicted in this series of pictures showing how Eleutherocercus, a mid-Pliocene form of three million years ago, could and often did dispose of unwary predators. Here the intended surprise attack of a marsupial sabertooth, Thylacosmilus, was stopped with one mortal blow from the huge tortoise-armadillo's spiked and club-like tail. The curious "funnel" on this glyptodont's back is believed to have housed a large skin gland. These drawings are part of the Hall 38 exhibit.